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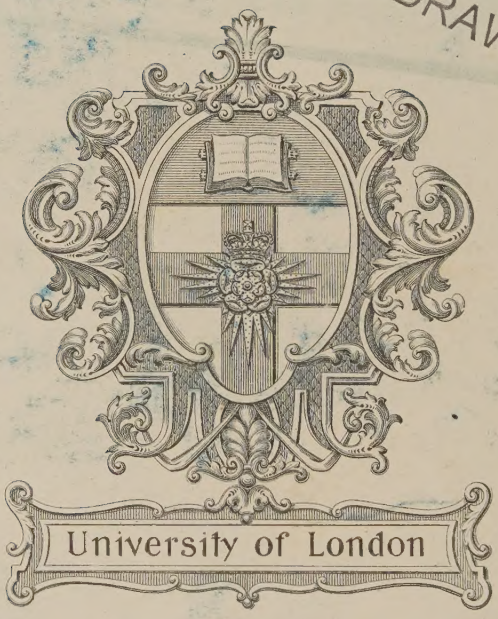

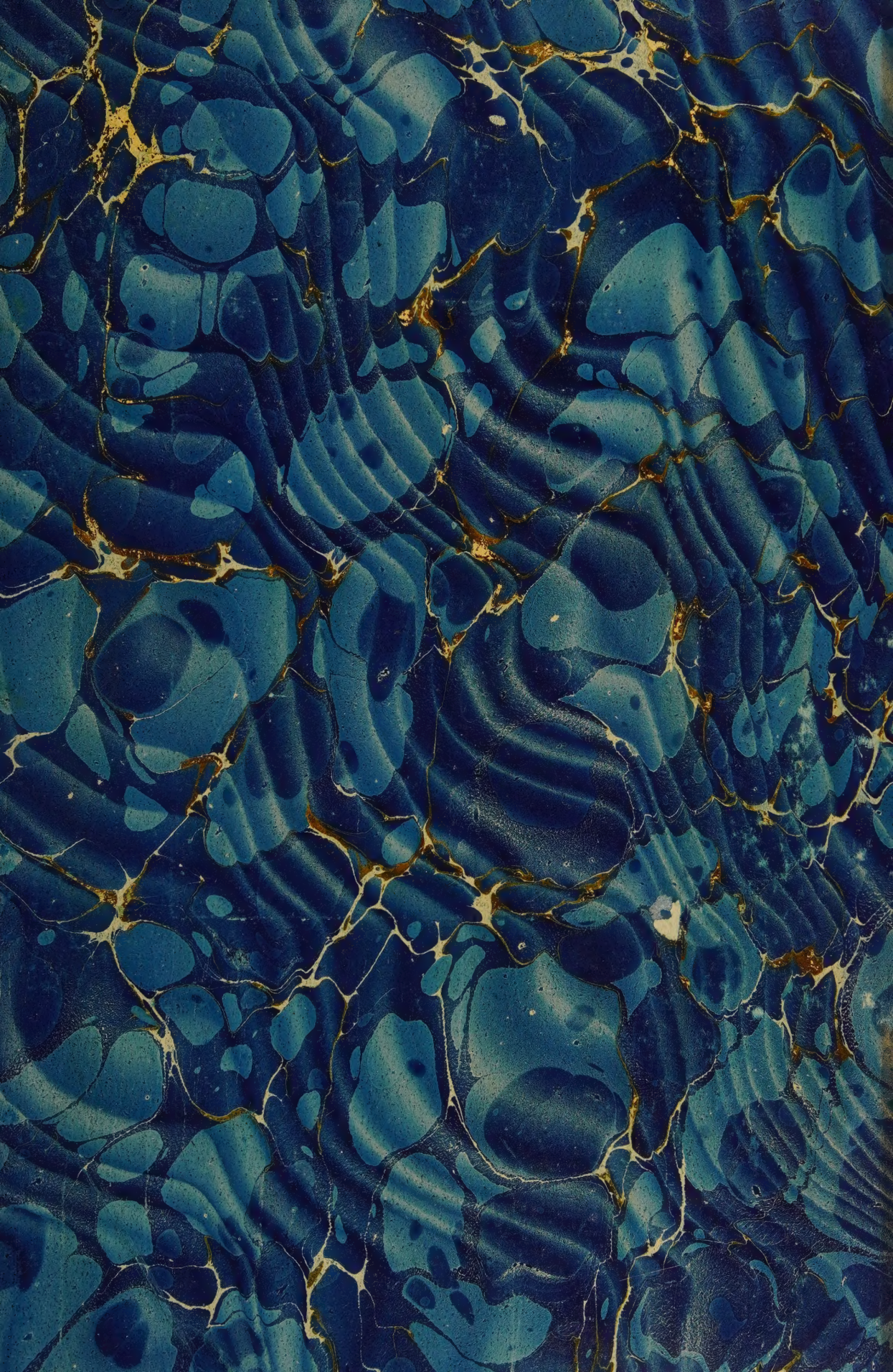

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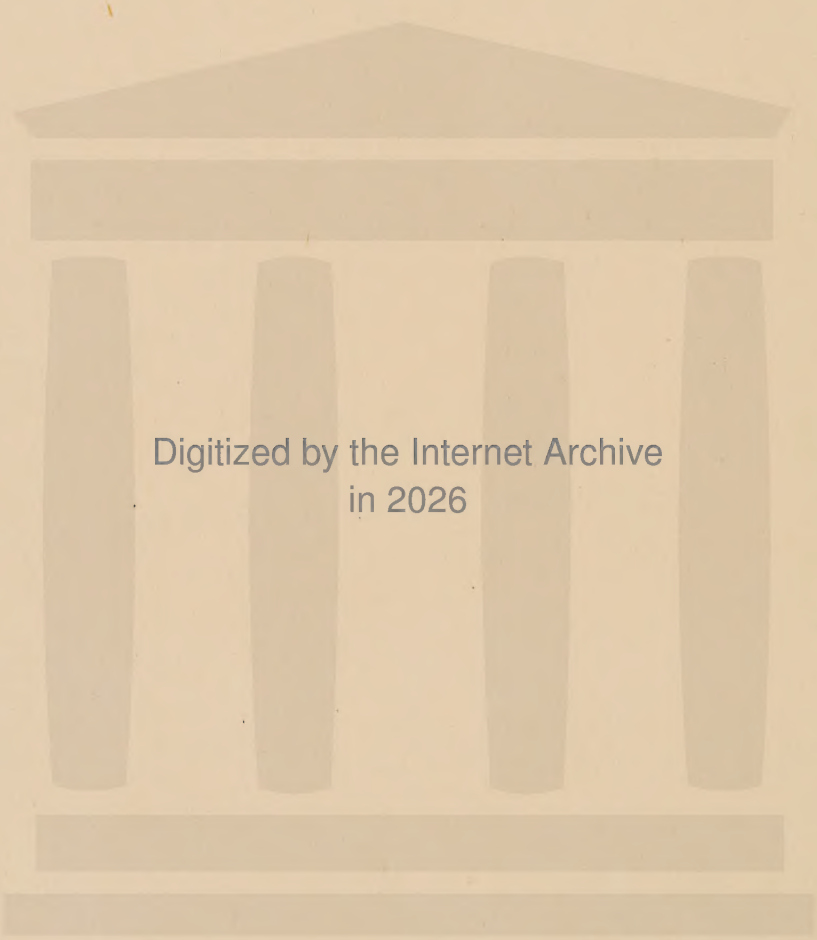
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CHAMBERS'S ENCYCLOPÆDIA

A DICTIONARY OF UNIVERSAL KNOWLEDGE

NEW EDITION

Edited by

DAVID PATRICK, M.A., LL.D.

AND

WILLIAM GEDDIE, M.A., B.Sc.

VOLUME IV

DIOPTRICS TO FREISTADTL

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LONDON and EDINBURGH
J. B. LIPPINCOTT COMPANY, PHILADELPHIA
1925

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Diplomacy; Enemy	Sheriff J. M. Irvine, K.C., LL.D.
Dipper	Professor J. Arthur Thomson.
Dipping-needle	Professor A. C. Mitchell.
Dipsomania	Professor Sir John Macpherson.
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Distillation; Ether	W. Inglis Clark, D.Sc.
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Frederick the Great	Findlay Muirhead.
Free Trade	Professor J. S. Nicolson.

A great many of the articles named above are new; others written for earlier issues of this Encyclopædia have been so thoroughly revised by their authors as to be virtually new. In addition to these many other revisers have taken part, including Professor J. A. S. Watson (Agriculture), Mr C. Inglis Clark, Dr Drinkwater, Mr William Morison (Chemistry), Dr Mary T. Rankin (Economics), Professor Frederic Bacon (Engineering), Dr R. W. Johnstone (Art. Fœtus), Mr J. Liddell Geddie (Art. France), Dr Robert Campbell (Geology), Mr G. E. Shepherd (India), Sheriff Irvine, Sheriff Dunbar (Law), Dr John D. Comrie (Medicine), Mr R. C. Mossman (Meteorology), Captain H. M. Johnstone, R.E. (Military subjects), Admiral Sir Reginald Tupper (Naval subjects), Professor W. Peddie (Physics). Thanks are due for information supplied by Mr Ossian Donner, Finnish Minister in London, and Mr Pape Cowl (Finland), Mr R. Mollerson, First Secretary of the Estonian Legation (Esthonia), and Dr A. H. Millar (Dundee).

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Dioptrics is that branch of geometrical optics which treats of the transmission of rays of light from one medium into another differing in kind. It consists of the results of the application of geometry to ascertain in particular cases the action of what are called the laws of refraction. See OPTICS, REFRACTION, LIGHTHOUSE.

Diorama. See PANORAMA.

Diorite. See IGNEOUS ROCKS, PETROGRAPHY.

Dioscorëa'ceæ, an order of Monocotyledons, of which the genus Dioscorea (see YAM) is the type. There are about 170 species, temperate or tropical, all twining shrubs, with large rootstocks or tubers. *Testudinaria elephantipes*, a South African species, sometimes called Elephant's Foot and Hottentots' Bread (q.v.), has a large fleshy rhizome, with a rough cracked bark, which is used as food by the Hottentots in times of scarcity. *Tamus communis* (Black Bryony) is the only British representative of the order.

Diosco'rides, PEDACIUS, or PEDANIUS, a Greek physician, was a native of Anazarba in Cilicia, and, probably in the 2d century of our era, accompanied the Roman armies as physician through many countries. He has left a great work on materia medica, in five books, in which he treats of all the then known medicinal substances and their properties, real or reputed. His authority in botany and materia medica was long undisputed, and is still maintained in the East. The best editions of Dioscorides, including some smaller works bearing his name, are by Saracenus (1598) and Sprengel (2 vols. 1829–30).

Dioscuri. See CASTOR AND POLLUX.

Diosma. See BUCKU.

Dios'pyros. See DATE PLUM, and EBONY.

Dip, in Geology, is the inclination of strata downwards into the earth. The amount or angle of dip is the degree of deviation from a level line, or the plane of the horizon. See HORIZON.

Diphtheria (Gr. *diphthera*, 'a pellicle') was described in 1826 by M. Bretonneau of Tours as a form of very fatal sore throat, occurring chiefly in children. In its milder forms the disease resembles other inflammations in the throat, but a case can be recognised by the finding of the diphtheria bacillus in the inflamed area. The disease begins by malaise, feeling of chilliness, loss of appetite, headache, and more or less fever; soon the throat feels hot and painful, whilst the neck is stiff and tender. If seen early, the throat is red and swollen, but a false membrane of yellowish or grayish colour quickly appears in spreading patches on an inflamed and ulcerated base in the pharynx or back of the throat, and often extends down the œsophagus or gullet, one side usually being more affected than the other. There may be enlargement of the glands at the angle of the jaw, and albuminuria generally occurs at some stage of the disease. Diphtheritic membrane may be got on any mucous surface, or even on a wound; if it extends into the larynx, it gives rise to difficulty in breathing. The throat affection is often accompanied by a low and very dangerous form of fever, with great and rapid loss of the patient's strength, which is still further reduced by difficulty in taking food; in other cases, the disease is fatal by paralysis of the heart, or by suffocation, due to invasion of the larynx, when tracheotomy may require to be resorted to. After the acute disease is over, the recovery may be delayed by paralytic symptoms of various kinds; or simply by extreme debility, with exhaustion and loss of appetite. Diphtheria is contagious, the bacillus being conveyed from individual to individual by the air, and it has the peculiar tendency of tacking itself on to other diseases, especially scarlet fever. Damp and temperate climates seem to favour its development, while the contagium may remain dormant for long

periods. Outbreaks are stated to have been traced to impure drainage and bad water. One attack affords only slight protection against recurrence. Diphtheria is caused by the diphtheria bacillus, discovered by Loeffler in 1884. The organism, multiplying in the throat, gives rise to the local inflammation, and also produces a powerful poison which, being absorbed into the body, causes the heart weakness and the paralysis alluded to above. This latter fact was proved by Roux of Paris finding that when the bacilli are grown in beef broth and subsequently removed by filtration through an earthenware filter, the remaining fluid or toxin, on injection into animals, gives rise to typical post-diphtheritic paralysis. The discovery led to Behring in 1893 elaborating the idea of treating the disease by antitoxin. If such an animal as the horse receives every few days increasing doses of the toxin, its serum, after two or three months, is found to contain a substance—antitoxin—which, when injected into animals, protects them against infection either with the diphtheria bacillus or its toxin; furthermore, even after infection, injections of the antitoxin will in a great many cases prevent death. Behring found that the last fact was also true in natural infection occurring in man, the inflammation in the throat being checked, and the general toxic effects being minimised. The antitoxin treatment thus discovered has diminished the mortality of diphtheria from 45 per cent. to about 10 per cent. Its success depends on its early application, if possible on the first day of the disease. A method was devised by Schick in 1913 of discovering by inoculation persons susceptible to diphtheria. The administration of a small dose of antitoxin to these affords protection against the disease. Besides the administration of antitoxin, the treatment consists in keeping up the strength of the patient by means of concentrated beef-tea, milk, egg-flip, &c. Iron in large doses is most valuable, and sometimes quinine. Locally, solvents, such as lactic acid, are applied to the throat by a brush; antiseptics are also useful, the best being Condy's fluid. It has been found that after an attack of diphtheria the bacilli may remain in the throat for weeks or months. It is chiefly by means of such 'diphtheria carriers' that the disease is kept alive in a community and fresh outbreaks originated. A diphtheria convalescent should not be allowed to mix with healthy people till bacteriological investigation has shown that no living diphtheria bacilli remain in the throat.

Diphthong. See PHONETICS, SPELLING.

Diplod'ocus, a gigantic dinosaur of the suborder Sauropoda, found in the Jurassic rocks of the western states of the American Union. One of the largest (if not the very largest) of animals known to have walked this globe, it had a comparatively short and low body, a small head, with slender teeth only in the front parts of the jaws, a very long neck, and was herbivorous and apparently aquatic. The total length was perhaps 75 or 80 feet, of which 20 fell to the neck and only 2 to the head; the weight must have been some 20 tons. In 1905 Mr Carnegie presented a cast of one from the mountains of Wyoming to the British Museum. The name was coined in 1878 by Dr O. C. Marsh (q.v.), to whom we owe the knowledge of so many of these dinosaurs, and is derived from Gr. *diploos*, 'double,' and *dokos*, 'beam' or 'bar.' See DINOSAURIA.

Diplo'ma (Gr., 'something doubled'), originally a document on two tablets of wax (see DIPTYCH), or on writing material which was folded. The Roman emperors granted diplomas to couriers, giving them the use of public servants and horses; hence diploma came to signify an official warrant of any kind. The term is now mostly applied to documents given by universities and other learned societies, in proof of the holder having attained a certain degree; to the licenses held by physicians and surgeons; and to certificates of merit awarded at exhibitions.

Diplomacy (from *diploma* in the sense of 'public document'), the art of conducting the intercourse and adjusting the mutual relations of nations, arises out of the necessary interdependence of states, and the rights and duties of political intercourse. Although the art of diplomacy is as old as official intercourse between states, the special class of officials now known as diplomatists did not, and could not, exist until permanent legations were instituted. The general rules regulating the authority of accredited diplomatic representatives and the means by which the intercourse between states is conducted, are embodied partly in international usages and partly in treaties.

The classification of diplomatic agents resident in foreign countries was regulated by the protocols of the Congress of Vienna in 1815, and the Congress of Aix-la-Chapelle in 1818. It is as follows: (1) Ambassadors and papal legates or nuncios; (2) envoys extraordinary, or ministers plenipotentiary; (3) ministers resident accredited to the sovereign; (4) *chargés d'affaires* accredited, not to the sovereign, but to the minister for foreign affairs. This classification is only of importance in relation to questions of precedence and ceremonial. In the diplomatic hierarchy ambassadors, being considered personal representatives of the heads of their states, enjoy special honours. Thus in the United Kingdom they rank in precedency immediately after the princes of the blood-royal.

A diplomatic agent is furnished with a letter of credence, announcing his appointment and requesting that full faith and credit be given to what he shall say on behalf of his state. This letter is presented by him to the government to which he is sent. Where a diplomatic envoy is entrusted with the conduct of specific negotiations, which are outwith the ordinary business of a permanent legation, e.g. the negotiation of a commercial treaty, it is necessary to furnish him with special powers, which may either be contained in the letter of credence, or, as is more usual, may be conferred by letters patent.

The most complete personal independence and freedom of action are essential to the efficient performance of the duties of a diplomatic agent. The inviolability of international agents was recognised by the nations of antiquity, and has been accepted in modern times as inseparable from the right of legation. This privilege is enjoyed from the moment that a diplomatic envoy enters the territory of the state to which he is accredited until he leaves that territory. During his residence in that state he continues to be domiciled in, and to be entitled to the protection of the municipal laws of his home state. He is exempt from the jurisdiction, both civil and criminal, of the state in which he resides. Thus, in England a foreign ambassador cannot be sued against his will, even in respect of private commercial transactions; and this privilege extends to his family and suite, attachés and secretaries, and domestic servants. This immunity, which is absolute in the case of an ambassador himself, is forfeited in the case of a member of his establishment if such a person engages in trade. The official residence of an ambassador cannot be entered by officers of justice, police, or revenue of the state to which he is accredited, unless he specially permits such entry. His residence is, indeed, by a fiction of law, held

to be a part of the territory of the state which he represents. On this fiction of exterritoriality was based the so-called right of asylum, under which criminals or other persons taking refuge within a foreign embassy secured freedom from arrest. The claim to grant such asylum has in practice been abandoned, and English law does not recognise any right of asylum as attaching to a foreign embassy. The right to freedom of religious worship (*droit de chapelle*) has long been recognised, and the larger tolerance of modern times in religious matters has deprived that right of much of its former significance.

Until the beginning of the 18th century Latin was the language generally used in diplomatic intercourse. French, however, gradually displaced Latin as the diplomatic language of states. At the Peace Conference at Paris in 1919, the English and French languages were employed on a footing of equality, and the English and French texts of the Treaty of Peace with Germany, and the Covenant of the League of Nations, are both authentic.

The permanent diplomatic agents of the several states not merely carry on the necessary intercourse and communications between their respective states, but are constantly engaged in adjusting points of difference, and in exchanging views on questions affecting the relations of these states. It is the duty of an ambassador, or other permanent diplomatic envoy, to keep his government informed on all matters of state policy or of political interest in the country in which he is resident; to protect the persons and property of subjects of his home state, and, in case of injury to them, to secure a remedy; and, in general, to forward the interests of his home state and those of its individual subjects. He must, however, scrupulously abstain from interference in the internal affairs of the state to which he is accredited. If he violates this rule, the state to which he is accredited may request that he be recalled. Thus, in September 1915, Dr Dumba, the Austro-Hungarian ambassador in Washington, was, at the request of the United States, recalled for proposing plans to instigate strikes in American munition factories, and for employing an American citizen, with an American passport, to carry official despatches secretly to Austria through the lines of the enemies of Austria.

In recent years many changes have been made in the organisation of the British diplomatic service. The foreign office and the diplomatic service, always closely associated, are now amalgamated. The examination for entrance to the service is the same as that for the general civil service and the Indian civil service, special provision being made to ensure that the candidates attain a high standard in French and German. Between the diplomatic service and the consular service, a new commercial diplomatic service has been formed. In the more important countries there is now a commercial counsellor, who is the deputy of the ambassador, and who has under him one or more commercial secretaries. In less important countries there is a commercial first secretary with a suitable staff.

Colloquially the term is frequently applied to conduct which, if not altogether fraudulent, is characterised by a certain degree of cunning and subtlety. This use of the word probably arose from the popular impression that, in conducting the affairs of nations, there is in use a code of morality which would be condemned if practised by individuals in their intercourse with each other. Nor, judging from the old literature of legation, can it be said that this popular conception of the ambassador and his functions was altogether unfounded. Of late years, however, the general progress of international morality, and more advanced conceptions of international relations, have considerably modified the older view of the functions of diplomacy and diplomatists. Speech in the mouth of a diplomatist is no longer an instrument for the concealment of thought; an ambassador is no more a functionary commissioned 'to lie abroad for the advantage of his country,' but one selected to tell the truth on her behalf.

The phrase *Corps Diplomatique* is usual for the whole body of ministers who are present at any court as representatives of foreign countries.

See P. Satow, *A Guide to Diplomatic Practice* (2 vols. London, 1917); Callières, *The Practice of Diplomacy* (London, 1919); D. P. Heatley, *Diplomacy* (Oxford, 1919); and Treatises on International Law.

Diplomatics, the science of dealing with historical documents, is closely connected with *Palæography* (q.v.). See RECORDS.

Diplozoon (Gr., 'double animal'), a remarkable flat worm or Trematode. It consists of two organisms fused together. The embryo, known as *Diporpa*, is ciliated and free-swimming, but soon relapses into parasitism. It loses its cilia, settles on a minnow's gills, loses its eyes, and remains for weeks or months like many another Fluke (q.v.). Finally, however, a curious phenomenon occurs. One individual moors itself by its ventral sucker to a conical knob on the back of another, 'which thereupon so twists itself as to fix the first individual in the same manner.' The cones and suckers are closely fused, but otherwise the secondarily twin animals remain independent. This double Trematode well deserves its name of *Diplozoon paradoxum*. See Zeller, *Zeitschcr. f. wiss. Zool.* xxix. (1877).

Diplozoon paradoxum.
(From Leunis, after Zeller.)

Dipnoi (lit. 'double-breathers'), a small order of fishes in which the air-bladder has become a single or double lung. See CERATODUS, LEPIDOSIREN, and MUD FISHES.

Dippel's Animal Oil, a panacea invented by Johann Konrad Dippel (1673–1734), a German chemist and alchemist. It was obtained in the manufacture of ammoniacal products by the distillation of bones. A mixture of oils passes over, and these, after being repeatedly distilled, eventually yield an aromatic liquid, free from fetid odour. This obtained a great reputation as an antispasmodic, and being present in the old spirit of hartshorn, gave it properties somewhat different from those of the modern sal volatile. Owing to the careless way in which it was usually manufactured, and the consequent disgusting odour and taste which it possessed, it has been quite discarded and is no longer used in medicine.

Dipper (*Cinclus*), a genus in the family Cinclidæ, sometimes mistakenly referred to thrushes. The bill is straight, and there is a membrane partially covering the nostrils; the wings are short and rounded; the tail is very short; there is a complete layer of dense down beneath the close-set outer feathers. Dippers frequent clear pebbly streams and lakes, feeding chiefly on molluscs and on aquatic insects and their larvæ. The bird carries its short tail elevated after the manner

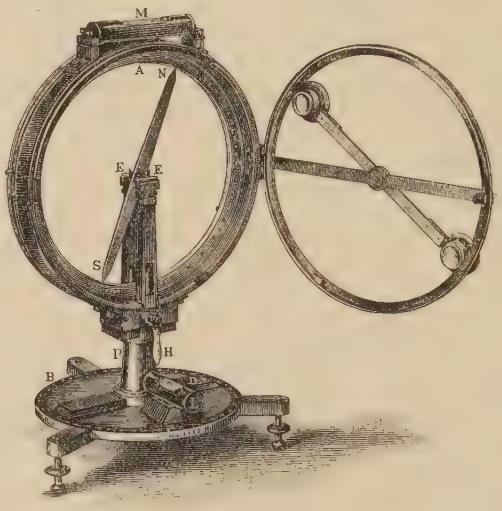
of wrens, which it also resembles in the frequent dipping of the head, accompanied with an upward jerking of the tail. One species is found in Britain, the Common Dipper or Water Ousel (*C. aquaticus*), a bird about seven inches in length, silky black above, with throat and upper part of the breast pure white, and then a band of chestnut-brown. It is found throughout central and western Europe, and the genus has a world-wide representation. It is not gregarious. The dipper never fails to attract notice, as it sits upon some stone in the midst of or beside the stream, its white breast

Water Ousel (*Cinclus aquaticus*).

rendering it conspicuous as it repeats the movement from which it derives its name. Its song is not confined to the breeding season, and may even be heard among the frosts of winter. Its movements under water are imperfectly understood; it walks quickly along the bottom, and also uses its wings like oars. The nest of interwoven moss, domed and with the entrance on the side, is built usually in some mossy bank close by a stream, and often near or under a cascade. The dipper breeds twice in the year. There are 4 to 6 dull white eggs. The statement is often made that it eats the spawn of fishes, but this charge is baseless. On the contrary, the dipper often devours the enemies of spawn.

Dipping-needle, or DIP CIRCLE. The magnetic dip or inclination, one of the three elements necessary for the complete determination of the earth's total magnetic force at any place, is defined to be the angle which the magnetic axis of a magnet, swinging freely in the plane of the magnetic meridian, makes with the horizon. The dipping-needle which is employed to determine its amount at any place, consists essentially, therefore, of a magnetic needle suspended in the plane of the magnetic meridian, so that it can indicate, on a graduated circle in its plane, the angle required. In the accompanying figure one form of the instrument is represented. A is a vertical brass circle, graduated into degrees and fractions of a degree, inclosed between circular glass doors (one of which is seen opened in the figure), and supported on the pillar P. This pillar fits into a socket in the horizontal circular disc B, also graduated at its margin, and from the base of the pillar two flat brass strips, CD, reach on opposite sides to the graduated edge. The horizontal disc is supported on three legs, whose lengths can be adjusted by screwing or unscrewing. On this horizontal circle the vertical circle can be turned in azimuth. The needle, NS, a thin flat piece of steel, pointed at both ends, is suspended in the plane of the vertical circle by means of hard, polished, cylindrical axles passing through its centre of gravity, and rolling on the agate edges, EE. When the indications of the needle are not actually being read, the axles may be raised by, so as to rest on, two Y-shaped brass edges, which are lifted or depressed again by turning the handle H. On the outside of the glass door a light cross-bar carries a flat rod, at each end of which a magnifying lens or microscope is placed to read off the dip of the needle as indicated by its ends, on the graduated vertical circle. For the purpose of setting the one circle truly horizontal and the other truly vertical, one level, L, is placed on the horizontal circle, and another, M, on the top of the vertical circle.

If the needle be swinging freely in the plane of the magnetic meridian, if its centre of gravity lies in the axis on which it is free to rotate, and if its magnetic axis coincides with its axis of figure, it



Dipping-needle.

will correctly indicate the dip. But there are numerous errors possible in such an instrument which can only be avoided by taking the mean of two observations which have errors of equal amount but of opposite sign. This duplication of observations has to be carried out for each of the known possible instrumental errors, so that finally the true angle of inclination or dip is obtained, as the mean of no less than sixteen readings. The errors in question may be due to the following causes: (1) The vertical circle may not be properly set, and in consequence, when the needle is standing vertically, it does not point exactly to 90°, as it should; (2) the bearings of the needle may not be exactly in the centre of the circle; (3) the centre of gravity of the needle may not be in the axis on which it can rotate; (4) its magnetic axis may not coincide with its axis of figure; (5) there may be friction or adhesion at the bearings.

In making an observation of the inclination with the instrument, the first requisite is the adjustment to verticality of the vertical circle by means of the levels. The plane of the magnetic meridian must then be found, and the axis turned round until the vertical circle is in that plane. This is done by finding the position in which the needle stands vertically, for in that position, which is at right angles to the plane of the magnetic meridian, the horizontal component of the earth's magnetic force is non-effective, owing to the mode of suspension; the vertical component only is effective, and causes the needle to hang vertically. The plane of the needle is then moved through 90°, and is thus brought into the magnetic meridian. In making this observation of the plane in which the needle stands vertically, it is necessary, in order to elimin-

ate the effect of faults in construction already noted, to take a reading from the lower end, and one from the upper end of the needle; then, turning the circle round through 180°, to make other two in the same way; the mean of these four readings, with 90° subtracted, gives the plane of the meridian. To determine the angle of dip, four readings are taken, two with the face of the instrument towards magnetic east, and two with it facing magnetic west; one of each two being with a marked side of the needle facing the circle, the other being in the reversed position. The needle is then magnetised afresh, so that its polarity is reversed, and another series of four similar readings is obtained. The mean of these eight readings gives the true amount of the inclination.

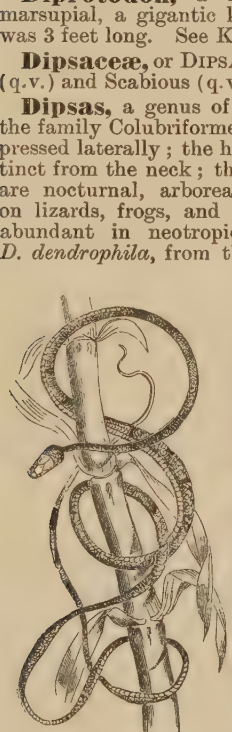
The turning of the instrument through 180° is to avoid any error due to that noted above as (1); to counteract (2), readings of both ends of the needle are taken; presenting both faces (or sides) of the needle, neutralises the effect of any error such as (3); errors such as (4) are obviated by the reversal of polarity.

The dipping-needle is not of such form as is convenient for continuous registration; for these requirements—i.e. the variations of the vertical component of the earth's magnetic force, the vertical force magnetometer is used. See MAGNETOMETER.

Diprotodon, a huge Australian Tertiary marsupial, a gigantic kangaroo. The head alone was 3 feet long. See KANGAROO.

Dipsaceæ, or DIPSACACEÆ, the order of Teasel (q.v.) and Scabious (q.v.).

Dipsas, a genus of non-venomous serpents of the family Colubriformes. The body is much compressed laterally; the head is thick, blunt, and distinct from the neck; the scales are smooth. They are nocturnal, arboreal animals, feeding chiefly on lizards, frogs, and small birds, and are most abundant in neotropical and oriental regions. *D. dendrophila*, from the East Indies, is over six feet in length. *Dipsas cyanodon* is a large and beautiful species found in Java and Sumatra.



Dipsas cyanodon.

Dip-sector, an astronomical instrument for determining the dip of the horizon, is in principle similar to the Sextant (q.v.). See HORIZON.

Dipsomania is the typical form in which the morbid craving for alcohol and other nerve stimulants manifests itself. The craving attacks are recurrent, often periodic, and in the intervals between them the subjects may either abstain altogether—which they are often able to do without difficulty—or they may take alcohol regularly without exceeding the bounds of moderation. The instinctive character of dipsomania is manifested in its symptoms, the chief of which are suggestibility, impulse, and suppression. After recovery from the drinking bout the painful experience is effectively suppressed from consciousness to such an extent that the inclination to alcohol may be converted into a repugnance towards it, and the subject believes that a recurrence of the experience is impossible. This psychological process of forgetting is quite natural, although, to the uninitiated, it forms one of the most puzzling symptoms of the malady. But although the experience is thus suppressed, it remains independently active in the unconscious, and is liable to be reawakened into conscious activity under the influence of suggestions of various kinds, of which alcohol itself is the most potent. When a powerful, suppressed experience gains an ascendancy over the controlling mental processes responsible for its suppression, it usually displays the instinctive character of an impelling impulse. The subject, aware of the danger and alive to the painfulness of his past experience, endeavours to repress the complex, but too often is overcome by a force stronger than his own impaired will. There is every degree of difference between the ordinary forms of Alcoholism (q.v.) and what have been called the pathological forms, to which the term dipsomania has hitherto been generally applied, but the main characteristics—suggestibility, recurrence, and impulse—are essentially the same. It is true that many of the subjects of the exaggerated forms of alcoholism have an hereditary tendency to the neuroses and to insanity, and that they often manifest a stronger craving for, and a stronger impulse towards, nerve stimulants than less neurotic individuals. So powerful may this impulse be, and so inaccessible to advice or control, that some authorities look upon the pathological form as true dipsomania, which they compare with epilepsy or certain phases of mania. As has been pointed out, however, the difference between the ordinary and the pathological forms is only one of degree, and dipsomania, notwithstanding its name, must be regarded as merely a more pronounced manifestation of the abnormal impulse to indulge in narcotic stimulants.

Dip'tera, an order of two-winged insects, distinguished even by Aristotle. The wings are transparent, never folded, with predominant longitudinal veins; the hind-wings are transformed into small 'balancers' or 'halteres,' rarely absent; the mouth organs are adapted for piercing and sucking, the palps on the first pair of maxillæ are free or absent, those of the second pair are modified into a tongue or labella; there is a complete metamorphosis (larva, pupa, and imago); the larva is a footless maggot or a grub with secondary feet, its mouth parts are adapted for biting or for sucking; those of the pupa are adapted for sucking. The order is very large, numbering probably from 15,000 to 18,000 species, not including the fossil forms preserved in amber and the like. Many species, both as adults and as larvæ, are directly or indirectly of economic importance because of their attacks on man, domestic animals, household stores, and cultivated plants; others again mitigate the ravages of other insects. The order will be sufficiently illustrated under separate articles—e.g. BLOW-FLY, CORN INSECTS, DADDY-LONG-LEGS, GNAT, HESSIAN FLY, HOUSE-FLY, MIDGE, &c.

Dipterocarpaceæ, or DIPTERACEÆ, an East Indian order of archichlamydeous dicotyledons, including about 300 species, of which many are majestic trees, valued alike for timber and balsamic resins (see SAL, COPAL, DAMMAR, &c.). *Dipterocarpus turbinatus*, the Gurjun tree, and other species yield a fragrant oily resin, the so-called Gurjun balsam, while that of other species is sometimes called Dammar. Their timber is valuable for sleepers, &c. The seeds of various species of Shorea and other genera, especially *S. stenoptera*, growing in Borneo, Sumatra, and Java, yield Borneo tallow, a fat resembling cocoa butter in characters and uses. These are sometimes called illipe nuts, a name better confined to the fruits of Bassia and other Sapotaceæ. For the Malabar tallow-tree, see TALLOW-TREE.

Diptych, a two-leaved writing tablet, in which were inscribed the names of living or dead Christians to be read aloud during the celebration of the eucharist. The practice was due originally to a custom under the Roman empire of magistrates, such as consuls, prætors, and ædiles, at the commencement of their office, giving away tablets inscribed with their names and portraits. In Christian usage it was in very early times customary to inscribe the names of dead bishops—a beginning of the calendars and martyrologies of later days. The insertion of the names of living persons may have had its origin in the ancient recital of the names of those who had voluntarily furnished the elements for the holy communion. It afterwards was extended to include the names of the living faithful, especially those in authority, ecclesiastical and civil. The commemoration of the faithful dead was originally distinct from any special prayer on their behalf. The earliest diptychs in existence are not older than the 5th century of our era. They are of various sizes, rarely exceeding eight inches by four, are sometimes of ivory and metal, as well as wood, and are adorned with an art that is elaborate, if not always beautiful.

Dipus. See JERBOA.

Dir'ce, wife of Lycus, treated with great cruelty her husband's divorced wife Antiope. The sons of Zeus by Antiope took vengeance on their mother's foe by tying her to a wild bull, which dragged her about till she died—a subject represented in a famous antique statue group.

Dircks, HENRY, civil engineer, born at Liverpool, 26th August 1806, is known as the author of works on perpetual motion (1861) and electro-metallurgy; of *The Ghost* (in which he describes his invention, commonly called 'Pepper's Ghost') (1863), of a life of the Marquis of Worcester (1865), of *Inventors and Inventions* (1867), and of novels and essays. He died at Brighton, 17th September 1873.

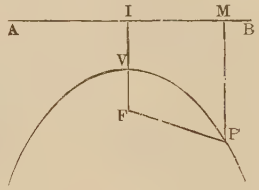
Director, one of a number of persons appointed to conduct the affairs of joint-stock undertakings, such as banks, railways, water and gas companies, fire and life assurance companies, and various kinds of manufacturing and trading companies. See COMPANY.—Director is a name used by Catholics for a spiritual guide and confessor.

Directorium is the part of the Catholic church calendar which gives the order of the festivals and prescribes the services for the several days of the year.

Directory, a name applied to a board of guardians over any commercial, industrial, or scientific enterprise. Historically the name refers to the body of five men—Lépeaux, Letourneur, Rewbell, Barras, and Carnot—to whom the executive was intrusted in France after the downfall of the Terrorists, 26th October 1795 (5th Brumaire III.), and which lasted till the 9th November 1799 (18th Brumaire VIII.). Its corruption and incompetence made government impossible, and it was overturned by the Abbé Sieyès and Bonaparte, who established in its stead the consulate, soon itself to fall before the imperial ambition of Napoleon.

Directory for Public Worship, a code of regulations concerning the different parts of public worship, drawn up by the Westminster Assembly in 1644, ratified by the English parliament in the same year, and adopted by the General Assembly of the Church of Scotland on the 3d February, and by the Scottish parliament 'without a contrary voice,' on the 6th February 1645. It was on express order from both Houses of the English parliament that the Westminster Assembly addressed itself to the work of preparing this Directory, to supply the place of the Book of Common Prayer, which had been abolished. In Scotland it was hailed as conducive to 'a happy unity and uniformity in religion among the kirks of Christ in these three kingdoms, united under one sovereign,' and to 'the corroboration of peace and love between the kingdoms.' Many of the regulations of the Directory are still complied with in all branches of the Presbyterian Church in Scotland, but in many things it has been generally departed from. The Directory is printed in vol. v. of Neale's *History of the Puritans*, and is usually appended to the Confession of Faith.

Directrix. If a point so move that its distance from a given fixed point is to its perpendicular distance from a fixed straight line in a constant ratio, it describes a conic section, of which the fixed straight line is termed the *directrix*, and the fixed point the *focus*. The constant ratio referred to is termed the *eccentricity*, and its magnitude determines the nature of the conic. Thus, if in the figure AB be the directrix and F the focus, if the point P move so that its distance from F is to its distance PM from AB in a constant ratio, then P will trace out a conic section, which will be an ellipse, parabola, or hyperbola, according as the ratio in question is less than, equal to, or greater than unity—i.e. as FP is less than, equal to, or greater than PM, or FV than VI.



Dirhem, a modification of the Greek *drachma* (see DRACHM), was the name under the califs for a weight of silver equivalent to about forty-five grains, and was also used for precious stones and medicine in Arabia, Persia, Egypt, and Turkey. As a coin the value varied, but may be given at 5½d. under the califs. In Turkey, the name dirhem has been given to the much smaller weight, the French gramme.

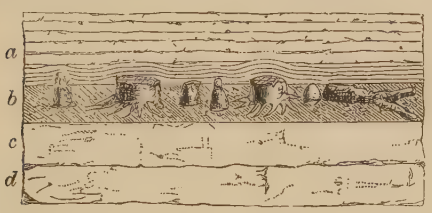
Dirk is a dagger. In the complete equipment of the Scottish Highlander, the *skean-dhu* ('black knife') is worn thrust inside the stocking.—The side-arm formerly worn by midshipmen and cadets of the royal navy when on duty was also called by this name. The weapon was a broad blade some 18 inches in length, furnished with a white fish-skin handle. This weapon, which superseded the sword in 1856, was clumsy, unsightly, and of small use for purposes of offence or defence.

Dirk Hartog Island, measuring 40 miles by 10, lies off the west coast of Australia, and, with Peron Peninsula to the south, incloses the Freycinet Inlet, while, with two smaller islands to the north, it forms the breastwork of Shark's Bay.

Dirschau (Polish *Tczew*), a manufacturing town of Poland, on the left bank of the Vistula, 20 miles SSE. of Danzig. Road and railway bridges cross the Vistula. Polish from 1466 till 1772, but occupied by Gustavus Adolphus in 1626, West Prussian to 1918, Dirschau is now a railway junction, and has great railway works and sugar-factories. Pop. 36,000.

Dirt-beds, the quarrymen's name of several layers which occur in the Purbeck (q.v.) Beds, having the appearance of black dirt. They rest on the fresh-water limestones of the Purbeck, and consist of one principal layer, from 12 to 18 inches thick, and from two to four thinner layers. The substance is to a large extent a dark-brown or blackish earthy lignite, being the remains of an ancient vegetable soil. Through it are dispersed in considerable abundance rounded fragments of limestone (derived from the underlying bed) from

3 to 9 inches in diameter. Fossil Cycads (q.v.) are the predominant vegetable remains; they occupy their original upright position, having become fossil on the spots where they grew. The stumps stand erect for a height of from 1 to 3, or even more feet, and at distances from each other similar to what may be observed in a recent forest. Besides these, the dirt-bed contains the silicified stems of



Dirt-bed (Isle of Portland):
a, fresh-water calcareous slate, &c.; *b*, dirt-bed with stools of trees; *c*, fresh-water bituminous limestone, &c.; *d*, Portland stone, marine.

coniferous trees, laid prostrate, in fragments 3 or 4 feet in length. From the accompanying diagram it will be seen that the marine conditions under which the Jurassic limestone (Portland stone) was accumulated were succeeded by estuarine and fluviatile conditions, when the overlying calcareous beds forming the base of the Purbeck series were deposited. These beds were in like manner overspread with sandy carbonaceous clay, which eventually formed a land surface upon which grew a forest of cycads. Subsequently this forest was submerged and converted into a morass; and the trees decayed, and were eventually overturned by the force of wind or flood. Thereafter they were buried under newer accumulations of silt and calcareous mud, which now form the overlying fresh-water calcareous slate, &c.

Dis, the Roman equivalent of the Greek Pluto (q.v.). It is akin to *divus*, and originally denoted merely 'godhead' or 'deity.'

Disability, in Law, is either absolute, which wholly disables the person from doing any legal act—e.g. outlawry, excommunication, attainder, alienage—or partial, as infancy, lunacy, and drunkenness. For Catholic and Jewish disabilities, see CATHOLIC EMANCIPATION and JEWS.

Disbar, to degrade from the rank of barrister-at-law. This power is in England reposed in the benchers of the four Inns of Court. As the courts of law require that every barrister, before he is allowed to practise, must have been admitted to that office by one of the Inns of Court, so they will refuse to hear any one who has been deprived of his rank by the same authority. The power is rarely exercised, and only when the conduct of the offending party has been grossly irregular, one case of disbarring having occurred in 1862, and another in 1874. In the United States, the power to disbar is vested in the courts which have power to admit counsellors and attorneys to the bar.

In Scotland, the power to disbar rests in the Faculty of Advocates (see ADVOCATES).

Disc, in Botany, is a term applied with considerable vagueness by different authors to modified regions of the floral axis, particularly when forming a prominent ring supporting functional or rudimentary stamens, or bearing glands or nectary. See AXIS, FLOWER.

Disc, or DISCUS, a circular plate of stone or metal about 10 or 12 inches in diameter, made for throwing to a distance as an exercise of strength or dexterity. Disc-throwing was one of the principal gymnastic exercises of the ancient Greeks and Romans, and was included in the *Pentathlon*, the five exercises (leaping, foot-racing, disc-throwing, spear-throwing, and wrestling) prescribed for athletes in the national games. The discus was held in the right hand, leaning against the forearm, and thrown in the manner of a quoit, the player throwing it farthest being the winner. The method is well shown in the celebrated statue of the Discobolus (the disc-thrower) by Myron (q.v.), of which several copies exist, one being in the British Museum. See also QUOITS, SCULPTURE

Discalced, or DISCALCEATE, is the technical term for certain orders or sections of orders of friars and nuns bound by rule to go barefoot (from *dis*, and *calceus*, a shoe), especially amongst the Augustinians (q.v.), Carmelites (q.v.), Franciscans (q.v.), and Trinitarians (q.v.).

Discant. See DESCANT, COUNTERPOINT.

Discharge. See BANKRUPTCY; ELECTRICITY; ABSCESS, BOIL, PUS, SUPPURATION, ULCERS, WOUND.—In the British army discharge is a matter of right at the expiration of the period of service for which a soldier has enlisted, subject to his subsequent service in the reserve. In 1914 this was seven years with the colours, and five years in the reserve. He is entitled to a certificate stating his service, conduct, and cause of discharge, with a note of any qualifications he may have for special employment in civil life. If abroad when discharged he is also entitled to be sent home free of expense. At any time within three months of his enlistment he may claim, in peace-time, his discharge on payment of £10, but after that the consent of his commanding officer is necessary, and the payment may amount to as much as £25. He may be discharged at any time if convicted by the civil power, or if sentenced thereto by court martial to be 'discharged with ignominy' when considered 'incorrigible and worthless.'

In the case of seamen, each person discharged receives an official paper giving the particulars of the voyage, with his rating, &c. A seaman who is discharged abroad and becomes distressed may be sent home at the expense of the owner of his last ship, or at the expense of the Mercantile Marine Fund. Lascars discharged elsewhere than in India must be returned to the port they shipped at.

Disciples of Christ, a group of Christians found in various parts of the world who seek a restoration of the New Testament Christianity, and who advocate the union of all Christians on that basis. The names Churches of Christ and Christian Churches are also used. That of Campbellites, sometimes given in derision, they repudiate. Alexander Campbell (q.v.) was only one of a number who started independent movements, afterwards united.

Disciplina Arcani (Lat., 'Discipline of the Secret'), a term first employed by the German controversialists Tentzel and Schelstrate (1683–85) to denote a discipline of the early church, founded upon the words of Christ in Matt. vii. 6, and on 1 Cor. iii. 1–2, and Heb. v. 12–14, in virtue of which the knowledge of certain doctrines and the liberty of presence at certain rites connected with the most solemn mysteries of the Christian religion were withheld by the initiated from pagans and catechumens. Both unbelievers and catechumens were removed from the church at the commencement of what was afterwards called the *Missa Fidelium* (see LITURGY); such doctrines as regarded the sacraments of baptism and the eucharist were either not mentioned in the presence of these classes, or were referred to in enigmatical language, unintelligible to the uninitiated. This principle of reserve accounts for the absolute silence as to the eucharist

preserved in many early Apologies; the earliest indications of the discipline are met towards the close of the 2d century. After the 6th century, all need for it having disappeared, the practice was discontinued.

Discipline. See ARMY DISCIPLINE, CHURCH DISCIPLINE.

Discipline, BOOKS OF, the First and Second, embody the constitution and order of procedure of the Church of Scotland from the period of the Reformation. The *First Book of Discipline*, or the 'Policie and Discipline of the Church,' was drawn up under a commission from the Privy-council of Scotland, in 1560, by John Knox and other four ministers—John Row, John Spottiswoode, John Winram, and John Douglas. These ministers, the same year, had prepared the doctrinal Confession of Faith of the church, which was inscribed among the acts of parliament as a statute of the realm; but for the practical government and discipline of the church, a form of order more elaborate than that imported from Geneva was required, and this was provided in the *First Book of Discipline*. It was approved by the General Assembly, but on being presented to the Privy-council several members manifested opposition to some things in the book, and it was not ratified by the council as such. Most of the members, however, subscribed it, and pledged themselves to set forward its regulations. These had reference principally to (1) the providing of ministers for the numerous congregations all over the country, but as ministers were then few in number, the temporary expedient was resorted to of appointing readers, exhorters, and superintendents; (2) the order of public worship and dispensation of the sacraments; (3) the establishment of schools in every parish, and of colleges in every 'notable' town; (4) the provision to be made for the support of ministers, schoolmasters, and the poor; and (5) the mode of dealing with offenders against the laws of the church. Subscription of the *First Book of Discipline* was required of all ministers of the church before admission to office.

On account of the urgent need which was felt for such a book, it was prepared with haste, and several important matters were soon found to have been omitted. So early as 1563 a revised book of discipline was desiderated, but in consequence of the harassments of civil dissensions the revision was postponed. In 1575 a committee was appointed to take charge of the matter. Of this committee Andrew Melville was a prominent member, and the result of its labours was—

The *Second Book of Discipline*, or 'Heidis and Conclusiones of the Policie of the Kirk.' This was received and adopted by the General Assembly in 1578, and in 1581 that venerable body ordered that it should be engrossed at length in their register, and that copies should be taken by all the presbyteries of the church. Efforts were made to have it ratified by parliament at the time, but without success. It was, however, on the basis of the *Second Book of Discipline* that the constitution of the Church of Scotland was settled by the Scots parliament in 1592, and again in 1690. It is sworn to in the National Covenant, and was ratified by the General Assembly in 1638 as well as in 1645, when the Assembly received and adopted the 'Form of Church Government' prepared by the Westminster Assembly of Divines. It was not intended that the *Second Book of Discipline* should annul or supersede the first, but rather that it might amplify and qualify its regulations. Profiting by the experience gained under the operation of the first book, the church by the second abolished the temporary expedients to which the exigencies of the case had obliged them formerly to resort; and in the new book the Presbyterian system was established on the broad and solid platform on which it stands to the present day. Both Books of Discipline are still standards in the Church of Scotland, and also in some of the other Presbyterian bodies which have seceded from it.

Disco, an island on the west coast of Greenland, under the parallel of 70° N. It is mountainous, reaching a height of 3000 feet, and has a total length of about 90 miles, and contains much excellent coal. Godhavn harbour is on the south coast.

Disco'bolus. See DISC.

Discomycetes. See FUNGI.

Discontinuance. See ABANDONMENT.

Discord is a combination of notes which leaves the ear unsatisfied unless it is followed by further combination, usually a concord, which is termed the *resolution* of the discord. See MUSIC.

Discount is an abatement made when a debt or bill is paid before its due date. True discount in arithmetic is the difference between the amount of a future payment and its present value. Thus if £105 be due one year hence, the discount (at 5 per cent.) will be £5, and the present value £100; for £100 will amount to exactly £105 in one year at 5 per cent. But the practice of bankers and bill-discounters, which is sanctioned by mercantile usage, is to charge *interest* on the principal sum for the period discounted—i.e. from the date when the cash is advanced till the date when payment is due. In the above example, a banker would charge £5, 5s. for discounting a bill of £105 due one year hence, at 5 per cent.; so that he gets an advantage of 5 per cent. over the arithmetical discount, which, as we have seen, is £5. The rate of discount varies according to circumstances, the official bank-rate being usually higher than that obtainable in the market. In the case of foreign bills, instead of a fixed charge being made for discount, the usual practice is to quote a rate of exchange lower than the current rate, so as to cover this charge. The term discount is also applied to the depreciation in value of stock, &c. Thus if a loan is issued at the price of £90 cash for a nominal £100, it is said to be at a discount of 10 per cent. Shopkeepers often grant a discount on prompt payment of an account, or as an encouragement to further dealings.

Discovery. The English common law did not permit a party to an action to be a witness; but a court of equity would compel him to discover or disclose facts which his opponent had a right to know. Parties may now give evidence; but discovery is granted before trial, in any division of the High Court, of such facts or documents as a party requires in order to frame his own case. But a party is not permitted, by means of discovery, to obtain a premature disclosure of the case of his opponent. In the United States, the rules of practice are substantially the same as those of the English courts.

Disease, according to its literal construction, a state of *dis-ease*, or absence of the condition of health, in which all the faculties and organs of the body and mind work together harmoniously and without sensible disturbance. It is common to treat of disease as being *functional* or *organic*—i.e. evidenced by changes of function or of structure; but function and structure are so closely allied in fact and in nature, that the more this distinction is examined, the more vague and impalpable it becomes, and it can therefore only be kept up as a provisional and conventional arrangement.

A classification of diseases is a necessary preliminary to any general inquiry regarding them; particularly to such statistical methods as are involved in the tabulation or causes of death by registrars,

in returns of hospitals, and of the medical departments of the army and navy, &c. The standard authority in Britain as regards diseases affecting man is the *Nomenclature of Diseases*, published under the supervision of the Royal College of Physicians of London. We give a short outline of the arrangement adopted in the fifth edition (1918). The list includes nearly 900 names of diseases, besides the various poisons and injuries specified, which extend it to more than 1200.

I. Diseases caused by infection, including the common febrile maladies like chicken-pox, diphtheria, enteric fever, erysipelas, influenza, measles, pneumonia, scarlatina, small-pox, tuberculosis; less frequent conditions like malaria, leprosy, meningitis, plague, tetanus, yellow fever; venereal diseases—syphilis and gonorrhœa; and diseases usually affecting only animals—e.g. anthrax, glanders, hydrophobia.

II. Diseases of the nervous system. These are divided into three sections. (1) Diseases of the nerves, spinal cord, brain and their membranes. (2) Diseases which are names for groups of symptoms of which the cause is not fully known—e.g. shaking palsy, chorea, spasmodic wryneck, and other habit spasms like writers' cramp, neuralgia, convulsions, epilepsy, migraine, hysteria, catalepsy, neurasthenia. (3) Mental diseases. Some of these are developmental, like idiocy; some are evidences of disordered function of the brain, like mania, melancholia, delusional insanity; in another group the symptoms are due to infective, toxic, or other general conditions—e.g. delirium, exhaustion insanity, alcoholic insanity.

III. Diseases of the eye.

IV. Diseases of the ear.

V. Diseases of the nose.

VI. Diseases of the circulatory system. This includes (1) diseases of the heart, like pericarditis, endocarditis, degeneration of the heart muscle, and disease of the valves; (2) disordered action of the heart; and (3) disease of the blood-vessels—e.g. arterio-sclerosis, aneurysm, and phlebitis.

VII. Diseases of the blood, such as anæmia, hæmophilia, and leucocythæmia.

VIII. Diseases of the spleen.

IX. Diseases of the lymphatic system—e.g. inflammation of the glands, lymphangitis.

X. Diseases of the glands of internal secretion, including those of the thymus, thyroid, adrenals, and pituitary gland.

XI. Diseases of the breast, such as inflammation, malignant growths.

XII. Diseases of the respiratory system, including those of the larynx, trachea, bronchi, lung, and pleura.

XIII. Diseases of the teeth and gums.

XIV. Diseases of the digestive system, including those of the mouth, tonsils, salivary glands, gullet, stomach, intestines, pancreas, liver, and peritoneum.

XV. Diseases due to disorders of nutrition—e.g. obesity, scurvy, gout, and diabetes.

XVI. Diseases of the generative system, male and female, including affections connected with pregnancy.

XVII. Diseases of the organs of locomotion, including those of bone, joints, spine, muscles, tendons, and deformities.

XVIII. Diseases of the skin.

XIX. Diseases of the urinary organs.

XX. Injuries general and local. Also there is an appendix containing lists of surgical operations, tumours, malformations, poisons, and parasites.

Diseased Meat. See FOOD, MEAT, PTOMAINES, PYÆMIA.

Dis'entis, a Swiss health-resort in the Grisons, on the Farther Rhine, 39 miles SW. of Coire. Its abbey was founded in the 7th century.

Disestablishment. See STATE CHURCH.

Dishonour. See BILL OF EXCHANGE.

Disinfectants are, strictly speaking, agents which can prevent infectious diseases from spreading, by destroying their specific poisons. The term is, however, often applied to all substances which destroy or neutralise bad odours, though not all such have the power of counteracting infection. Many infectious diseases have now been proved, and all are believed, like Putrefaction (q.v.), to be due to special micro-organisms which are found in different parts of the body, and are communicable in different ways in different diseases (see GERM THEORY). The action of disinfectants is therefore exactly analogous to that of Antiseptics (q.v.), and consists in the destruction of low forms of life. But the two classes do not necessarily correspond, as the same substance may have unequal poisonous effects on different forms. It is of the utmost importance to discover the conditions which are most deadly to each disease-poison, and to apply them, if possible, within as well as without the diseased body. But little has yet been done in this direction.

Carbolic acid, which probably stands highest in popular esteem as a disinfectant, is undoubtedly one in the strict sense. It is not, however, in the very dilute state that it can act thus, and it is necessary to use it comparatively concentrated before good can result. Thus a 2 per cent. solution, mixed with vaccine lymph, completely destroys it, but a more dilute solution has almost no action on it. As a deodoriser, carbolic acid is not so energetic as chlorine and permanganate of potash, but there is this great difference, that while the acid destroys the organic substances which give rise to the offensive odour, the others mainly attack the odour itself, and therefore require to be applied frequently if perfect sweetness is desired. Thus a piece of putrid flesh is not rendered odourless so quickly by carbolic acid as by the other substances named, but one thorough application of it will prevent the recurrence of decay, a property not possessed by the others.

The vapour of carbolic acid is not a disinfectant at ordinary temperatures, as bacilli are not destroyed, even when exposed to it for six weeks. It is therefore evident that the mere exposure of that substance in vessels is of no service in disinfecting a room. It is curious that carbolic acid dissolved in oil or alcohol has no antiseptic action whatever, but that if water be present, as in the case of a wound, it acts powerfully.

Sulphurous acid has long been in repute, both in the form of solution and in the gaseous state. Experiments on cultivated bacilli seem to prove that, while in the liquid state it is a powerful disinfectant, it has little action either as dry gas or along with water vapour.

Mercury salts, such as the perchloride (corrosive sublimate) and biniodide, are powerful disinfectants, and are much used at present as antiseptics. For general domestic use, however, they have great disadvantages. The former attacks metals, and therefore ruins many pipes, while it is very rapidly neutralised by the presence of organic matter, especially where sulphuretted hydrogen has been developed. The biniodide is preferable, but neither of them is completely satisfactory. Of all the long list of popular disinfectants, chlorine, bromine, iodine, osmic acid, permanganate of potassium and of sodium, and corrosive sublimate seem to be the most certain and rapid, but all of these are open to objections. The employment of fumigating pastilles, burning brown paper, camphor,

benzoin, mastic, amber, lavender, and other odoriferous substances, is merely serviceable in cloaking over the offensive, fetid, and hurtful gases, and should never be resorted to unless in conjunction with the use of other agents possessing the properties of true disinfectants. For disinfecting clothes, bedding, &c., the most satisfactory treatment is heat. They may be heated to 250° F. without harm.

It will be seen from the foregoing that a general, satisfactory disinfectant is still a desideratum, and that even those in most use require favourable conditions, and a more lavish application than is generally forthcoming.

Dislocation consists in the displacement of one bone from another with which it forms a joint (*put out of joint* being the popular expression). Dislocations are generally the result of sudden accident, but may be the result of disease, or may be congenital. The displacement may be *partial* or *complete;* and surgeons classify their cases into *simple* dislocations, when the skin remains unbroken, and *compound*, when there is a wound by which the external air may communicate with the joint. Occasionally, in addition to the dislocation, there are fractures of the bones, or lacerations of important blood-vessels in the neighbourhood, or other injuries; it is then termed a *complicated* dislocation. Dislocation is a rare accident in infancy and old age, because in the former the joint-ends of the bones are very flexible, and yield to violence; while the aged skeleton is so rigid that the brittle bones fracture under force that would drive mature and stronger ones out of their sockets. Dislocations are most frequent between the ages of twenty and sixty. Persons with weak muscles, and lax, long ligaments, or those in whom the latter have been softened by inflammation of the joint, are predisposed to dislocation. The shoulder is far more frequently dislocated than any other joint in the body; in the lower extremity the hip most often suffers.

General Symptoms of a Dislocation.—After a blow, fall, or violent muscular exertion, a limb is found to have lost its natural mobility at the injured joint, though there may be some movement in abnormal directions under examination; there is some pain, and the shape of the part is changed; but soon swelling ensues, and every distinctive mark about it is obscured. If left alone, or merely treated as an inflamed joint, the swelling gradually subsides; but the immobility continues, the limb is crippled for months or years, when at last nature forms a new socket for the end of the bone, and some amount of useful motion is recovered. The proper shape of the part is never restored, but remains an eyesore to the patient, and a disgrace to the surgeon.

The general treatment of dislocations consists in their *reduction*, or bringing the displaced bone back into its place. Its return is opposed by the muscles attached to it, these being stimulated to contraction by the pain of the operation, and by the ligaments surrounding the joint, which generally fix it in its unnatural position. Sometimes it is necessary to remove this spasm of the muscles, and in former days bleeding from the arm, emetics, the warm bath, &c., were generally made use of; nowadays chloroform or ether attains the same ends, and renders the treatment of dislocations much more simple and humane than before the introduction of anæsthetics.

Till about the year 1870, reduction of dislocations was generally effected by means of *extension.* When the surgeon is about to reduce a dislocation in this way, he fastens the part of the limb above the displaced bone or the trunk, so as to afford him *counter*-extension; he then pulls on the limb either with his hands, or with a bandage or skein of worsted attached to it. This he fixes by making a *clove-hitch* on it—i.e. two loops in opposite directions laid together (see figure), and slipping it up the limb to the point desired, where a wet bandage has previously been applied to give a firmer hold. In old-standing cases in the larger joints, the hands grew weary before the extension had been kept up sufficiently long; and it was often found necessary to adapt pulleys to draw upon the clove-hitch, as with them the traction could be made as strong as the surgeon desired. Sudden, forcible pulling is useless and hurtful, the main object being merely to tire out the muscles which resist the attempts at reduction; when they are exhausted, the bone will generally slip back into its place with an audible snap.

Clove-hitch.

Of late years, however, reduction by extension has been to a very large extent given up in consequence of the general adoption of reduction by *manipulation.* This method, known it seems from ancient times, but curiously neglected, consists in executing certain complex movements of the dislocated limb which effect the return of the displaced bone to its socket by ingeniously utilising its unruptured attachments and evading the opposition of the muscles, by fraud rather than by force. It is particularly applicable to the hip, which, as it is commanded by the strongest mass of muscles in the body, always presented the most formidable obstacles to the old method. The first paper on this subject which attracted general attention was by Dr Reid of Rochester, U.S. (1851); and in 1869 Professor Bigelow of Boston published a careful and exhaustive discussion of injuries to the hip, with such full and clear directions for the manipulation method, as to secure its general adoption in the case of this joint by surgeons in this country as well as in America. The method, however, had been described and used in France and elsewhere, though with less care and precision, in the earlier half of the 19th century.

The class of persons called Bonesetters (q.v.) almost invariably give the opinion, in cases of stiff joints brought to them, whether as the result of disease or injury, that 'a bone is out;' and if a regular practitioner has been treating the case, further say that he has failed to detect it. They are almost invariably wrong in this opinion; for there are very few cases of dislocation not easily recognisable, at all events after the swelling following the accident has subsided. When, however, the forcible movements they employ succeed in improving the condition of the joint, their view is naturally adopted by the patient and his friends that they have replaced the 'bone.' In most cases of this kind, what really takes place is the rupture of Adhesions (q.v.) remaining after sprains or bruises in the neighbourhood which limited and rendered painful the movements of the joint.

Whenever a dislocation occurs, the nearest medical man should be summoned, even should the mere displacement be rectified at once, because no such accident can occur without some tearing of the soft parts, and it will depend on the after-treatment whether the joint will ever become useful again or not. It must also be remembered that the sooner a dislocation is reduced the easier is the reduction. Since the introduction of anæsthesia, however, and the subcutaneous division of tissues, many ancient cases may be improved, and many crippled limbs restored to usefulness.

Dismal Swamp, measuring 30 miles from north to south by 10 in breadth, lies chiefly in Virginia, but partly in North Carolina. In the centre is Lake Drummond, about 6 miles broad; elsewhere its dense growth of cypress and cedar has been greatly thinned, and part of the region has been reclaimed. The tract is intersected by a canal connecting Chesapeake Bay and Albemarle Sound.

Dismas, the Catholic traditional name of the penitent thief, the impenitent being Gesmas.

Dismembered. See DEMEMBRÉ.

Disorderly House. See PROSTITUTION.

Dispensaries are institutions for supplying the poor with medical advice and medicines. They are of two kinds, provident and free. The first are excellent institutions for encouraging habits of thrift, and training the poor not to depend on medical charity. The members of provident dispensaries pay a few pence weekly, which entitles them and their families to advice and medicine when necessary. The medical officer attends at the dispensary every morning to prescribe for those who call; after a certain hour he goes the round of the district, and visits those who are too ill to attend at the dispensary. It is often necessary in starting these institutions that there should be certain honorary members paying a subscription that will cover the expense of the building and drugs; the pence of the ordinary members should cover the officer's fee. Free dispensaries much resemble the out-patient department of hospitals, without the advantage of having wards to which the worst cases can be relegated. In Ireland, since 1851, when the Irish Dispensaries Act was passed, every district has a dispensary, where the poor are entitled to advice and medicine on presenting tickets, which are distributed by relieving officers, guardians, &c. The first dispensary founded in Britain was the Royal General Dispensary, Bartholomew Close, London, opened in 1770. See HOSPITAL.

Dispensation, the remission of a law in a particular case by competent authority. It is generally admitted, even by the most extreme of the Roman Catholic canonists, that no dispensation from the natural and moral law can be granted by any human power (Liguori, *Theol. Moral.* vi. 1119). On the other hand, it is generally held that the pope can dispense from oaths and vows, because in this case the obligation is founded upon an act of free human will, which the pope may annul. Further, with regard to positive divine laws—i.e. with regard to things which are not essentially good or evil, but which God has been pleased to command or prohibit by special revelation, it is held that the pope may declare that a particular case does not really fall under the law. For the rest, the pope may dispense from the general laws of the church. He may, e.g., allow a man to marry his deceased wife's sister, for the prohibition is derived solely from the church law, the Mosaic code, as such, having no authority among Christians; and, therefore, the supreme authority in the church may dispense from it. Of such dispensations the most noteworthy was that allowing Henry VIII. to marry Catharine of Aragon. In the earlier periods of church history, bishops and provincial councils also dispensed from the general law of the church, but since the time of Innocent III. the pope alone can do so as a general rule, and bishops only in certain cases mentioned by the canon law, unless, indeed, they act as papal delegates. Papal dispensations, if they are of a public nature, are granted through the Apostolic Dataria; if they concern the secret tribunal of conscience, through the Penitentiary. Bishops, in the exercise of their ordinary power, dispense from the proclamation of banns, from certain 'irregularities' which impede ordination, from clerical residence, &c. Many canonists add that bishops may dispense in pressing cases, where recourse to the pope is impossible, and the approval of the pope may be certainly presumed. Besides this, in virtue of faculties which may be obtained from the pope for five years at a time, a bishop can dispense from the law of abstinence from flesh-meat, from all the ecclesiastical impediments which make marriage unlawful, and from some of those which nullify it, from most 'simple' vows, &c. The vicar-general can dispense in very few cases, except by commission of the bishop. During the vacancy of a see, the bishop's ordinary power of dispensation passes first to the chapter and then to the vicar-capitular. Parish priests, &c. have no power of dispensation. The Council of Trent (Sess. xxv. c. 18) requires that dispensations be given only for a 'just and urgent' cause, after full consideration, and gratis. The last word, however, does not exclude the payment of the statutory fees.

In the English Church, papal dispensations were swept away by 25 Henry VIII. chap. 21. The Archbishop of Canterbury grants special licenses for marriage, and the bishop of the diocese may dispense a clergyman from residence, or grant him leave to hold more than one living.

In civil matters, the dispensing power of the crown, grossly abused by James II., was abolished by the Bill of Rights, and the sovereign's power of pardoning criminals is the sole form of it which is left.

The term dispensation is also used in Mosaic or Jewish dispensation, Christian or gospel dispensation, for the systems of rights and duties imposed by Providence under the Old Testament economy and that of the New respectively.

Dispersion. The refractive index of a transparent medium is different for different kinds of light. Thus, when white light passes through a given prism, the rays of different refrangibility of which it is composed are bent by different amounts from their original common direction. They are said to be *dispersed.* The dispersion for the given prism depends upon the difference of the refractive indices of the extreme rays of the visible spectrum. It varies with the substance and the angle of the prism. The relative breadth of any two parts of the spectrum varies with the substance of the prism. This constitutes the so-called *irrationality* of dispersion. In general, rays of short wavelength are more refracted than rays of long wavelength, but in some refracting media this law breaks down in part. This is known as *anomalous dispersion.* The term *false dispersion* is applied to the scattering of light by reflection from motes suspended in a transparent medium. See LIGHT.

Displayed, a heraldic term used to describe the position of an eagle or other bird with its wings expanded.

Disposition, in the Law of Scotland, is a deed of conveyance and alienation, which transfers a right to property, either heritable or movable. The most common form of disposition is that which conveys heritage from a seller to a purchaser. Dispositions of movable subjects are also known in practice. Another form of disposition is the general disposition and settlement, which is used to settle the whole succession to an estate including both heritable and movable property. When such a succession is settled by a conveyance to trustees with specified powers, the deed is called a trust-disposition and settlement. All these deeds have a form, similar, indeed, but varying according to

the nature of the property conveyed and its destination. For disposition in security, see HERITABLE SECURITIES.

Disputation, an exercise of logical and dialectic skill, in which one party advanced an argument, and the other sought to refute it. Challenges to such exercises were often issued—e.g. at Paris in 1577, by the 'Admirable' Crichton. Memorable religious disputations were those between Knox and Kennedy (1562), and between Laud and Fisher the Jesuit (1623). The practice survives as an academic form.

D'Israeli, ISAAC, man of letters, was born at Enfield in 1766, the only son of Benjamin D'Israeli (1730–1816), a Jewish merchant, who in 1801 was made an English citizen. Isaac was educated at a school near Enfield, and for two years at Amsterdam under a freethinking tutor; in 1782 he returned home, bent on authorship. He published two volumes of verse and seven romances; but his *Curiosities of Literature* (6 vols. 1791–1834), the fruit of much reading at the British Museum, showed his forte to lie not in creative literature, but in the illustration of history and literary character. To this he devoted himself with much success, his chief other books being *Calamities of Authors* (1812–13); *Quarrels of Authors* (1814); *Commentaries on the Life and Reign of Charles I.* (5 vols. 1828–30), which won him the honour of D.C.L. from Oxford; and *Amenities of Literature* (1840). Though somewhat slipshod and inaccurate, they are pleasant, readable works, and gained for their author the friendship and admiration of Byron, Scott, Southey, Moore, Bulwer Lytton, and Rogers, the last of whom observed, with his usual sneer: 'There's a man with only half an intellect who writes books that must live.' In 1802 Isaac D'Israeli married Maria Basevi (1775–1847), and by her he had one daughter and four sons, the eldest the famous statesman, Lord Beaconsfield (q.v.). Always a lax observer of the Jewish faith, he broke with the synagogue in 1817, and had all his children baptised. In 1829 he removed from Bloomsbury Square to Bradenham House, Bucks, where, after nine years of blindness, he died 19th January 1848. See, prefixed to the 1849 edition of the *Curiosities*, a memoir by Lord Beaconsfield, who also published a collected edition of his works (7 vols. 1858–59).

Disruption. See FREE CHURCH OF SCOTLAND.

Diss, an urban district of Norfolk, on a rising-ground above a mere of 5 acres, 19 miles SSW. of Norwich. It has a good Perpendicular church, with a fine peal of bells, of which, early in the 16th century, John Skelton was the unholy rector. The old weaving trade has long been a thing of the past. Pop. (1851) 2419; (1921) 3513.

Dissection. See ANATOMY.

Dissemination. See GEOGRAPHICAL DISTRIBUTION.

Dissenters. See NONCONFORMISTS.

Dissepiment, in Botany, the partition between two Carpels (q.v.) in an ovary or fruit composed of a number of carpels. See OVARY.

Dissidents is a general term for dissenters in various countries, but has been specially used of the Polish non-Catholics or *dissidentes*—Lutherans, Calvinists, Greeks, and Armenians (not, however, including Anabaptists or Socinians).

Dissipation. See ENERGY.

Dissociation. See ELECTRICITY, MOLECULE, PHYSICAL CHEMISTRY, and for mental dissociation, HALLUCINATIONS, HYSTERIA.

Dissonance is a combination of musical sounds which produces beats. See SOUND, MUSIC.

Distaff, the staff on which the flax or wool is fastened, and from which the thread is drawn in spinning by hand. See SPINNING.

Distemper (Fr. *détrempe*, from *detremper*, 'to moisten;' Ital. *tempera*), a method of painting in which opaque colours are mixed with water and such glutinous substances as size, white of egg, the sap of the fig-tree, &c., and applied to a smooth surface of dry plaster or *gesso*, spread commonly upon wood, but sometimes upon canvas. It is a process of great antiquity; and it was the ordinary method by which the early Italian and Flemish painters produced their easel-pictures (see PAINTING). Such works, when they have been afterwards oiled or treated with an oil-varnish, are frequently difficult to distinguish from oil-pictures. It is to be distinguished from Fresco (q.v.), in which the colours are applied to a fresh damp surface of plaster, with which they become incorporated. Distemper is now most commonly employed for scene-painting.

Distemper is a contagious and infectious disease of dogs, and perhaps of all animals of the canine family, sometimes met with, it is said, in the cat. The causal organism is not known. As a rule, it occurs only once in a lifetime, runs a definite course, is accompanied by low fever and debility, and is most successfully treated by good nursing and attention to diet and regimen. It has been divided into five different forms—catarrhal, pneumonic, intestinal, hepatic (known as yellows), and nervous, perhaps really different diseases. The catarrhal always accompanies and frequently precedes the other forms. The eyes are red or yellow, weak, and watery; the nose dry and hot; draughts of air or movements of the animal readily excite sneezing or cough; there is dullness, fever, and loss of appetite. The thickened slimy mucus which the inflamed membrane after some days secretes, accumulates about the eyes and nostrils, and lodging in the bronchial tubes, prevents the free access of air and the proper purification of the blood. Hence ensue distressed breathing, increasing weakness, and symptoms of nervous disturbance, such as staggering gait, chorea, and fits. All dogs are liable to distemper, but the delicate and highly bred varieties suffer most severely, and amongst them the mortality is very great. Bleeding, physicking, and all irritating and reducing remedies, must be carefully avoided, and a good dry bed in a comfortable airy place provided. The stomach, if overloaded, should be relieved of its contents by an emetic, which, for an ordinary sized English terrier, may consist of two grains each of tartar emetic and ipecacuanha, with eight or ten grains of common salt, given in a wine-glassful of tepid water. If no effect is produced, the dose must be repeated in twenty minutes. Constipation, if present, should be corrected by half an ounce each of castor and olive oil, to which, in large dogs, a few grains of gray powder is a useful addition. The febrile symptoms, if acute, may be alleviated by giving four times daily, in cold water, five drops of laudanum, and five grains each of nitre and hyposulphite of soda. Distressed breathing may be relieved by applying to the chest and sides, for an hour or two continuously, a thick flannel cloth, wrung at short intervals out of hot water. The throat may also be rubbed with hartshorn and oil, and the nostrils sponged and steamed occasionally. Give frequently, and in small quantities at a time, milk and bread, or any other such simple and digestible food; and when recovery is tardy, and weakness ensues, endeavour by nursing, tonics, and stimulants, to support the strength. The term is sometimes applied to Influenza in horses, and epizootic Pleuro-pneumonia (q.v.) in cattle.

Distich (Gr. *distichos*, 'consisting of two rows') is the classical name given to any two lines, but especially to a hexameter and pentameter, making complete sense, the character of which is seen in the following well-known example by Schiller:

Im Hexameter steigt des Springquells flüssige Säule,
Im Pentameter drauf fällt sie melodisch herab;

which was thus Englished by Coleridge:

In the hexameter rises the fountain's silvery column,
In the pentameter aye falling in melody back.

It was much used by the Greeks and Romans as a vehicle for the expression of single thoughts and sentiments; and hence became almost exclusively employed for the classical epigram. The greater poets of modern Germany, as Goethe and Schiller, have also shown a fondness for the distich, and remarkable skill in its use. A collection of moral maxims in Latin, ascribed to a certain Dionysius Cato (q.v.), is called *Disticha*, and was highly popular during the middle ages.

Distillation is the name given to the process of applying heat to a liquid, or, it may be, a solid, in order that certain constituents may pass away in vapour, and, by suitable arrangements, be obtained in the form of a liquid. When the vapour does not condense as a liquid, but only as a fine dust or flour, the process is called *Sublimation* (q.v.). The natural evaporation of water, by the heat of the sun, or warm air currents, the ascent of the vapour into the colder regions of the atmosphere, and the condensation there into clouds and mists, with the subsequent rain-shower, form together the grandest example of distillation. The apparatus for artificial distillation essentially consists of three parts, the Still (or RETORT, q.v.), Condenser, and Receiver. The *still* is made of glass, copper, iron, or earthenware, according to the nature of the substances to be placed in it. In experimental chemical work, glass is almost the only material admissible, while in the preparation of alcohol from grain, copper-stills are commonly employed. The *condenser* is made in an infinity of forms, the object being to condense the vapours disengaged from the still as rapidly and effectually as possible. For this purpose it is important that the condenser shall expose a large surface to the cooling medium, water or air. Owing to its rapidity in conducting heat, and the thinness of pipes made of copper, this metal is generally employed in the construction of condensers. Whatever the form, the principle is the same—viz. that the hot vapours pass through a tube or vessel surrounded with cold water, which running in a constant stream, passes away more or less warm after it has done its work. The *receiver* merely consists of a suitable vessel in which to receive the *distillate*. As the forms of apparatus are capable of infinite variety, so the conditions of distillation are innumerable; the best defined types being Fractional Distillation, Destructive Distillation, and Distillation in Vacuo.

In *Fractional Distillation* a mixture of liquids having different boiling-points is put in the still and heat is applied. If the vapours were allowed to pass over together and the distillate to be received in a single receiver, it is evident that nothing would be gained. If, however, the temperature be raised very slowly, and especially if the vapour requires to rise through a high *head*, or tube, before passing into the condenser, it will be found that the more volatile liquids pass over first in a state of comparative purity, and the others follow as the heat is increased. Several types of fractionating heads or columns are used in the laboratory, all with constrictions or interceptors of some type, to pass vapour over previously condensed vapour. If the receiver be frequently changed, *fractions* or portions of liquid are obtained, corresponding to the different substances present. For example, if a mixture of glycerine, water, alcohol, chloroform, and ether were distilled, the ether would distil first, then the chloroform, next the alcohol, and lastly, the water, while nearly all the glycerine would be left behind.

Destructive Distillation, or Dry Distillation as it is sometimes called, is best exemplified when coal is heated in an iron still or *retort*, as in the manufacture of gas. Now, in coal there are only traces of moisture capable of distillation, but when strongly heated, the coal is destroyed, or *decomposed*, and a large number of substances distil over, some of which, like lighting gas, are permanently in the gaseous state, others like Creasote (q.v.) are liquid, while others, such as naphthaline, are solid bodies at the ordinary temperature. Here no distillation takes place until the substance heated is destroyed, hence the term destructive distillation. Further examples are the distillation of wood in close vessels, at a red heat, when charcoal is left in the vessel, and wood-vinegar, wood-spirit, tar, &c. pass over in vapour, and are condensed; and the heating of bones in similar retorts, when animal charcoal is left in the retort, and Dippel's animal oil distils over. See CHARCOAL, COAL-TAR, and DIPPEL'S ANIMAL OIL.

Distillation in Vacuo.—When water is heated in a kettle it eventually boils, and if a thermometer be plunged into it, the mercury is seen to remain stationary at a temperature of about 212° (100° C.). It will be noticed, however, that when the barometer is low, the temperature of the boiling water is somewhat below 212° (100° C.), and that when the barometer is very high, the temperature is also high. On the summit of Mont Blanc, it is found that water boils at about 180° (82° C.); while in a vessel from which the air has been removed by an air-pump, it continues to boil even when the temperature falls down to the freezing-point (see BOILING.) There are many substances which are injured by heat, such as extract of malt and sugar, and when solutions of these bodies require to be evaporated on a large scale, they are always distilled *in vacuo*, so that the water may be removed without unduly heating the vessel.

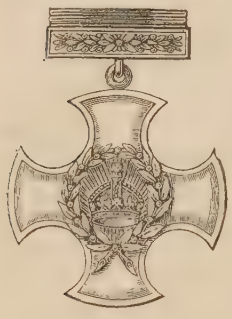
There is another very interesting method of distillation whereby liquids which, alone, cannot be distilled without decomposition, are made to distil in presence of the vapour of some other liquid. Thus, glycerine is not, practically speaking, capable of being distilled, but when heated with high-pressure steam, it readily distils over, and can thus be purified. The great object of distillation is purification, and in the manufacture of the fragrant volatile oils of lemon, lavender, &c., it is necessary to distil them along with water so as to avoid overheating of the oils, and consequent injury. Not only is the flavour improved by this treatment, but they distil at a lower temperature along with water than when alone. The term distillation in excise language refers to the distillation of alcohol alone. For information on this subject, see FERMENTATION, ALCOHOL, BRANDY, GIN, SPIRITS, and especially WHISKY; under which latter head the subject of the duties payable and of illicit distillation are also treated.

Distilled Water is the condensed product obtained by the distillation of water. All natural waters, even rain-water, contain certain saline matters (common salt, &c.) in a state of solution, from which they can only be completely freed by the process of distillation. The characteristics of distilled water are, that it possesses a mawkish, insipid taste, without odour or colour, and when evaporated to dryness in a vessel, it ought to leave no residue. Unless very specially prepared, it is sure to contain

traces of free ammonia, and, when this is the case, it is liable to form a green vegetable growth in any bottle containing it. The other properties of distilled water will be noticed under WATER.

Distilled Waters is the name for what is obtained by distilling water along with the parts of plants containing essential oils. Rose-water and lavender-water are familiar examples.

Distinguished Service Order. This order was instituted by royal warrant on 6th September 1886 for rewarding the distinguished services of naval and military officers who have been honourably mentioned in despatches. Foreign officers who have been associated with British forces in naval and military operations are eligible as honorary members of the order. The Companions of the order rank immediately after those of the Order of the British Empire. The Sovereign is head of the order. The badge consists of a gold cross, enamelled white, edged gold, having on one side in the centre, within a wreath of laurel enamelled green, the imperial crown in gold upon a red enamelled ground, and on the reverse, within a similar wreath and on a similar red ground, the royal cipher; and it is suspended from the left breast by a red riband, edged blue, of one inch in width.



Dis'tomum. See FLUKE.

Distortion. When any body is subjected to the action of a deforming force, or stress, the corresponding deformation, or strain, is sometimes termed a *distortion*. In this limited sense the term is frequently used in treatises on elasticity. The definition would almost indicate some relation between a distortion and the force causing it. Such relation was first given by Hooke (1635–1703) in the law which bears his name: Distortion is proportional to the distorting force. Thus, for example, if a plank of wood supported at each end be deflected at the middle through a certain space by the placing there of a given weight, twice the weight will give twice the deflection, and so on. See ELASTICITY.

Distrain. See DISTRESS.

Distress, in English law, is the common-law remedy by which a man may enforce payment of rent or other duties, or may impound another's cattle trespassing upon his land. Distress is defined as the taking of a personal chattel out of the possession of the wrong-doer into the custody of the party injured, without process of law. Distress was formerly an incident of all feudal services, such as suit of court, and fealty: it was also used to compel obedience to the orders of a court leet. In modern days, distress is practically enforced chiefly for non-payment of rent, for non-payment of rates and penalties, and upon cattle straying upon land not belonging to their owner. Cattle so straying may be impounded and retained as security till their owner make satisfaction Distress for rates and penalties is allowed by the statutes imposing them. In this species of distress, and distress for non-payment of rent, the articles are not merely kept as security, but may be sold to pay the amount due. Whatever goods the landlord finds on the premises, even goods belonging to a stranger (not being a lodger), may be distrained; but animals *ferœ naturæ*, and goods delivered to the tenant by way of trade (as horses in a smithy, garments at a tailor's), may not be taken. Lodgers' goods are protected against distraint by an Act of 1871; bedding, wearing apparel, and tools or implements of trade to the value of £5 are also protected. Under the Law of Distress Amendment Act, 1888, distress can only be levied by a certified bailiff. A landlord may, by a statute, 11 Geo. II. chap. 19, distrain goods fraudulently carried off the premises; and by the same statute he may, with the assistance of the peace-officer of the parish, break open doors to obtain the goods so removed.—In the American Union, some of the states have abolished distress, as being harsh to the tenant, and unjust in favouring the landlord over other creditors.

In Scotland, the term distress was formerly in use; the right to lay hold of straying cattle and the landlord's right of hypothec are analogous to the English law. See POINDING.

D'Istria, DORA. See GHIKA.

Distribution, in Political Economy, refers to the method in which the products of industry are shared among the people concerned. The methods of distribution have varied and do vary in accordance with the state of social development. They depend on legal as well as on economic conditions. They depend mainly on the ideas and institutions which prevail with reference to property in the three requisites of production—viz. land, labour, and capital. In countries where slavery prevailed, the slaveholder, as the owner alike of land, labour, and capital, disposed at his pleasure of the entire product of industry. Under the feudal system, by which the cultivator was attached to the soil and had a fixed interest in it, he was obliged to render to his superiors dues in labour, in kind, and latterly in money, which were fixed by custom or authority. Where the system prevails of cultivators owning the soil, as it does in America, and among the peasant proprietors of the European continent, the owner, inasmuch as he unites in his own person land, labour, and capital, disposes of the entire product, except such portion as may be claimed by the money-lender. In cases where the state owns the land, the cultivator pays a rent or tax to the government, and retains the remainder. The *metayer* system still exists in Italy, the owner advancing the land and stock (in whole or in part), and receiving from the cultivator a fixed share of the produce, generally one-half.

In Great Britain, and to a large extent in other countries with a highly developed industry, land, labour, and capital are supplied, each by a different class of person, and their share in the product is termed respectively rent, wages, and profits (interest, earnings of management, &c.). The respective amounts of these shares are determined by three main factors: (1) the amount produced; (2) the price obtained; (3) the relative bargaining power, collective or individual, of the above three agents. It should be pointed out that under such a system the central function in distribution, as well as in production, rests with the employer. As he originates and controls the productive process, so in the distributive process he settles with landlord and labourer, and markets the product. If the employer operates in whole or in part with borrowed capital, interest on that capital must also be deducted from his share of the produce. All these claims satisfied, the amount of his share will depend on the relative efficiency of his management compared with that of competitive employers. The above process is, however, considerably modified by the influence of law and custom. There is an increasing tendency to revert to judicial rents and wages. Account must also be taken of the growing share in wealth claimed by government through

taxation for public purposes—defence, justice, education, pensions, public health, &c. Some sections of the so-called professional classes are from this source paid for services rendered to the state. But the clerical and teaching professions derive their income more or less from corporate property, while the legal and medical professions obtain their share of the distribution mostly from the services they render to private individuals.

It is now admitted that economists have bestowed excessive attention on production, to the neglect of the problem of distribution. But the reproach has a much wider application than to economists merely, for it may generally be said that while modern communities have enormously increased their productive forces, they have not yet solved the problem of distribution. The enormous inequalities of distribution are a danger felt by all thinking men. It is a question which is more and more challenging the attention of statesmen and economists. An economic system can be satisfactory only when a high standard of production finds its complement in a reasonable and equitable distribution, supplying to the mass of the citizens the means for their due physical, intellectual, and moral development. Merchants, wholesale and retail, are said to effect the distribution of manufactured products, acting as middlemen between the manufacturer and consumer. For special methods of seeking to secure the equitable distribution of profits amongst those who earn them, see CO-OPERATION, PROFIT-SHARING; for other kinds of distribution, see KIN (NEXT OF) and HEIR; also GEOGRAPHICAL DISTRIBUTION.

For an analysis of national income, see *The Division of the Product of Industry*, by A. L. Bowley (1919), *Wealth and Taxable Capacity*, by Sir J. Stamp (1922).

District Councils. See PARISH, LOCAL GOVERNMENT.

District of Columbia, a district of the United States, now coinciding with the federal capital, is bounded on the west by the river Potomac, and on all other sides by Maryland. It originally embraced lands on both sides of the Potomac, the portion east of the river being ceded to the general government by Maryland, and that west of the river (36 sq. miles) by Virginia in 1788–89; the latter section, however, was retroceded to Virginia in 1846, and the present district has an area of 69 sq. miles. The federal city, afterwards called Washington, was laid out from a plan furnished by Major L'Enfant, and the public buildings were erected and completed before December 1800, when the seat of government was removed hither from Philadelphia. In 1814 the British burned the Capitol, White House (the president's residence), and executive buildings, besides much private property, the total damage being estimated at $2,500,000. The district remained an unorganised territory, under the sole government of congress, up to the year 1871, although it had a county organisation, and Washington and Georgetown held charters for their local government; a congressional committee each session recommended such legislation and appropriations as were deemed needful for it. An Act passed in 1871 organised a territorial government, and provided for a governor to be appointed by the president, and approved by the senate; for a secretary, appointed by the president; and for the election of a delegate to congress, to serve for two years. There was also a legislature, with eleven councilmen appointed by the president, and twenty-two delegates chosen by the people. In 1874–78, however, congress placed the whole control and government of the district in charge of three commissioners, appointed by the president and approved by the senate. These have full power to make appointments to absolutely all offices in the district; the citizens have nothing to say in relation thereto, nor is a vote given to them either in district or national affairs. Area, 69 sq. m. (land area, 60 sq. m.); pop. (1800) 14,093; (1850) 51,687; (1870) 131,700; (1880) 177,624; (1890) 230,392; (1900) 278,718; (1910) 331,069; (1920) 437,571. See WASHINGTON.

Distrito Federal, a district of the republic of Mexico, including the city of Mexico, almost surrounded by the state of Mexico, but touching Morelos in the south, is directly administered by the federal authorities, with some small measure of local government; area, 578 sq. m.; pop. 1,000,000, mostly in Mexico city.

Dita Bark, the bark of the apocynaceous forest tree *Alstonia scholaris*, found in the Philippines and elsewhere, has tonic and antiperiodic properties, like that of other trees of the genus. It yields an alkaloid ditain or ditarnin, $C_{16}H_{19}NO_2$.

Dital, a key or stop for raising the pitch of a guitar or lute by a semitone.

Ditch, in Agriculture, is a trench usually made along the sides of fields, so that all the drains may be led into it, or along the top of a field to divert surface water. A hedge is often planted along the side, and the two form a better fence for cattle. In cold undrained lands the earth thrown out of the trench forms a mound of dry earth, which is particularly serviceable for the growth of thorn-hedges. Accordingly, in certain districts this is the common mode adopted in planting hedges. Various forms of ditches are made; sometimes a double ditch is adopted, with the hedge between. Since the general use of small and large pipes, however, ditches have in many cases been converted into underground drains, a great saving of land being thus effected, and fields often given a more convenient form. See DRAINAGE.

Ditchling Beacon, a summit of the South Downs (813 feet), 6 miles N. of Brighton, is not the highest point in the range or in the county.

Dithyrambus, originally a surname of Dionysus, of uncertain derivation and meaning, was subsequently applied to a species of lyric poetry cultivated more particularly at Athens, and characterised by loftiness and vehemence of style, which, however, at a later period, degenerated into bombast and extravagance. The Dithyrambus was originally a passionate hymn, sung by one or more revellers to the music of a flute; but Arion is said to have invented for it a regular choral or antistrophic form. He is also spoken of as the inventor of the tragic style, as having introduced among lyrics of a more festive and joyous character, gloomy dithyrambs, representing the sorrows of Dionysus. Lasus of Hermione freed the dithyramb from its antistrophic character; and thenceforward it became more and more mimetic and dramatic. It was out of the mournful dithyrambic songs that the stately and solemn tragedy of the ancient Greeks arose. But few fragments of the dithyrambic poetry survive.

Ditmarsh, DITHMARSCHEN, or DITMARSEN, the western district of Holstein, lying between the Eider and the Elbe, with an area of 550 sq. m., and a pop. of 100,000. It is low-lying and fertile, and has to be defended by dykes from flooding. Originally a part of Saxony, and from 1474 till 1559 practically an independent state between Germany and Denmark, the district still retains many ancient peculiarities. The *Landbuch*, containing the ancient laws, dates from 1348. The *Chronik* was written in the Lower Saxon dialect by Adolfi (1559–1629).

Dittany (*Dictamnus*), a genus of Rutaceæ, of which the common species, also called Bastard

Dittany or Fraxinella (*D. albus*), a native of the south of Europe, is an old inmate of our gardens. It is a perennial, with unbranched stem, pinnate leaves, and a fine raceme of white or rose coloured (var. *fraxinella*) flowers. The plant diffuses a powerful fragrance from its numerous oil-glands when in flower, and during dry hot weather exhales such a quantity of volatile oil, that it is said that a slight flash has been obtained by its sudden combustion when a candle is brought near it on a warm summer evening. The root is thick, white, and very bitter, and was formerly in medicinal repute.—Dittany of Crete, used as a febrifuge, is a very different plant (*Origanum Dictamnus*), a kind of Marjoram (q.v.).

Dïu, a seaport, situated at the eastern extremity of a Portuguese island (7 × 2 miles) of the same name, off the south coast of Kathiawar, 180 miles NW. of Bombay. Once an important city of 50,000 souls, it has sunk in importance till now the whole island has but 20,000 inhabitants, mostly fishermen. Some magnificent buildings still attest its ancient splendour, such as the Jesuit College (1601), now a cathedral. The place has been in possession of the Portuguese ever since 1535, and stood a famous siege in 1545.

Diuretics, medicines having the property of increasing the secretion or excretion of urine, and on this account much employed in dropsies, as well as in a variety of other diseases. The principal diuretics are the salts of potash, especially the nitrate, acetate, and bitartrate (cream of tartar); squill, in powder, vinegar, or syrup; digitalis or foxglove, in powder or infusion; the decoction or infusion of broom-tops (*scoparium*); nitrous ether (in sweet spirit of nitre); caffeine, the active principle of coffee; the alcohols and ethers, with most of the volatile oils, especially that of juniper, as in gin; the berries of the common elder; the tincture of cantharides or Spanish flies; turpentine, &c. The last named (from the alcohols onwards in the above enumeration) are more or less irritating in their effects on the urinary organs, and should not be used without due consideration as to the requirements of the particular case. Cream of tartar and the broom-decoction form one of the safest and best diuretic mixtures which can be employed in domestic use; or cream of tartar may be given alone, either dissolved in hot water and allowed to cool, or in substance along with syrup.

Divan is a Persian word meaning collection, society, council, audience-chamber, as also the kind of cushioned seats or sofas which in reception-rooms in the East are ranged against the wall. Another meaning is a collection of poems—in which special sense of the term Goethe used it for his *West-östlicher Diwan.*

Diver, or Loon (*Colymbus*), a genus of birds of the family Colymbidæ, emphatically oceanic, and confined to northern latitudes. They have a strong, straight, rather compressed, pointed bill, about as long as the head; a short and rounded tail; short wings; thin compressed legs placed very far back, a short hind-toe, and the other digits completely webbed. They fly well, but are particularly expert in diving. They prey upon fish, which they pursue under water, making use of their wings as well as of their legs and webbed feet in their dexterous swimming. On land they can hardly walk, and the name *Loon* is supposed to refer to this incapacity, and to be from the same root with *lame.* They nest on the islands, rocks, or shores of lochs and fiords, but except at breeding-time keep to the water. In winter they sometimes follow the rivers inland. The Great Northern Diver or Loon, also called the Immer or Ember Goose (*C. glacialis*), is a bird about 2¾ feet long, exhibiting no little beauty of plumage; the upper parts black, spotted with white; the head black, with tints of green and blue; the belly white. In winter and in youth it is predominantly brownish-gray and white beneath. It is a winter visitant of the British coasts, even to the farthest south, and is occasionally seen in inland districts; is found in like manner in most parts of Europe, the north of Asia, and North America as far south as Texas, but it breeds chiefly in he more northern regions, as Labrador, Iceland, and Spitsbergen. Its cry is very peculiar and wild, has been likened to the howl of a wolf, and is in some countries superstitiously regarded as ominous of evil. The bird is easily tamed, and becomes very familiar.—The Black-throated Diver (*C. arcticus*) is another northern bird, of similarly wide distribution, but much smaller size, being only about 26 inches in length. It is found round the coasts of Britain, and occasionally breeds in the fresh-water lochs of the north of Scotland. The upper head and neck are ashen-gray, the cheeks and throat black, the general upper surface black with white spots, the under surface white with posterior black spots. In youth and winter it is blackish-brown above, and white beneath.—The Red-throated Diver (*C. septentrionalis*) is also found in all the northern parts of the world, is more common in Britain than either of the other species, and is the bird generally called Loon on the British coasts. In size it scarcely equals the Black-throated Diver. Its back is brownish-gray, the belly white, the throat red. In winter, like the preceding species, this diver is more soberly coloured, and without the red throat. The flesh of all the divers is dark, tough, and unpalatable. The name is sometimes extended to allied genera. See Auk, Grebe, Penguin, &c.

Great Northern Diver (*Colymbus glacialis*).

Di'ves (Lat., 'rich'), the name popularly adopted for the 'rich man' in the parable of the rich man and Lazarus, from the Vulgate translation.

Dividend, the sum falling to be divided among the creditors of a bankrupt from the realised assets, after payment of the expenses. The dividend is reckoned at so much per pound of the claims, and the term is applied both to the whole sum divided and the proportion falling to each creditor (see Bankruptcy). The profits of a bank, railway, or other joint-stock company, distributed annually or half-yearly among the shareholders, are also called dividends; and the same term is used to denote the interest payable on the public funds, and sometimes on other loans and debentures.

Dividing Engine. See Graduation.

Dividi'vi, or Libidibi, the curled pods of *Cæsalpinia coriaria* (see Cæsalpinia), a West

Indian and South American leguminous tree, are of remarkable astringency, and are imported especially for use in tanning.

Divination (Lat. *divinatio*; Gr. *manteia, mantikē technē*), the act of obtaining the knowledge of unknown or future things by supernatural revelation, or more strictly, the knowledge of the divine thought manifested to the human soul by objective or subjective signs, and apprehended by means outside the range of the rational. It postulates a belief in a divine providence, and the possibility of reciprocal relations between man and God considered as being able to contribute to man's happiness. Its essential characteristic is thus a belief that the divine thought may be comprehended by the human understanding in a knowledge of a special nature, more or less direct, more or less complete, but always through supernatural means, with or without the concurrent agency of the reason. Thus its domain includes all that the human mind can apprehend by its own powers; in the first place, the future, in so far as it escapes rational foresight; in the second place, the past and the present, in so far as they are inaccessible to ordinary investigation. This supernatural knowledge, says M. Bouché-Leclerq, has been oftener applied to the investigation of the past or of the present than to that of the future. Most of the ancient prodigies were considered as having their causes in the past; the result of their interpretation was always to make known the present will of the gods, and through that, but indirectly, the secrets of the future. And in the future even, considered as capable of being modified, divination oftener teaches that which should happen in accordance with the actual plan of providence, than reveals that which actually will happen. It is closely connected with magic, which may here be defined summarily as the art of voluntarily producing effects contrary to the laws of nature, by a mastery over obscure supernatural forces. Many of its methods consist in the interpretation of the marvellous effects produced at first by magical receipts, and there is an element of magic in every practice or rite destined to prepare or to produce an act of divination. While magic is the consequence of the active knowledge which permits the human will to make use of supernatural influences, the specially prophetic faculty—the particular function of the diviner—on the other hand, is the result of the contemplative knowledge which places the divine thought within the scope of the human intelligence. The former is an enlargement of the activity and of the human initiative at the expense of the divine freedom; the latter is like an increase of visual power added to the understanding.

Otherwise a broad distinction may be made between *artificial* divination by haruspication, astrology, lots, the interpretation of prodigies, lightning, augury, and the like; and *natural* divination, by dreams and prophetic oracles, considered as the direct revelation of the divine will, or an inward intuition flashed with irresistible conviction upon the human soul. The last subjective divination follows from that conception of the prophetic function which had its place in the philosophical system of Plato. It proceeds by a state of psychic exaltation or prophetic ecstasy, which suspends the intellectual energies of the human agent in a kind of sympathetic passivity suitable for the transmission of the divine thought. The conditions most favourable for receiving the divine impressions have beforehand been induced by the weakening or the destruction of the individuality of the medium through certain morbid physiological conditions, as ecstatic enthusiasm, deep sleep, sickness, or the approach of death—the last, a notion that lingers long in the heart of our modern civilisation. The scientific spirit of Aristotle rejects external divination and accepts subjective prophecy, but reduces it to nothing more than the natural exercise of a special faculty. 'It is neither easy,' he says, 'to despise such things, nor yet to believe them.' The Stoical school maintained divination because the gods were too beneficent to have denied to men a gift so good, but they identified providence with necessity or the inevitable connection of causes and consequences, and thus involved divination in an illogical confusion betwixt fatalism and free-will, the only reason for its existence that remained being its utility. The usual attempt at an explanation was that divination and the consecutive resolution of man had been foreseen with the rest by providence, and that thus its end was active co-operation in the realisation of the divine plan. The Epicureans made divination impossible by leaving it neither object nor agent, for their gods exercised no providence over men. The sceptical Lucian imitates Aristophanes in his amusing burlesques on the difficulty which Apollo feels in composing his official hexameters. The brilliant Carneades left divination in its fatal dilemma betwixt necessity and free-will, and Cicero follows with a halting conservatism, unable entirely to surrender his wishes to a conviction that his logic demands. Pliny the naturalist and Suetonius feel all the embarrassments of the old dilemma, and their attitude to divination may to some extent be explained by classifying them as superstitious rationalists. Plutarch, an eclectic Platonist, enumerates with marked particularity all the prodigies and miracles that had happened to his heroes, and seems to have believed in an innate human faculty for divination, a state of receptivity through which the soul becomes the instrument of God, just as the body is the instrument of the soul. With the spiritual revival that marked the rise of Neoplatonism, we find divination again established and based on cosmic sympathy. The Egyptian ascetic Plotinus accepted inward revelation, and directly ascribed all the phenomena of divination to the agency of the gods and other spiritual forces. Porphyry had an intensely vivid sense of the spiritual in nature, and regarded the supernatural and its external expression almost as the least extraordinary of all her secrets. The divine communicates itself to the human through inward illumination in specially gifted souls, and to others less highly endowed through dreams, chance presages, and voices.

The early Christian controversialists accepted the supernatural inspiration of the Pagan oracles, but explained that it came not from God, like that of the Hebrew prophets and the saints, but from the devil. It was easy for them to demonstrate the fallacy and errors of the ancient oracles, but they were hardly logical in, at the same time, accepting such of these as could be interpreted as foretelling the coming of Christ or some of the peculiar dogmas of Christian theology. It was St Augustine who finally formulated the orthodox opinion of western Christianity on the subject in a special treatise, *De Divinatione Dæmonum*. He limits greatly the part ascribed to conscious fraud in the function of the diviner, as he found the whole mystery sufficiently explained by the intervention of the bad angels, which existed in such countless numbers. The devils imitated as far as possible the divine methods, and hence we have false dreams, visions, and prophetic inspirations resembling in everything save their origin those so often vouchsafed to the saints. Thus early Christianity agreed perfectly with Paganism upon the facts of divination, simply substituting the wicked angel for the good genius and the gods of a polytheistic religion. It merely eliminated the external rites, as infected with magic,

substituting for these prayer, and preserved everything that came spontaneously from God, as dreams, visions, and prophetic inspirations. Perhaps the feelings that lay at the heart of the faith in the ancient divination helped unconsciously to prepare the human mind for the Christian belief in providence, in the efficacy of prayer, and in a special revelation of God to man.

Many of the most ancient forms of artificial divination have survived to our own day, even in the heart of our vaunted modern civilisation. The sense of the efficacy of these methods undoubtedly depends on the association of ideas in supposed analogies, and in symbolism. The Samoan rain-doctors wet a stone when they want rain, and dry it at the fire when they want dry weather; and sorcerers all the world over bring harm upon their victim by wishing it strongly, or by prophesying that it will happen, as well as by symbolically representing it in some simple act, as by torturing a wax-model or the like. There is an elemental confusion between the subjective and the objective connection which the primitive mind is unable to distinguish. It cannot resist the conviction that association in thought involves similar connection in reality. The analogies are not consciously arbitrary, but admit fairly of ratiocination if we can get into the proper mental attitude to commence the chain. Rousseau's conviction of his salvation or damnation from his hitting or missing a tree with a stone is based upon a mental process natural enough to the primitive mind. Added to this is the belief in the direct agency of supernatural powers which influence the casting of lots or the tossing of a coin, now a mere mechanical appeal to blind chance, but once a solemn attempt to educe the divine will. Early grave ideas of supernatural interference with games of chance linger long in folk-lore, and we still turn our chair to change our luck at dice or cards, and attach absurd importance to certain numbers for lottery-tickets. The Moravian Brethren even chose their wives by sortilege or casting lots with prayer, just as the Hebrew patriarchs did at grave or doubtful junctures three thousand years ago. The ancient Greek *kottabos*, by which fortune in love was discovered by the particular splash made by wine thrown out of a cup into a metal basin; the *astragali*, or knuckle-bones of the Romans, used for divination and as dice; the Polynesian divination by spinning the *niu* or coconut to see if a sick person will recover; and the playing-cards by means of which Gypsies still read fortunes at English fairs (*cartomancy*), are enough to show the great variety in range of methods of divining. Many of these have been gravely formulated and systematised into pseudo-sciences. Thus astrology was not only one of the most serious studies of the ancient Chaldæans, but was still more than respectable in the time of Newton; augury by the sight and cries of birds alone gave employment to a whole college of officials in ancient Rome; and the ordeal by fire or battle had the most solemn sanction of the medieval Christian church.

Many of the notions lingering in folklore about the hearing of certain birds on the right or the left hand, or the meaning attached to first meeting certain animals or people and the like, may be understood by symbolism; but many more are now at least completely inexplicable and hopelessly confusing. Dreams to animistic thinkers are directly due to spiritual intercourse, and their symbolical interpretation (*oneiromancy*), either as taken directly or by the equally valid method of contraries, has been practised from the days of Joseph until now, and has given rise to a rich crop of folk-lore superstitions everywhere. Divination by the appearance of entrails, or *haruspication*, was much respected by the ancient Romans, and is still practised by the Malays and Polynesians. Somewhat similar to it is *scapulomancy*, the method of divining by the cracks and lines made in a shoulder-blade placed in the fire. Palmistry, or *cheiromancy*, has still its thousands of votaries and its own literature, and is warmly defended by those who fail to see how childish is the sham symbolism, and how entirely arbitrary are all the analogies on which it is based. Other methods of divining again may depend on the more or less conscious action of the agent. Such is the *planchette*, by means of which answers in writing are given; but the most famous form in this kind is the divining-rod, with its supposed power of indicating a hidden spring of water, a vein of ore, or a buried treasure (*rhabdomancy*). For these, see AUTOMATIC WRITING, PLANCHETTE, and DIVINING-ROD. Of the same nature are the ancient *coscinomancy*, with a hanging sieve and shears, and the ordeal of the key, both highly useful where a culprit was apt to betray himself by his fears. Other of the thousand forms of divination are *bibliomancy*, by opening at random the Old or New Testament, or such popular books as the works of Homer or Virgil; *crystallomancy*, by looking into a crystal or beryl to see the future represented directly in pictures, or symbolically by figures capable of being interpreted; *geomancy*, by the observation of points or lines on the earth, or on paper; *pyromancy*, by the behaviour of fire; and *botanomancy*, from the chance combinations made by the wind upon leaves of trees on which words and questions had been written. Of profound significance also are the barking of dogs, the fall to the right or left hand of stones or sticks flung upwards, the behaviour of a ring hung over a cup at the approach of particular persons, the spots on the finger-nails, the physiognomy of the persons met by chance at critical periods, the blowing off the seeds of the dandelion, or the pulling off the petals of the daisy with certain time-honoured formulas repeated the while. Countless omens are derived by means of hemp sown at midsummer, by nuts burned before a fire, from certain appearances of green ivy leaves, willow-wands, and the like; while those who are observant of the proper rites may ward off ill-luck, and force the future to their convenience, with the sign of the cross, and the use of the horseshoe, silver, or the holly. The future is often foretold also by apparitions, and these are not infrequently, as in the classical case of the witch of Endor, capable of being called forth for the purpose of prophesying by powerful sorcerers.

Divination is founded on faith, but has often also been helped by fraud. It is a sincere although fallacious philosophy, and finds its strongest support in the fancied proofs of its truth that strike the minds of a primitive people, who forget or overlook the misses in their eagerness to verify the hits. The persistent tendency to believe what one wishes to believe, and the inherent human craving for mysteries and wonders, account for any belief. 'The human understanding,' says Bacon, 'when any proposition has been once laid down (either from general admission and belief, or from the pleasure it affords), forces everything else to add fresh support and confirmation; and although most cogent and abundant instances may exist to the contrary, yet either does not observe or despises them, or gets rid of and rejects them by some distinction, with violent and injurious prejudice, rather than sacrifice the authority of its first conclusions.'

See the articles APPARITION, ASTROLOGY, AUGURIES, CHARM, DEMONOLOGY, DIVINING-ROD, DREAM, OMENS, ORACLES, ORDEAL, MAGIC, MYSTICISM, PALMISTRY, and SORTES VIRGILIANÆ; also Bouché-Leclerq's *Histoire de la Divination dans l'Antiquité* (4 vols. 1879–82); Halliday's *Greek Divination* (1913).

Divine Right, a term applied to describe the source of the power claimed for the monarch, by the royalist party, in the great controversies between the monarchical and parliamentary or commonwealth parties in England in the 17th century. The monarch was held to be the immediate representative of the Deity, to whom alone he was responsible for all his actions—a principle which relieved him from all human responsibility, and gave him an absolute claim to the obedience of his subjects. Two of the confessions of Henry VIII.'s reign—the *Institution* and *Necessary Doctrine*—both insist on the duty of passive obedience as a corollary of the fifth commandment; and Cranmer so altered the coronation oath at the accession of Edward VI., as to make the king's hereditary right wholly independent of election or the will of the people. But the doctrine became full fledged only after the quiet transfer of the crown from the Tudor to the Stewart dynasty showed that the hereditary principle was firmly established; and James I. constantly harped on the necessity of this great principle. The chief writers on the side of divine right were Salmasius and Sir Robert Filmer; on the other, Milton, Algernon Sidney, and Harrington. The controversy died a natural death after the accession of the Hanoverian dynasty. The miraculous power claimed by English sovereigns of curing the 'king's evil' (see SCROFULA) by the royal touch, was a consequence of their divine right. See J. N. Figgis, *Divine Right* (2d ed. 1914).

Diving. The 'treasures of the deep' have at all times been the subject of much visionary exaggeration, and the accounts of the exploits of divers equally extravagant. Thus, it is sometimes affirmed that the pearl-divers of the East acquire by practice the power of remaining under water from 15 to 20 minutes, or even two hours. It need scarcely be said that these accounts are absurd, no such endurance being possible. The more skilful divers may remain under water for 2 or even 3 minutes; and 4 minutes 29⅕ seconds is claimed to have been attained in a glass tank (see PEARL). Most divers suffer severely from the continual efforts in holding the breath; bloodshot eyes and spitting of blood are common among them. It is noteworthy that if one about to dive breathes hard for a short time, he is then able to hold his breath much longer under water (see SWIMMING). The rude mode of diving is now but little used except for pearl and sponge fishing. Even for these purposes the diving apparatus is now largely used, the diver thus collecting, it is computed, as much as twenty naked divers under the old primitive regime, and being able to remain from two to four hours under water. In the Mediterranean sponge-fisheries, hundreds of sets of diving apparatus have long been in use, and the dress has been introduced into the fisheries at the Bahamas, Bermuda, Australia, &c.

DIVING-BELL.—For all such purposes as subaqueous works upon the foundations of piers, bridges, &c., or the exploration and raising of sunken vessels, the efforts of the unaided diver would be almost valueless, and, accordingly, various contrivances for supplying air to the diver have been made. Roger Bacon (1240) is said, on most doubtful authority, to have invented a machine for working under water. Taisnier's description of the *cacabus aquaticus*, or aquatic kettle, used by two Greeks in Spain, at Toledo in 1538, in the presence of the Emperor Charles V. and a multitude of spectators, is one of the earliest reliable accounts of a diving-bell. From his description, this must have been similar in principle and construction to the modern diving-bell, but of clumsy dimensions, and wanting in efficient means of renewing the supply of air. In 1620 Lord Bacon in his *Novum Organum* describes the crude method in vogue in his day, in which no means of replenishing the air were employed. Towards the close of the 17th century, many attempts were made, and much capital sunk in submarine exploration, but the primitive nature of the apparatus employed rendered the various enterprises undertaken abortive. Dr Halley's diving-bell, about 1720, was a wooden chamber of about 60 feet internal capacity, open at the bottom, where it was loaded with lead, to keep it perpendicular in its descent. Strong pieces of glass were set in the upper part, to admit light. Casks filled with air, and loaded with lead, were let down with the bung-hole downwards; and from these a supply of air was drawn by means of a hose. John Lethbridge, about the same time, constructed a conical bell, into which he forced compressed air by means of bellows, enabling him to remain over half an hour beneath the surface. In 1754 Dr Richard Pococke saw a diving-bell used at the Needles to raise what they could of the wreck of a man-of-war. 'They are let down in a machine made of leather, strengthened at the knees and shoulders, and, if I mistake not, on the head, with brass. There are two leathern tubes to it—one for the air to go down and to speak by, the other to pump out the air. They stay down five minutes' (*Travels through England*, Camden Soc. 1889). In 1779 Smeaton employed an oblong box supplied with air by means of a pump on the surface, for repairing the bridge at Hexham, in Northumberland.

The form of diving-bell now in use was first constructed by Smeaton for work at Ramsgate, in 1788. It was of cast-iron, and weighed 50 cwt., its height 4½ feet, length the same, and width 3 feet. It sunk by its own weight, and was lighted by stout pieces of bull's-eye glass, firmly cemented in brass rings near the top. The next improvement of importance was that due to Rennie, who designed in 1813, for the works of Ramsgate Harbour, a diving-bell of cast-iron, 6 feet high, 4 feet 6 inches wide, and 6 feet long. Six bull's-eyes of glass in the top admitted light. Air was admitted through the top by a valve, and was supplied by an air-pump through a 2½-inch hose. The interior of the bell was fitted with seats, chains for attaching stones, &c., and a rail for carrying tools. The bell, which weighed about 5 tons, was suspended by stout chains to a crab fixed to a truck travelling on an overhead gantry, and was successfully employed in various undertakings carried out by its designer. Access is gained to some large diving-bells by means of a wrought-iron shaft and Air-lock (q.v.), whereby the necessity of raising the bell is obviated. This apparatus has been both efficient and economical in working.

The air-chambers of the caissons used for founding the piers of bridges are nothing more than huge diving-bells, only they remain in position when sunk to the requisite depth, and are filled up solid with masonry (see CAISSON). At the St Louis Bridge across the Mississippi the maximum depth attained was 110½ feet, and the greatest pressure 51 lb., a pressure which proved fatal in a few instances to the workmen. The air-chambers of the caissons of the Forth Bridge were 70 feet in diameter, and 7 feet high. The work of excavation was carried on by electric light, and presented a singularly novel and weird spectacle. The maximum pressure was about 33 lb. per sq. inch above the atmosphere. The altered conditions of existence under a pressure of three atmospheres presents many points of interest. The voice sounds unnatural, and as if proceeding from another person; whistling is impossible. Effervescing drinks open flat, the pressure outside being

equal to that accumulated in them. A feeling of lassitude is generally experienced on return to ordinary atmospheric conditions. The passage through the air-lock on entering, and the gradual admission of pressure, is at times, and more especially to novices, accompanied by severe pains in the ears; but with due care, and the observance of the prescribed simple expedients, these pass away. Under increased air-pressure the blood dissolves a considerable quantity of atmospheric nitrogen, which in the diving-bell remains dissolved just as does the gas in aerated waters. When the pressure is released it is liberated in bubbles in the blood-vessels, and produces the symptoms of 'caisson-disease.'

The principle of the diving-bell will be easily understood by floating a piece of lighted candle or a wax match on a cork, and then covering it with an inverted tumbler, and pressing it downwards; the candle will descend below the level of the surrounding water, and continue burning for a short time, although the tumbler be entirely immersed. The reason is obvious enough: the air in the tumbler having no vent remains in it, and prevents the water from occupying its place, so that the cork and candle, though apparently under water, are still floating, and surrounded by the air in the tumbler; the candle continues burning until the oxygen of the air is exhausted, and then it goes out, as would the life of a man under similar circumstances. If vessels full of air, like the barrels of Dr Halley, were submerged, and their contents poured into the tumbler, the light might be maintained; but this could be better done if a tube passed through the tumbler, and air were pumped from above through the tube into the tumbler.

Diving-bell:
a, section showing inside; *b*, top.

The modern diving-bell, which is made of cast-iron like Smeaton's, is supplied with air in this manner. It must be remembered that air is compressible, and diminishes in bulk in proportion to the pressure, so that at a depth of about 33 feet in water, it would occupy half the space it filled at the surface; if the inverted tumbler were carried to this depth, it would be half-filled with water. A considerable quantity of air has therefore to be pumped into the diving-bell, merely to keep it full as it descends; the air thus compressed exerts a corresponding pressure, and would rush up with great force if the tube were open and free. This is prevented by a valve opening downwards only. When the diving-bell has reached its full depth, the pumping is continued to supply air for respiration; and the redundant air overflows, or rather *under*flows, by the open mouth, and ascends to the surface in great bubbles. The diving-bell is provided with a platform or seat for the workmen, and

Divers at Work.

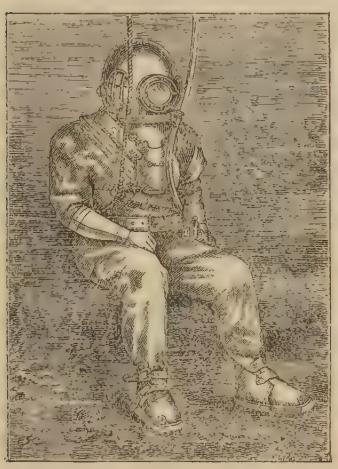
suspended from a suitable crane or beams projecting from a barge or pier; men above are stationed to work the pumps, and attend to the signals of the bellman. These signals can be made by striking the sides of the iron diving-bell with a hammer, and as sound is freely communicated through water, they are easily heard above. One blow signifies 'more air;' two blows, 'stand fast;' three, 'heave up;' four, 'lower down;' five, 'to eastward;' six, 'to westward;' &c. These, of course, may be modified as agreed upon. Messages may also be sent up written on a label attached to a cord. The telephone is now used.

Diving-dress.—In Schott's *Technica Curiosa*, published in 1664, is described a *lorica aquatica*, or aquatic armour, which consisted of a leathern dress and a helmet to protect the diver from the water. In 1721 Halley describes a contrivance of his own of nearly the same kind; its object was to enable the diver to go out from the bell and walk about. He was to be provided with a waterproof dress, and a small diving-bell, with glass front, as a helmet over his head, which was to be supplied with air by means of a tube from the diving-bell. Kleingert, of Breslau, in 1798 devised a diving-dress, consisting of strong tin-plate armour of cylindrical form encasing the diver's head and body; the lower portion of his person being clad in stout leathern costume. A pipe conveyed air to the diver, whilst a second pipe returned the air when vitiated to the surface. This apparatus was available only for depths up to 20 feet.

The open helmet diving-dress was invented in 1829 by Augustus Siebe, and marked considerable advance on previous attempts. This dress consisted of a copper helmet with breastplate attached, a canvas jacket being fastened to the latter. The lower part of the jacket was left open (hence the name), and the air escaped by this outlet, hence the water was only a few inches below the diver's mouth, and he had to maintain a vertical position. Leather boots loaded with lead were also worn.

In 1839 Siebe obviated the dangers attendant on the open dress by perfecting his close dress—a

waterproof costume covering the whole body, save the head and hands, of strong tanned twill and rubber, with vulcanised rubber collars and cuffs. The helmet is made of tinned copper with three circular glasses in front; sometimes guards are added to protect them. The front eye-piece is made to unscrew and enable the diver to receive or give instructions without removing the helmet. One or more outlet valves are placed at the back or side of the helmet to allow the vitiated air to escape. These valves only open outwards by working against a spiral spring, so that no water can enter. The inlet valve is at the back of the helmet, and the air on entry is directed by three channels running along the top of the helmet to points above the eye-pieces, enabling the diver always to inhale fresh air, whilst condensation on the glasses is avoided. The helmet is fixed to the breast-plate below by a segmental screw-bayonet joint, securing attachment by one-eighth of a turn. In some dresses the escape valve is regulated at will by the diver, and enables him to vary the pressure, and even to float himself by closing the valve and inflating his dress, but except in the hands of a skilled man this may prove a source of danger. The junction between the waterproof dress and the breastplate is made watertight by means of studs, brass plates, and wing-nuts. The diver carries back and front weights, each about 40 lb. The boots, made of stout leather with leaden soles, weigh about 16 lb. each. The helmet weighs about 40 lb. A life or signal line enables the diver to communicate with those above; or the diver may speak to his attendant, or to other divers, by a telephone fitted to his helmet. The air-pipe is made of vulcanised india-rubber with galvanised iron wire imbedded.



Diving-dress.

In the diving-dress invented by Fleuss, and patented by him in 1880, the diver is independent of supplies of air from above. A strong copper cylinder fastened to the back of the diver carries a supply of compressed oxygen, regulated at will by a jamb screw-valve. The carbonic acid exhaled by the diver is absorbed by caustic soda in a receptacle fixed above the copper cylinder, whilst the nitrogen is breathed over and over again. In this dress, which weighs about 26 lb., and can be adjusted in a few seconds, a man may remain below the surface for several hours without harm. In clear water and at moderate depths no light is required, but where illumination is necessary, an improved oil-lamp, invented by Siebe, supplied with air by a small force-pump, has been employed. Both arc and incandescent electric lights are now used for this purpose with most satisfactory results. Communication is made by means of the telephone, a slate, or ordinary signal line. Siebe states the greatest depth to which a man had ever descended to be 204 feet, equivalent to a pressure of 88½ lb. per sq. inch; but by means of later methods used by the British Admiralty, two officers have done practical work in safety at 210 feet. Three United States divers have remained 5 to 27 minutes at the bottom at 275 feet. With still more recent apparatus, German divers have reached a depth of about 500 feet. Slight men of muscular build, with good circulation, sound hearts, steady nerves, and temperate habits, make the best divers.

Divining-rod, often called the *Virgula Divina*, the *Baculus Divinatorius*, the Caduceus or wand of Mercury, the Rod of Aaron, is a forked branch, usually of hazel, and sometimes of iron, or even of brass and copper, by means of which minerals and water are said to be discovered beneath the surface of the earth. The rod, when suspended by the two prongs, sometimes between the balls of the thumbs, indicates by a decided inclination the spot under which the concealed mine or spring is situated. It has often been used also to discover the authors of a crime, as by the famous Jacques Aymar in a case of murder and robbery at Lyons in 1692. Many men, even of scientific knowledge, have been believers in the occult power ascribed to this magic wand. Agricola, Sperlingius, and Kirchmayer all believed in its supernatural influence. Bayle, under the word *Abaris*, in his Dictionary, gives some ingenious arguments both for and against the divining-rod. It seems to be still believed in, not only by Cornish miners, but by some English civic officials, men of science, and other responsible persons, even in the 20th century.

Most scientific authorities regard this alleged power of the divining-rod as due to a more or less unconscious delusion, the phenomena merely being the effect of a strong impression on the mind acting through nerves and muscles.

See Chevreul's *De la Baguette divinatoire* (1854), Lang's *Custom and Myth* (1884), and the testing experiments near Vincennes in March 1913, and at Guildford in April 1913. But see also Barrett in *Proc. Soc. Psychical Research* (1897, 1900).

Divisibility is that property in virtue of which the whole may be broken up into parts. This process of division may be conceived to be carried on indefinitely so far as space is concerned. But the question of infinite divisibility as applied to matter at once raises the further question of the Atom (q.v.), and the Electron (q.v.). See also MATTER. A thickly gilt silver rod has been drawn out into a fine wire still covered with a continuous coating of gold the thickness of which must have been about $\frac{1}{100\,000}$th of an inch. A small particle of common salt placed in a flame will colour it for some hours; and one grain of musk can scent, by its slow evaporation, the air of a room for years.

Divisibility, in the Theory of Numbers, is that property of any number whereby it may be divided by another without remainder. To find the condition of divisibility of one number, N, by another, D. Let $N = b_o + b_1 r + b_2 r^2 + \ldots + b_{m-1} r^{m-1} + b_m r^m$, where b_o, b_1, &c. are coefficients, and r is the *radix* of the notational scale (see SCALES OF NOTATION). Introducing D and $-D$ along with r, we may write: $N = b_o + b_1 (D + r - D) + b_2 (D + r - D)^2 + \ldots + b_m (D + r - D)^m$. Expanding the terms on the right-hand side of this equation, it will appear that $\frac{N}{D}$ will be an integer if $b_o + b_1 (r - D + \ldots + b_m (r - D)^m$ be divisible by D. For example, if $r = 10$ (i.e. if the number be given in the denary or ordinary scale), and $D = 9$, and therefore $r - D = 1$, any number will be divisible by 9 if the sum of its coefficients b_o, b_1, &c. be so—i.e. if the sum of its digits be divisible by 9. Further rules found in this manner are fully given in Mackay's *Arithmetical Exercises*.

Division, of an army, is the unit which contains all branches of the service, except the flying corps and siege artillery. The table shows the war establishment of a British division in 1914:

Detail.	Officers.	Other Ranks.	Horses.	Guns.	Vehicles.*
Headquarters	15	67	54	—	7
3 Infantry Brigades	372	11,793	741	24	201
Artillery Headquarters.	4	18	20	—	—
3 Field-Artillery Brigades	69	2,316	2,244	54	225
1 Howitzer Brigade	22	733	697	18	62
1 Heavy Battery	6	192	144	4	18
Ammunition Column	15	553	709	—	104
2 Companies Engineers.	15	432	160	—	38
1 Signal Company	5	157	80	—	12
1 Cavalry Squadron	6	153	167	—	3
Supply Train	26	402	378	—	146
3 Ambulances	30	672	198	—	69
Total	585	17,488	5,592	100	885
At Base	18	1,732	16	—	—

* Exclusive of gun-carriages and bicycles. Of the latter there are 275, and 9 motor-cycles.

The infantry 'guns' are machine-guns. Tent supply is not provided for in the normal establishment. Ammunition is provided by a series of reserves—for infantry companies on pack-cobs, for batteries in 6-horse wagons, for battalions in 2-horse carts, for infantry and artillery brigades in 4-horse and 6-horse wagons, for the whole division in a horsed ammunition column, which is kept filled by an ammunition park of motor-lorries working from the advanced base. Three days' rations for men, and two days' forage for horses, are carried, chiefly by the supply train (horsed), which is kept filled by a motor supply column.

In large foreign armies, Japan excepted, two divisions, similar to, but weaker than, the British, constitute an Army Corps (q.v.). A cavalry division is composed of a number of Brigades (q.v.), with horse-artillery batteries, squadron of engineers, ambulances, and a signal squadron.

Naval Division.—For convenience of command and manœuvring a fleet is divided into two, three, or more divisions, and each division into two subdivisions. Each division is commanded by a flag-officer.

Division of Labour is based on the principle that industry can be best carried on when each man has a special work to do. Constant practice in doing the same thing leads to a perfection which could not otherwise be attained. The classical illustration of it in the history of political economy is that of pin-making as given by Adam Smith: 'One man draws out the wire, another straights it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving the head; to make the head requires two or three distinct operations; to put it on is a peculiar business; to whiten the pin is another; it is even a trade by itself to put them into a paper; and the important business of making a pin is in this manner divided into above eighteen distinct operations, which in some manufactories are all performed by distinct hands. In this way ten men could make about 48,000 pins in a day, whereas, if they worked separately and independently, they certainly could not each of them have made twenty, perhaps not one pin in a day. Adam Smith offers the following reasons why the division of labour secures greater efficiency: 'First, the increase of dexterity in every particular workman; secondly, the saving of the time which is commonly lost in passing from one species of work to another; and lastly, the invention of a great number of machines which facilitate and abridge labour, and enable one man to do the work of many.' Economists believe, however, that Smith has laid too great stress on both the second and third of the above reasons.

Though the name of Adam Smith has been so closely associated with the principle of the division of labour, the importance of it had been recognised before, notably by Plato in his *Republic*, and by Adam Ferguson in his *History of Civil Society*. And it is hardly necessary to say that the invention of labour-saving machinery has rendered the example of the principle which he drew from pin-making almost entirely obsolete as an illustration of the existing methods of industry. (A good example of division of labour is given under CUTLERY: an ordinary three-bladed pocket-knife goes through more than a hundred processes; similarly with needles. Pins, which were made in thousands through the co-operation of human hands, are now turned out in millions by the aid of machinery. In modern industry very little is due to the direct operation of the human hand; almost everything is done by a machine. The development of steam and electricity as the motive powers, both of production and exchange, has along with the parallel development of machinery completely revolutionised the conditions of industry, necessitating a division of labour on a far wider basis than that contemplated by Adam Smith. At the present day it is not a mere question of personal adaptation, but of local, national, and international fitness and specialisation for carrying on different forms of industry. Differences of climate and of other natural conditions, as well as differences of industrial development, impose upon nations a most comprehensive division of labour.

This division of labour, it must be obvious, has as its necessary complement an elaborate combination or organisation of labour. In every large industrial undertaking, whether it be a factory, railway company, or any other, the highest efficiency can be attained only when, every man having his proper work to do, each man's work effectually contributes towards the general result. It is only through the wise selection of the fittest persons for each class of work, and their special adaptation to it, that such an organisation can be maintained. Thus the division of labour is only a factor in the wider problem of the organisation of labour, necessary to the success of every great industrial undertaking. See LABOUR.

But while the division of labour is necessary towards an efficient industry, economists recognise that it has many disadvantages. It is attended with a monotony of occupation, which is not favourable to the development of the general intelligence and capacity of the workmen. Each man can perform his own narrow function, and beyond that his skill does not go. The monotony itself is most painful, especially under the long hours of work which prevail in so many countries. But the worst feature of all is that through the changes which so frequently occur in the industrial world, owing to the introduction of new machinery and other causes, the class of work to which the men have been trained may be entirely superseded. The most striking instances of this in the history of English industry was hand-loom weaving, rendered obsolete by the introduction of the power-loom. Workmen thus trained and specialised have a great difficulty in finding, and in adapting themselves to, any other form of occupation.

Division of Labour, a conception borrowed from Economics and introduced into Biology by Milne-Edwards, to describe the difference of function exhibited by the individual members of an

animal colony, or by the different organs, tissues, and cells of a single organism. The figure of a hydroid colony, Hydractinia, shows how members, primarily and fundamentally the same in structure, become set apart as nutritive, reproductive, sensitive, and protective. The same division of labour or predominance of special functions in different individuals is beautifully illustrated in the Siphonophora—such as the Portuguese Man-of-war (q.v.).

Hydractinia echinata (after Allman): *a*, nutritive individuals; *b*, reproductive; *c*, protective; and *d*, sensitive individuals.

At a much higher level, vivid illustrations of the same fact may be found among the social Ants (q.v.) and Bees (q.v.). But division of labour in some degree is essential to every organism. Even in a single unit mass or cell, it is hardly possible for all the parts to be entirely in the same external and internal conditions; certain portions become more contractile, others more sensitive, others more nutritive, and so on. In a ball of cells, such as Volvox, the inequality in the conditions becomes more marked; the inside cells are not in the same state as their outside neighbours; they thus become seats of different vital processes, and distribution of function or division of labour is the result. The same process may be traced in the gradual evolution of tissues and organs, as also in the development of special 'persons' with limited and preponderant functions in animal colonies. When the predominance of some function has been established, it brings with it difference of structure. This differentiation or, when it concerns a colony, polymorphism is the structural side of the physiological fact of the division of labour. See COLONIAL ANIMALS, DIMORPHISM, HYDROZOA, &c.

Divorce is the disruption of the legal tie between husband and wife. The desire to obtain a release from the matrimonial bond has existed under all systems of law or custom. In early times, such release was often permitted on very easy conditions. The Romans of the late republic and the empire permitted divorce at the will of either spouse; but a husband divorcing without cause forfeited the wife's dowry. The Emperor Constantine was the first to prohibit divorce at the mere will of the parties; after some fluctuations in the state of the law, the grounds which would justify husband and wife respectively in divorcing were settled by Justinian. These changes in the law were partly due to the introduction of Christianity.

The Jewish law of divorce is contained in Deut. xxiv. 1–4. The Christian view of marriage is declared in Matt. xix. 9; Mark, x. 9–12; Luke, xvi. 18; and 1 Cor. vii. Marriage was held by the early Christians to be a sacred tie, not to be dissolved except for unfaithfulness. By the canon law it was regarded as a sacrament, and the tie could not be broken, even in the case of adultery, except by a papal dispensation. In cases of misconduct, a separation *a mensâ et thoro* might be decreed; or if the marriage had not been regularly contracted, it might be declared null *ab initio*. Suits for separation, or for a declaration of nullity, belonged to the ecclesiastical courts. These rules of the canon law were not uniformly adopted by European states; but in 1562 the Council of Trent established in Catholic countries the rule that marriage should be deemed indissoluble, even after adultery.

Many of the Reformers disputed the Catholic view of marriage. For reasons stated by Milton in his tract on the subject, they permitted a certain liberty of divorce. But in England the old rule held its ground till 1857–58; marriage could only be dissolved by a special act of parliament. A husband petitioning for such an act was required first to sue for a separation, and to bring an action for damages against the seducer of his wife. Divorce, therefore, was possible only for the rich.

By an Act of 1857 the jurisdiction in divorce and matrimonial causes was transferred to a new civil court, which since 1873 has formed part of the High Court of Justice, Probate, Divorce, and Admiralty Division. A decree of divorce may now be pronounced by a single judge, trying the case with or without a jury; but the decree is a decree *nisi* (i.e. a decree, *unless* cause be shown to the contrary), which cannot be made final until six months have elapsed. A husband may obtain a divorce on the ground of his wife's adultery; he may also obtain damages against the co-respondent. Till 1923 a wife might obtain a divorce on the ground of the husband's adultery only if aggravated by cruelty, incest, bigamy, rape, &c., or by desertion without cause for two years. The law was therefore unequal as between husband and wife; a reason given for the inequality was that unfaithfulness on the part of a wife throws doubt on the legitimacy of the children of the marriage, while unfaithfulness on the part of the husband does not. A strong commission, presided over by Lord Gorell, considered the whole subject, and in 1912 reported in favour of equality of the sexes, and of greater facilities for the poor. The majority favoured extension of the grounds of divorce. Bills framed to give effect to the commission's recommendations failed to become law; but the Matrimonial Causes Act (1923) placed the wife on the same footing as the husband. Mere desertion, however long continued, is not ground for a divorce, but for an action for restitution of conjugal rights. The husband may be ordered to pay an alimentary allowance to his divorced wife; and the court may make orders in respect of the custody, maintenance, and education of the children of a dissolved marriage. A petitioner who is himself or herself in fault is not entitled to the remedy of divorce; thus, the petition of a husband may be dismissed on the ground of recrimination, if he has himself been unfaithful; and if the wife, as sometimes happens, refuses to press the countercharge, it may be the duty of the King's Proctor to intervene and call the attention of the court to the facts. The petition may also be dismissed on the ground of collusion or connivance, if, for example, the husband has encouraged another man to make improper advances to his wife; or on the ground of condonation, if he has continued to cohabit with her after discovering her offence. Similar rules apply to the petition of a wife. The confession of an accused party is evidence against him or her; but proof of this nature ought to be received with caution. If the respondent is of unsound mind, and therefore unable to plead, the petitioner will not be allowed to proceed with his case. Divorced persons are free to marry again; they cannot require a clergyman of the Church of England to marry them; but a clergyman who refuses must permit the use of his church for the purpose.

In Scotland, since the Reformation, the courts

have decreed divorce, on the petition of either spouse, on the ground of adultery. An Act of 1573 makes desertion without cause for four years a ground for an action of adherence; and, if redress is not obtained by that means, decree of divorce may be pronounced. It is not permitted that marriage should take place between offending parties. In case of divorce, the offending party forfeits all pecuniary benefit which might accrue from the marriage (see ALIMENT). Separation may be obtained on the ground of ill-usage, and perhaps desertion. Bars to divorce are condonation, connivance, collusion, but not recrimination.

In France divorce was established during the Revolution, abolished under the Empire, and restored by a law of 1884, which permits husband or wife to claim a divorce on the ground of adultery, cruelty, or conviction for any infamous crime. In most Protestant countries divorce is granted for adultery, and other reasons. In all Mohammedan countries divorce is extraordinarily easy for the husband, a few words of repudiation practically sufficing to loose the marital bond.

In America the laws of the States vary. In South Carolina divorce is entirely unknown. In most of the States, adultery, ill-usage, and desertion are now regarded as good reasons for divorce; in some, drunkenness, imprisonment, and even incompatibility of temper are added to the list. There are in the United States no ecclesiastical or other specially constituted matrimonial courts; as a general rule, the civil courts have jurisdiction to dissolve the marriage of a party who is a citizen thereof, or domiciled therein.

Questions frequently arise as to the competency of a court to annul a marriage contracted in another country on grounds which would not in that country be regarded as sufficient. As a general rule, the courts of a country have jurisdiction in matrimonial causes over all persons *bonâ fide* domiciled therein. But the English courts would probably refuse to recognise the dissolution of an English marriage by a foreign court on grounds not held sufficient in England.

See S. B. Kitchin, *A History of Divorce* (1912); the Reports of the Divorce Commission (1912); also MARRIAGE, ADULTERY, HUSBAND AND WIFE, PARENT AND CHILD.

Dix, JOHN ADAMS, American statesman and soldier, born in Boscawen, New Hampshire, 24th July 1798, was appointed cadet in 1812, and lieutenant in 1814, and while on the staff of General Jacob Brown studied law, afterwards being admitted to the Washington bar. In 1828, with the rank of captain, he resigned his commission; in 1830 he was appointed adjutant-general, and from 1833 to 1840 was secretary of state and superintendent of schools for the state of New York. He was for four years a democratic United States senator, and secretary of the treasury from 1861 to the end of Buchanan's administration. At the outbreak of the civil war he raised seventeen regiments, and in July 1861, with the rank of major-general of volunteers, he took command of the Department of Maryland, where he rendered effective service to the cause of the Union; from 1863 to the close of the war he commanded the Department of the East. He was appointed minister to France in 1866, and elected governor of New York by the Republicans in 1872. He died in New York City, 21st April 1879. His memoirs were published (1883) by his eldest son, the Rev. Dr Morgan Dix.

Dixie, or DIXIE'S LAND, a term which came, by a popular error, to be identified with the South and Southern institutions during the civil war. It is derived from a Northern negro refrain, which was sung in New York about the beginning of the 19th century, and which expressed the supposed regrets of the slaves of a man Dixie, who had shipped his slaves to the South as the abolition sentiment grew stronger. This rude chant afterwards was developed into the melody that for a time became the rival of *Yankee Doodle*.

Dixmuyde (Fr. *Dixmude*), a small town of West Flanders, on the Yser, was, with its church of St Nicolas, almost entirely destroyed in the Great War.

Dixon, WILLIAM HEPWORTH, an English writer and traveller, was born in Manchester, 30th June 1821, early became a merchant's clerk, but soon determined to devote himself to a literary life. He had already written much, and even edited for two months a Cheltenham paper, when in 1846 he settled in London. In 1854 he was called to the bar, but did not practise. A series of papers, published in the *Daily News*, on 'The Literature of the Lower Orders,' and another on 'London Prisons,' attracted considerable attention. The latter reappeared in a volume published in 1850. Before this, but in the same year, he published *John Howard, and the Prison World of Europe*. It was with difficulty he could induce a publisher to accept it, yet when published it went through three editions in one year. Dixon now devoted himself principally to historical biography. In 1851 appeared the first edition of his *William Penn*, a work called into existence by the onslaught made by Macaulay on the eminent Quaker, in which Dixon undertook, not without success, to disprove the great historian's charges. In 1852 was published his *Life of Blake*, and in 1860 his *Personal History of Lord Bacon*, two works which were indeed popular, but failed to satisfy competent critics. From 1853 to 1869 Dixon was editor of the *Athenæum*. His books of travel, all bright and interesting, include *The Holy Land* (1865), *New America* (1867), *Free Russia* (1870), *The White Conquest* (1875), and *British Cyprus* (1879). His *Spiritual Wives* he issued in 1868. Accused of indecency in his *Free Russia*, he brought an action for libel against the *Pall Mall Gazette*, and was awarded a farthing damages. His historical works include *Her Majesty's Tower* (4 vols. 1869–71), *The History of Two Queens* (Catharine of Aragon and Anne Boleyn; 4 vols. 1873–74), and *Royal Windsor* (1878–80). His novels are unimportant. He died suddenly in London, 27th December 1879.

Dixon Entrance, a strait on the west coast of North America, separating Queen Charlotte Islands from the Prince of Wales Archipelago, and so dividing British territory from a part of Alaska.

Dizful, a town in the Persian province of Arabistan, about 190 miles W. of Ispahan, on the river Diz, here crossed by a handsome bridge of twenty arches. It has over thirty-five sacred tombs, and nearly as many mosques; but half the town consists of subterranean excavations in the rock, on account of the heat. It has a large trade in indigo, and is noted for the manufacture of reed-pens, which are exported to India and Constantinople. Pop. 35,000. Fourteen miles SSW. lie the ruins of ancient *Susa*.

Djerablus, or JERABLUS. See CARCHEMISH; also HITTITES.

Djezzar (i.e. 'butcher'), the name given, on account of his cruelty, to Achmed Pasha, famous for his obstinate defence of Acre against Napoleon I. He was born in Bosnia about 1735, and rose, through murder and treason, from the condition of a slave to be pasha of Acre. In the beginning of 1799 the French entered Syria from Egypt, and advanced from victory to victory till they reached Acre, which was laid siege to on the 20th March. By advice of Sir Sidney Smith, Djezzar was

induced to hold out; and such was the savage doggedness of his defence, that Bonaparte was obliged to retire on the 21st of May. He died at Acre in 1804.

Djibutil, or DJIBOUTI, a port on the Gulf of Aden, which, in 1890, superseded Obok (q.v.), on the opposite side of the Gulf of Tajurra, as capital of French Somaliland. The railway to Addis Ababa greatly increased its importance. Pop. 8000.

Djinn, or JINN. See DEMONOLOGY.

Dmitrieff, RADKO, general, born a Bulgarian in 1859, won the battle of Lule Burgas, but disagreeing with Ferdinand's policy, entered the Russian service, and in the Great War commanded in Galicia and later in the south.

Dmitrov, a town of Russia, dating from 1154, on a tributary of the Volga, 42 miles N. of Moscow, with some trade; pop. 10,000.

Dnieper (ancient *Borysthenes*), one of the large rivers of Europe, has its source, near the Volga and the Western Dwina, in certain swampy forestlands in White Russia. It flows with a general southerly direction past Kiev, Ekaterinoslav, and Alexandrovsk to the Black Sea. Its embouchure (increased by the waters of the river Bug) forms a gulf nearly 50 miles in length, with a breadth of from 1 to 6 miles. Its principal affluents are the Desna and Soj from the east, and the Pripet, Beresina, and Druz from the west. The total length of the Dnieper is 1330 miles, and its drainage area embraces 245,000 sq. m. Some of the finest provinces of eastern Europe lie within its basin. At Dorogobush the stream becomes navigable, but below Kiev and at other points traffic is interrupted. Below Ekaterinoslav, indeed, there are no less than sixteen rapids in the course of about 25 miles; but these impediments to navigation have been overcome in part by blasting. The produce of the southern districts is usually conveyed down the river to ports on the Black Sea, but many vessels pass annually from the Dnieper to the Baltic by the Brest-Litovsk canal (50 miles) and other waterways. The important river-traffic is now mostly below Smolensk; the chief fisheries are between Kherson and the estuary. The stream is permanently bridged at Kiev only, but boat-bridges and ferries are numerous along its banks. At Smolensk, the waters of the Dnieper are frozen from November to April; at Kiev, they are ice-bound only from January to the end of March; and at Kherson the river is frequently open all the year. See KINBURN.

Dniester, a river, chiefly of Rumania and Ukraine, having its rise in the Carpathian Mountains, in Galicia. It separates Bessarabia from Podolia and Kherson, and enters the Black Sea by a shallow shore lake, 18 miles in length and 5 in breadth, between Akjerman and Ovidiopol. The total length of the Dniester is 650 miles, and it drains an area of nearly 30,000 sq. m. Its current throughout is very rapid, and after reaching its easterly bend, rushes muddy and turbid through a broad, flat plain. The navigation is interrupted by a series of falls and whirlpools near Jampol. Wood and grain are the chief products conveyed down the river. Fishing-villages are frequent along its banks in Bessarabia.

Do'ab (from the Sanskrit, 'two rivers;' cf. Punjab) is a term used in India for the country between any two rivers, but specially the space inclosed by the Jumna on the south-west and the Ganges on the north-east—a space extending from Allahabad to the base of the Himalayas, a distance of upwards of 500 miles, with an average breadth of 55 miles. It is the granary of Upper India, its great natural fertility having been increased by the Ganges, Lower Ganges, and Eastern Jumna canals, and the extensive irrigation system which these render possible. It is all well cultivated, and is densely peopled throughout.

Dobell, BERTRAM (1841–1914), after hard struggles set up a small stationer's and newsvendor's shop in Kentish Town, from which developed his well-known book-shops in Charing Cross Road. He was the friend and discoverer of the second James Thomson, and had extraordinary success in bringing to light old literature of importance. His great find was Thomas Traherne. Smaller achievements were William Strode, and an unknown text of Sidney's *Arcadia*. He wrote *Sidelights on Charles Lamb*, and three volumes of original poems.

Dobell, SYDNEY, poet, was born at Cranbrook in Kent, 5th April 1824. His father, a wine-merchant, removed to London about 1825, and in 1835 to Cheltenham; with Gloucestershire and with his father's business Sydney's whole after-life was connected. Under the influence of a sect, the 'Freethinking Christians,' founded by Samuel Thompson, his grandfather, he developed a hot-house precocity, and at fifteen became engaged to the girl whom he married at twenty. He never quite recovered from a severe illness (1847); and the chief events of his life were visits in quest of health for himself or his wife to Switzerland (1851), Scotland (1854–57), and Cannes, Spain, and Italy (1862–66). He died at Barton End House, among the Cotswold Hills, 22d August 1874. His principal works are *The Roman*, by 'Sydney Yendys' (1850); *Balder* (Part I. 1854); *Sonnets on the War* (1855), in conjunction with Alexander Smith; and *England in Time of War* (1856). The first and the last achieved a success to wonder at. For though some of his lyrics are pretty, though his fancy is ever sparkling and exuberant, his poems as a whole are nerveless, superfine, grandiose, transcendental. 'Spasmodic' does hit them off better than comparison either with Shelley or with Donne. Professor Nichol edited his collected poems in 1875, and his prose works in 1876 as *Thoughts on Art, Philosophy, and Religion*. See his *Life and Letters* (2 vols. 1878), and the memoir by W. Sharp prefixed to his selected poems (1887).

Döbeln, a town of Saxony, on an island formed by the Mulde, 40 miles SE. of Leipzig by rail, with foundries, and manufactures of fire-engines, machines, cigars, cloth, leather, sugar, carriages, and pianos. Döbeln dates from the 10th century, and in spite of its sufferings at the hands of the Hussites and in the Thirty Years' War, has preserved a number of interesting old buildings. Pop. 20,000.

Do'beran, a favourite bathing-resort of Mecklenburg-Schwerin, 2½ miles from the Baltic, and 25 miles NE. of Wismar by rail. It has a palace, dating from 1232, a large bathing establishment, and a chalybeate spring. Pop. 5000.

Döbereiner, JOHANN WOLFGANG (1780–1849), professor of chemistry in Jena, and friend of Goethe, is remembered for what is called *Döbereiner's Lamp*, a piece of platinum sponge which ignites a jet of hydrogen in the presence of oxygen.

Dobritch. See BAZARDJIK.

Dobrizhoffer, MARTIN (1717–91), born at Gratz, became a Jesuit in 1736, and from 1749 worked for eighteen years as a missionary among the Guaranis and the Abipones of Paraguay. Afterwards he lived in Vienna, a friend of Maria Theresa. He was praised by Southey, and his *Historia de Abiponibus* (1784) was translated (1822) by Sara Coleridge.

Dobrovsky, JOSEPH, the founder of Slavonic philology, was born 17th August 1753, at Gyermet,

near Raab in Hungary, where his father, a Bohemian by birth, was stationed in garrison. He studied mainly at Prague, in 1772 entered the Jesuit order, and was successively a teacher, a family tutor, and the editor of a critical journal. In 1792, at the expense of the Royal Bohemian Scientific Society, he made a journey to Denmark, Sweden, and Russia, to search after the fate of those Bohemian books and MSS. which the Swedes had carried off from Prague during the Thirty Years' War. Till his death, January 6, 1829, he was reckoned one of the highest authorities on all matters connected with Bohemian history and literature. Among his works are *Scriptores rerum Bohemicarum* (1784), a history of the Bohemian language and literature (1792), a German-Bohemian dictionary (1802–21), *Glagolitica* (1807), and *Institutiones Linguæ Slavonicæ* (1822). See his Life in German by Palacky (1833).

Dobrudja (also spelt *Dobrudscha*, *Dobrutcha*, or, by Rumanians, *Dobrogea*), the south-eastern portion of Rumania, between the lower Danube and the Black Sea, transferred to the kingdom by the Berlin Congress of 1878, which fixed the southern limit at a line from Silistria on the Danube to Mangalia on the sea-coast. A slice from Bulgaria was added by the war of 1913. The north-east of this region is occupied by marshes and the delta of the Danube; the rest mostly a treeless steppe, too dry for farming, on which large herds of cattle, horses, and sheep are raised. The climate is malarious and unwholesome, and the inhabitants are a feeble folk. Rumanians and Bulgarians are the most numerous; many Circassians formerly settled here, Tatars and Turks having since 1878 gone to Turkish territory; but there are still many Turks and Russians, and some Germans.

Dobson, Henry Austin, poet, was born at Plymouth, 18th January 1840. He was educated at Beaumaris, Coventry, and Strasburg, and at first intended to follow the profession of his father—a civil engineer—but in 1856 entered the Board of Trade, where he remained till 1901. In poetry he practised especially the more artificial forms of French verse, the rondeau, the ballade, and the villanelle. In these he showed rare perfection of form, often informed with true natural pathos, and revealed genuine satirical strength. His chief collections of verse are *Vignettes in Rhyme and Vers de Société* (1873), *Proverbs in Porcelain* (1877), *At the Sign of the Lyre* (1885), *The Sundial* (1890), *Beau Brocade* (1892), *The Story of Rosina* (1895), and *Carmina Votiva* (1901). The *Old World Idylls* (1883) consisted in great part of pieces selected from the first two. A collected edition of his poems was published in one volume in 1897. In prose Dobson published Lives of Hogarth, Fielding, Steele, Bewick, Goldsmith, Horace Walpole, Richardson, Fanny Burney (1903), and others. He wrote the critical notices of Hood, Gay, Praed, and Prior for Ward's 'English Poets' (1880); contributed articles on the three last named, and on Fielding, Goldsmith, Hogarth, and Richardson to *Chambers's Encyclopædia;* and edited *Eighteenth-century Essays* (1882), Gay's *Fables* (1882), *The Vicar of Wakefield* (1883), *Le Barbier de Séville* (1884), *Selections from Steele* (1885), and Fanny Burney's *Diary and Letters.* His *Eighteenth-century Vignettes* appeared in 1892–96, *A Paladin of Philanthropy* in 1899, *Side-walk Studies* in 1902, *Rosalba's Journal* in 1915, *Later Essays* in 1921. He died 2nd September 1921.

Dobson, William, portrait-painter, was born in London in 1610, and succeeded Vandyck as king's serjeant-painter and groom of the privy chamber. He attended the king at Oxford, where he painted his portrait, and those of the Prince of Wales, Prince Rupert, and other members of the court. The disturbances of the time and his own careless habits threw his affairs into confusion, and he was imprisoned for debt, and died in poverty, 28th October 1646, shortly after his release. His finest portraits are lifelike and well executed, resembling those of Vandyck. Examples are preserved at Coombe Abbey, Bridgewater House, Devonshire House, the National Portrait Gallery, and at Hampton Court, where is the excellent painting of himself and wife.

Doce'tæ (from the Gr. *dokeō*, 'I appear or seem') was the name given in the early church to those heretics who held that the human nature of Jesus Christ was a semblance and not a reality. The docetic tendency originates in the oriental and Alexandrian notion that matter is as such imperfect and impure; and the Gnostic and Manichæan heretics found it impossible to conceive the essential union of the divine nature with a body composed of matter. The difficulty was got over in one of three ways: the body of Christ was either considered a real earthly body, but not belonging essentially to his nature, and only assumed for a time; or it was declared to be a mere appearance or illusion (as by Marcion, the Ophites, the Manichæans); or, finally, it was believed to be a heavenly body, composed of ethereal substance, though having the appearance of being material (as by Basilides, Bardesanes, Tatian, Valentine). Clement of Alexandria and Origen are most free from traces of Docetism; the Priscillianists and Bogomiles may be reckoned amongst the Docetæ. See Gnosticism, and the works on the History of Dogma.

Dock. The large genus Rumex of the order Polygonaceæ is usually divided into Docks and Sorrels, the latter distinguished not only by their peculiarly acid taste, but by hastate leaves and usually dicœcious flowers (see Sorrel); those of the docks proper being generally hermaphrodite. They are large perennial herbaceous plants, natives chiefly of temperate climates, with large generally lanceolate or ovate leaves, and panicles of small greenish flowers. They have great tap-roots, and are with difficulty eradicated from pastures. They also multiply rapidly by seed. The best mode of dealing with them is generally found to be repeated cutting away of their leaves and shoots, by which the plants are killed. Many of the species prefer watery places. Several of the European ones have found their way to North America, where they have reinforced the indigenous species as troublesome weeds. The large astringent roots of various species, notably of the Great Water-dock (*R. Hydrolapathum*), as also of the Monk's Rhubarb (*R. alpinus*), were much esteemed in medicine until superseded by more powerful remedies. They have also been used in dyeing.

Dock, an inclosure for the accommodation of shipping, of which there are three principal types—wet docks, with entrances that can be closed; tidal docks, being harbours or basins with unclosed entrances; and dry, or graving, docks, to contain a vessel out of the water for repair. Floating docks are a type of dry dock.

At most ports, and particularly at British ports, a system of either wet or tidal docks is required, in order to provide the necessary sheltered quayage-space for shipping. There are, however, certain ports naturally endowed with a large and more or less sheltered deep-water basin, small tidal range, and absence of strong currents; and at such ports, as, for example, New York, the construction of wet or tidal docks is not required. But dry or floating docks are a necessary part of the equipment of every large modern port.

It is at ports where there is a great rise and fall

of tide, such as Liverpool or Bristol, where the range of tide is over 30 feet, or on the Thames, where it is over 20 feet, that wet docks are most necessary. When the range of tide is small, however, as on the east coast of North America, where it varies from 1 foot 8 inches at Baltimore or Galveston to 9 feet 6 inches at Boston, there are no wet docks, strictly speaking, but simply tidal basins excavated to a great depth under the low-water level. As the cost of dock walls and quays increases enormously with each additional foot of depth of foundation, it will be understood that, where there is a large tidal range and where shipping of great draft is to be accommodated, a tidal quay-wall will be very costly in comparison with a wet dock quay-wall, which would be less in height usually by nearly the amount of the tidal range. Owing to the increased draft of shipping in recent years, engineering costs govern the choice between the two types even more largely than hitherto. Generally at ports where the tidal range exceeds about 12 feet, a system of wet docks is constructed in preference to a system of tidal basins or open quays.

Wet docks are basins in which the water is maintained at a level nearly constant, being usually that of high-water of the tide. Entrance is generally gained by means of a Lock (q.v.), having two sets of gates separated by the length of the largest vessel using the dock. Vessels can thus enter or depart during a considerable period when the state of the tide outside is within a few feet of the level of the water in the dock. Occasionally arrangements for locking can be made to pass in vessels at any state of the tide. Frequently, for the sake of economy both in space and in cost, locks have only one set of gates, so that vessels can enter or depart only at or very near the hour of high-water.

The use of wet docks enables vessels always to keep afloat, thus avoiding straining by taking the ground; also, they save vessels from moving vertically up and down the quays with the rise and fall of the tide, thus securing that the quays shall not be sometimes too high and at other times too low for convenience in shipping and discharging cargoes. On the other hand, time required to lock vessels out and in wet docks, and the trouble of entering the dock, are inconveniences.

Wet docks are usually surrounded by quay or wharf walls of masonry or concrete, but where the chief purpose is for laying up vessels and not for loading or unloading, the shore-margin is sometimes only a natural sloping beach. For keeping up the water-level in a wet dock pumping is sometimes resorted to, but feed-water reservoirs are occasionally constructed. The tendency of the bottom to silt up by deposits of fine mud is of common occurrence, particularly in some situations, and dredging or some other means must be employed from time to time to keep the dock reasonably clear. Small docks are occasionally emptied for the purpose of cleaning. Dock-gates, when on a small scale, are opened and closed by means of chains worked by hand, but when on a large scale they are operated by hydraulic or electric machinery. Small dock-gates are constructed of timber, but wide and deep dock entrances are closed either by steel gates or by a single steel caisson or sliding door.

An example of a large modern wet dock is the new Royal Albert Dock, London. The new wet dock extends over an area of 64 acres, has a length of 4500 feet, a breadth varying from 500 feet to 700 feet, and a depth of water of 38 feet over the greater part of its area. The design provides berth accommodation simultaneously for fourteen of the largest ships entering the Port of London. Entrance from the river Thames is gained through a lock 800 feet long by 100 feet wide, divisible into two compartments and controlled by three pairs of hydraulically operated steel gates, while a passageway 100 feet wide connects the former Albert Dock with the new dock. A conspicuous feature is the increased quayage obtained by the construction parallel to the south wall of seven reinforced concrete jetties, each 520 feet long, and connected with the quay by a bridge, thus allowing barges to pass freely between the jetties and the quay wall. The jetties are equipped with cranes of various capacities, chiefly 3-ton, electrically operated, with an outreach capable of transferring cargoes from vessels either into barges lying alongside the quay or on to the quay itself. Two auxiliary self-propelled floating derricks of 100 tons and 10 tons capacity deal with unusually heavy loads. Extensive storage accommodation is provided, with rail and road facilities. On the north side there are three two-storey reinforced concrete warehouses, each 1100 feet long by 120 feet wide, and on the south side there are seven single-storey steel sheds, from 480 feet to 520 feet in length and 120 feet in breadth. A graving dock, 750 feet long, is situated at the end of the wet dock, and is fitted with extensive ship-repairing plant. This dock is emptied by electric pumping machinery of 1750 horse-power, discharging the water through two pipes 48 inches in diameter.

An instance of a wet dock designed for a particular trade is that constructed at Ellesmere Port, at the sea end of the Manchester Ship Canal. This dock is designed specially for the safe handling of highly inflammable oil traffic. Every care has been taken in its lay-out and construction to prevent outbreak of fire. The dock is in an isolated situation on the north side of the canal, and is capable of accommodating one large oil-tank ship, and for easy access is placed at a convenient angle with the canal. The dimensions are: length, 600 feet; width, 100 feet; depth of water, 30 feet; and width at entrance, 80 feet. In order to prevent spread of burning oil or escape of oil, the vessel to be discharged is shut off from the canal traffic by means of a floating reinforced concrete caisson, 82 feet 6 inches long, placed across the dock entrance. The depth of caisson is only 10 feet. While the vessel is discharging no fires or lights are permitted on board, and the crew is removed. Steam generating plant ashore supplies steam through underground pipes to operate the ship's pumps for discharging the oil. The storage-tanks belonging to various oil companies being on the south side of the canal, the oil supply-pipes are led under the bed of the canal by a tunnel, 6 feet in diameter and 466 feet long, cut in sandstone. The tunnel terminates in a vertical shaft 60 feet deep at each end, the one shaft being 6 feet and the other 8 feet in diameter.

Tidal docks require no particular description; they are merely basins surrounded by quay-walls, and having open entrances permitting the free ebb and flow of the tide, as at Glasgow, Greenock, Shanghai, and Southampton. The Port of Glasgow consists of a series of tidal docks, which are situated on the river Clyde some 15 miles above Greenock. Being of the open type, they are open to traffic at all states of the tide, and congestion in the channel at times of high-water is thus obviated. The total water-area of the port, only 75 acres in 1873, is now 540 acres, and the total length of quayage, which includes numerous wharfs on the river side, is about 11 miles. The largest docks are Princes Dock, Queen's Dock, and Rothesay Dock. Princes Dock has a water-area of 35 acres, and a quay area of about 40 acres, including sheds and roads. Three basins, together with a canting basin, have a depth of from 20 feet to 25 feet at low-water, or 12 feet deeper at high-water, and

give a combined quay length of 3737 yards. Berthage for vessels of the largest class is provided at the west quay, which is 1000 feet long. The cost of this dock, completed in 1897, was £996,000. Queen's Dock is on the north side of the river, opposite Princes Dock. The area covered by its three basins is 34 acres, and the quayage is 3334 yards. The north quay is 1891 feet, and the south quay 1668 feet in length, and the general depth at low-water is 20 feet. The capital cost was £902,000. For coal and iron-ore traffic Rothesay Dock is situated several miles farther down the river from

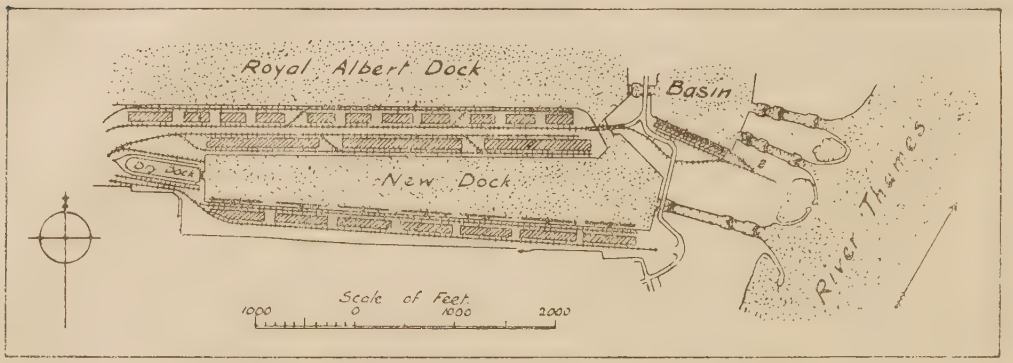


Fig. 1.—Plan of the Royal Albert Docks, London.

Glasgow. This dock has two basins, which together have an area of 20 acres, the inner basin being 1735 feet long, and the total quayage is 2045 yards. The depth of water is 25 feet at low-water, and 36½ feet at high-water. Rothesay Dock was opened in 1907 at a cost of £574,900. In addition to the large number of privately owned graving docks on the river, there are three graving docks belonging to the port authorities, which are situated beside Princes Dock. New York Harbour forms a large natural tidal basin, the port works consisting of many narrow piers up to 1350 feet in length, and

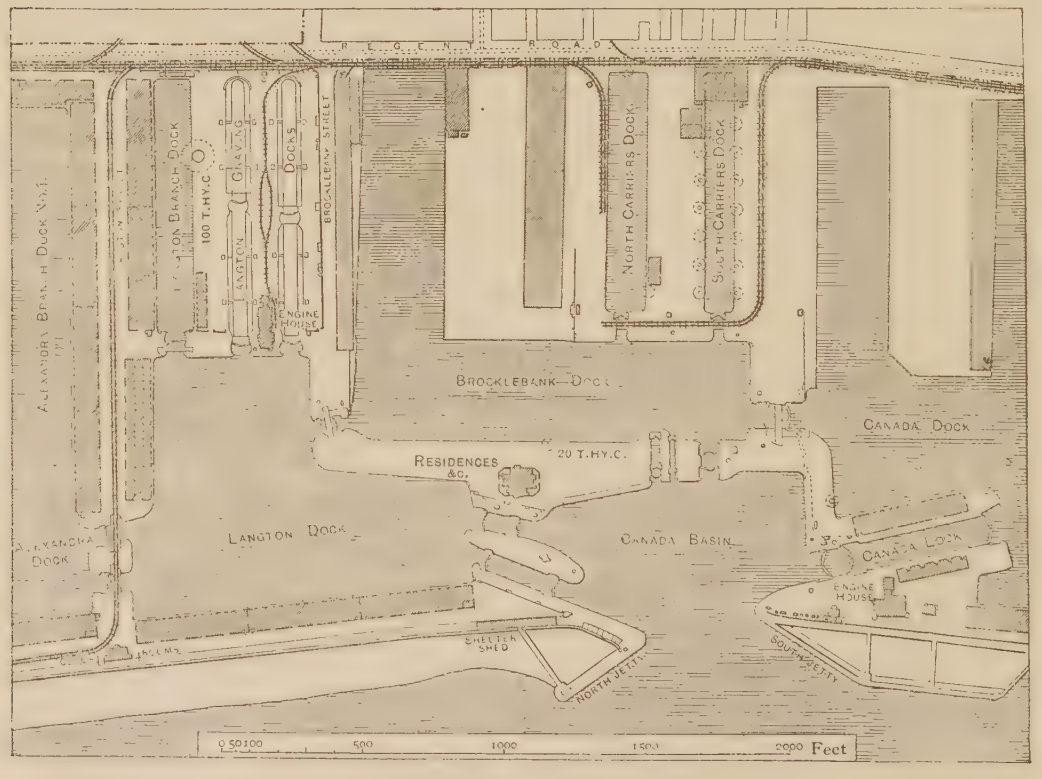


Fig. 2.—Plan of the Canada Basin and its connections, Liverpool.

200 feet in breadth, which, extending out to deep water, have hitherto provided all the quayage necessary for shipping.

With small ranges of tides, tidal docks are convenient for shipping if made deep enough to keep vessels afloat at low-water; but with tides of considerable range they are attended with the disadvantage of large vessels grounding at low-water,

and owing to the large volume of water, generally more or less turbid, which enters at every tide, they are much more liable to silt up than are wet docks. For removing muddy or soft deposits the plan is sometimes resorted to of releasing a reserve of water with a sudden gush from an inclosure at the inner end of the dock. This scouring action is usually confined to clearing small docks or basins and their approach channels, and the method is of most effect when carried out about the period of three-quarters ebb of the tide.

Dry docks or *graving docks* are used for the purpose of laying vessels dry for examination or repairs. The earliest graving dock was a bed or 'grave' dug on the shore for receiving a vessel at high-water or spring-tides, the excavations being then protected from ingress of water by an artificial bank thrown up at time of low-water. As ships increased in size, dry docks became essential works, and all modern ports, dockyards, and ship-repairing establishments are equipped with a generous supply of dry docks. A dry dock, however, rarely earns any reasonable interest on its cost. It is remarkable that the first principles involved in early dock construction still obtain, development being confined to larger dimensions, details of construction, and elaboration of equipment.

Dry docks may have their entrance either from

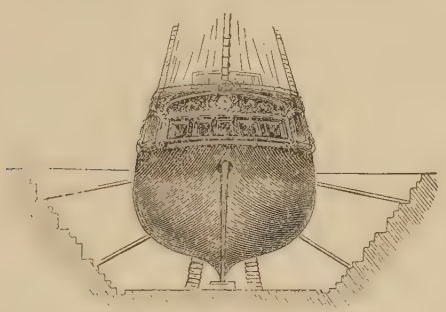


Fig. 3.—Section showing principle of Dry Dock.

a wet dock or from a tidal harbour or sea or river, but the former is usually the more convenient arrangement, as it admits of vessels being docked or taken out independently of the state of tide and free from the disturbance of currents, and gives more economical design of entrance and gates. These dry docks are built of good water-tight masonry or of concrete. The entrance is closed by means of a Caisson (q.v.) or by a pair of folding gates, pointing outwards to exclude the water. When the tidal range is great, the bottom of the dock may be placed above low-water level so that the dock can be run dry without pumping, but generally, when the rise of the tide is small, the bottom is well below that level, in which case pumping is required for emptying the dock in about three hours. The floor may be level or may slope slightly for drainage purposes towards the sides and entrance. The keel of the vessel to be docked rests on wooden blocks fastened down to prevent them floating, and built up to such a height, about 5 feet, as to admit of the shipyard workers getting under the vessel's bottom. Side-shores are put in to keep the vessel in an upright position, and blocks are fitted under the bilges as soon as possible after the water-level has been lowered. The sides generally consist of stone steps, called altars, the purpose of which is to fix the lower ends of the shores and also for the convenience of supporting the workmen's scaffolds. Dock sides are now usually steeper than shown in fig. 3, the use of altars being modified, and the lower part of the wall being vertical. Dry docks may be made long enough to hold several vessels at one time, being divided longitudinally, but it is a more economical arrangement to have a system of several docks of different dimensions. The same pumping-machinery and other equipment, such as an unusually large crane, can be made to serve two docks if they are built close together in parallel. A dry dock is now frequently designed so as to allow for future extension, and in several British docks the caisson at the entrance is arranged to give additional length for accommodating a particularly long vessel.

In addition to adequate pumping-machinery, dry docks are equipped with cranes of various outreach and power, capstans to assist in making the entrance, and entrance gate-opening machinery. The operating power is hydraulic or electric, and a supply of water, light, steam, and power for riveting, &c., is available all over the dock area. The workshops should be arranged close to the dock.

The following table gives the dimensions in feet of various large British dry docks with depth over the sill at high-water of spring-tides :

	Length.	Breadth.	Depth.
Liverpool—Gladstone	1050	120	43
" —Canada	926	94	32
Southampton—Trafalgar	912	100	35
Thames—Tilbury	846	78	35
" —King George V.	750	100	34
Immingham	740	56	23
Avonmouth	879	100	35
Clyde—No. 3	911	83	27
Belfast—Thompson	864	96	36
Rosyth—Naval	860	109	40

At the Port of Liverpool there are twelve dry docks that can hold vessels over 500 feet long. At Rosyth Naval Dockyard four dry docks can accommodate vessels over 830 feet long. One of the largest dry docks is at Taranto, in Italy. Its length of 820 feet can be lengthened to 1150 feet, its breadth at entrance is 134 feet, and depth 40 feet. At Havre a dry dock is 1030 feet long, 125 feet in breadth, and 28 feet deep at low-water spring-tides.

The use of the graving dock is frequently superseded in the case of small harbours by that of an inclined Slip (q.v.). These slips are also a useful adjunct to a general dock system, but they are seldom designed to accommodate vessels over 1500 tons.

Floating docks were originally built of timber and of small size, and are a development of the *gridiron* formerly used at several tidal ports. This consisted of a frame of timber, over which vessels were floated at times of high-water, and grounded upon it during the ebb tide. A partial examination was then made at low-water, prior to dry docking of the vessel for repairs, if seen to be necessary. The earliest floating docks took the form of a large timber box, with a flap door falling down at one end, which was closed after entrance of a vessel, and the water was pumped out. On account of their lack of stability, and from the fact that they could be used only in shallow water, the use of the timber dock was limited, but the introduction of iron for shipbuilding rendered practicable the construction of floating docks of large dimensions, and capable of working in deep water.

The early history of floating docks is marked by the numerous accidents which accompanied their development. Some were wholly lost by storm or capsizing, or proved unmanageable when completed. Even at the present day the slow process of towing a floating dock in the open sea, as frequently has to be done, from its place of construction to its destination, is attended with great difficulty and

considerable chance of disaster. Though few are in existence in Britain, the floating dock has several advantages over the graving dock, which may make it more suitable for particular port conditions. It can be more quickly built, is cheaper, and its cost is accurately known, there being no uncertain foundations to be dealt with. It is cheaper and requires less pumping. It can be more easily lengthened, and its position can be changed; and, if it becomes unsuitable, it can be sold. On the other hand, it requires a wide and deep basin to lie in. It is not so accessible for workmen, being off-shore, and its equipment in large cranes and convenience of workshops cannot be so complete. Its moorings are of difficulty, and it may require extensive repairs.

Large British floating docks are the naval docks on the Tyne and at Portsmouth, which are capable of lifting 32,000 tons, being 680 feet long and 113 feet wide at entrance, with available depth of 36 feet when submerged. Floating docks have been built with lifting capacities of 45,000 tons, and even of 60,000 tons.

Dockisation, or the conversion of tidal rivers into wet docks, may sometimes be carried out with advantage in suitable conditions. The water-level at the quays is held up by the construction across the river of a barrage with entrance-locks. Where more depth at low-water is required at the river quays, dockisation may render unnecessary extensive dredging, thus exposing existing quays to less risk than would be the case if dredging were resorted to, possibly below the levels for which they were designed. The enormous expense of wholesale reconstruction of quayage is thereby avoided, but the advantages or otherwise of the dockisation of British tidal rivers is one of the subjects on which, in recent years, there has been shown to be much difference of opinion among engineers.

Cost of docks, as already stated, varies greatly with additional depth of foundation of the quay-walls, and has even been estimated as varying as the cube of the depth available for shipping. The problem of providing facilities at a port for larger ships has frequently to be faced, and it is a serious one for dock authorities, as the necessary works are usually clearly unremunerative, and, as the largest vessels trading to any port are few in number as compared with the average-sized vessels trading, the cost will fall to be met by the smaller trading vessels. The two large commercial vessels, the *Majestic* and the *Leviathan*, the former being 915 feet long, 100 feet beam, and 39 feet draft loaded, can be accommodated at only one British graving dock—the Gladstone Dock at Liverpool. But ports intending to attract in the near future the largest vessels are looking to having to provide docks and facilities for ships of 40 or even 45 feet draft.

The cost of dock construction varies greatly at different ports, the depth and nature of the foundation for the quay-walls being the main items governing the cost. On the Clyde, quay-walls have cost about £40 per lineal foot of length for 60 feet depth of wall, and this cost is half that of a quay-wall of approximately similar depth at Antwerp. The cost of a quay-wall of over 70 feet deep constructed at Southampton, where unusual engineering difficulties of construction had to be faced, has been calculated at about £150 per lineal foot of length of wall when completely equipped.

Dock equipment is of extreme importance to shipping, and its adequacy is essential at a large modern port. The requirements of shipping, so far as docks are concerned, are: ease of access from sea to ample sheltered quayage, speedy facilities for loading and discharging cargoes, for transport to and from the quays, and for bunkering, provisioning, and repairs. The enormous expense of dock extensions can frequently be avoided by improved facilities in equipment, which are particularly called for, owing to increased wages and labour difficulties at ports. The tonnage dealt with at many ports is now enormous. At Glasgow over 10 million tons of goods are dealt with annually, and the annual income from dock dues amounts to over one million pounds. For Liverpool the corresponding figures are 50 per cent. greater.

The method of dealing with cargoes differs at the various ports. It can be discharged straight on to the quays, as at Liverpool, being delivered directly into railway waggons or other vehicles for land transport. It can be dealt with by water transport, the vessel discharging into lighters alongside, as is the procedure with a large proportion of cargoes at London. In the case of the extended Albert Dock, the system of discharge is a combination of both methods, the ship's gear discharging into lighters and the dock gear discharging ashore.

A usual manner of dealing with general cargoes is with quay cranes of under 3 tons capacity with net slings—one crane opposite each hatch. The average weight of most packages is under 30 cwts., and larger loads can best be taken by floating cranes of from 3 to 20 tons capacity. At Liverpool, self-propelling floating cranes have been provided for lifts up to 200 tons. 2000 tons a day is a good rate of discharge for general cargoes.

Particular bulk cargoes where the quantities are large, goods about the same dimensions, and traffic is regular, are best dealt with by special appliances. Grain can be dealt with by conveyor belts, or probably best by pneumatic suction. For discharge the grain can be sucked from hold, automatically weighed, and delivered loose into barges or directly into sacks. At Montreal, grain elevators can deliver 80,000 bushels per hour, and a vessel can be loaded up under twenty-four hours with a full cargo of, say, a quarter of a million bushels. At Sydney, the grain silos have a capacity of 6½ million bushels. Frozen meat is dealt with by conveyor belt between ship and special storage sheds. Coal is dealt with by grabs or by raising and tipping the railway waggons. In discharging oil a pipe line can be laid under water and the oil can be pumped ashore, the vessel anchoring at a dolphin at the end of the pipe line. Other bulk cargoes frequently handled by special means are ore and timber. Cargoes of bananas from the West Indies are handled by special arrangements at Avonmouth.

Most dock appliances are best operated by electricity, which gives power usually always ready, and affords greater flexibility of movement for cranes and greater economy when operating at loads less than the maximum.

See *Proceedings of the Institution of Civil Engineers.*

Docket (from the same root as *dock*, 'to cut off or clip'), a small piece of paper or parchment, containing a brief or summary of a large writing. All attestations or declarations annexed to written instruments are called dockets, more particularly those that are done by a Notary (q.v.).

Dock Warrants are orders or authorities for the removal of goods and merchandise warehoused in the various docks. The orders are granted by the proper officer at the docks, on application of the importer, in favour of any one whom the latter shall name. Careful rules as to obtaining warrants are laid down by the East and West India Dock and the London Dock Companies. These rules are, in a great measure, followed by the other dock companies in the kingdom. Unless the rules are complied with, goods will not be delivered from the docks. Warrants may be obtained for either the whole or a part of a cargo consigned. A warrant may be assigned by the holder. A single warrant may also, at the desire of the holder, be

divided into smaller warrants, and these also may be assigned. In case a warrant is lost, a new warrant will not be issued till the loss has been advertised, and the holder furnish the company with an engagement to indemnify them for any loss which may arise.

Dockwra, or DOCKWRAY, WILLIAM, a merchant who in 1683 devised a new penny postal system in London, was alternately favoured and persecuted by the authorities, and died in poverty about 1702. See POST-OFFICE.

Dockyards. Under the names of the several towns where the royal dockyards are situated those establishments are briefly noticed.

A large number of men-of-war are built by the government at one or other of the dockyards at Portsmouth, Plymouth, Sheerness, Chatham, and Pembroke; but Rosyth dockyard is principally used for repairs. Each of these establishments comprises slips on which the ships are built, docks in which they are kept, and all the appliances for fitting them out for sea. Boat-building and mast-making are also carried on; and in some, though not all of the yards, rope-making, sail-making, anchor-forging, block-making, and other manufacturing operations connected with the finisning and furnishing of ships. There are also arrangements connected with the storing of guns, torpedoes, and other munitions of war. At Plymouth, Gosport, and Deptford are large establishments for victualling the navy; while machinery is repaired and constructed in the dockyards proper. To enable ships to be repaired and refitted abroad, there are royal dockyards at Gibraltar, Malta, Bermuda, the Cape of Good Hope, and Hong-kong. Dockyards are maintained by the various Dominion authorities at Sydney, Halifax, Esquimalt, and Bombay. Haulbowline is now maintained by the Irish Free State authorities. Since the creation of a steam-navy, and the large substitution of iron for wood in shipbuilding, an increasing proportion of the royal ships are built in private yards. All the royal dockyards are under the Admiralty, and each is governed by a distinct set of officers responsible only to that department. The chief officer, called the superintendent, is always a naval officer —an admiral at the larger yards, a captain at Sheerness and Pembroke. The superintendent controls all the other officers, and all the artificers and labourers employed; examines the accounts, authorises the payments, and is responsible for the stores. When a new ship is to be built, or other work executed, the superintendent receives general instructions from the Admiralty, while special instructions are conveyed to other officers more immediately concerned with the actual working. Engineers and electricians form an important part of the establishment. The artisans of the dockyards comprise shipwrights, platers, blacksmiths, caulkers, joiners, smiths, millwrights, block-makers, sail-makers, rope-makers, &c.; while under these is a large body of labourers.

The general direction of the royal dockyards is under the superintendence of the Controller of the Navy, under whom are many professional and technical officers. See also COALING STATIONS.

In the United States there are 'navy yards' and naval stations. *Navy yards* are Boston, Mass.; Charleston, S.C.; Mare Island, Calif.; New York, N.Y.; Norfolk, Va.; Philadelphia, Pa.; Portsmouth, N.H.; Puget Sound, Wash.; Washington, D.C. *Naval stations* are Cavite (Philippines); Culebra (Porto Rico); Guam; Guantánamo (Cuba); Key West, Fla.; New Orleans, La.; Newport, R.I.; Pearl Harbour (Hawaii); St Thomas (Virgin Islands); and Tutuila (Samoa).

The great naval centres of France are Cherbourg, Brest, Lorient, Rochefort, and Toulon. Germany had till 1919 three ports of war—Kiel, Danzig, and Wilhelmshafen. Of these, Danzig was made a free town under the League of Nations. Trieste and Pola were the Austro-Hungarian naval harbours. These became Italian in 1919. Russia has Cronstadt and Nikolaieff at home, and Vladivostok in Siberia. Italy has Spezia, Naples, Venice, Taranto, Castellamare, and Pola; Spain, Ferrol, Cartagena, and Cadiz. Japan has Yokosuka (destroyed by earthquake, 1923), Kure, and Sasebo. See ARSENAL.

Doctor (Lat. *docēre*, 'to teach'), a teacher. Originally the word doctor was used to signify a teacher in general, and it was not till the 12th century that it became the highest university title of honour for the learned. It had frequently appended to it in those early days some additional expression intended to characterise the peculiar gift of its possessor. Thus, Thomas Aquinas was called the Doctor Angelicus; Bonaventura, the Doctor Seraphicus; Alexander de Hales, the Doctor Irrefragabilis; Duns Scotus, the Doctor Subtilis; Roger Bacon, the Doctor Mirabilis; William Occam, the Doctor Invincibilis or Singularis; Joseph Gerson, the Doctor Christianissimus; Thomas Bradwardine, the Doctor Profundus; Adam Marsh, the Doctor Illustris; Raymond Lully, the Doctor Illuminatus; St Bernard, the Doctor Mellifluus; Henry of Ghent, the Doctor Solennis; and the like. Formal promotions to the university degree of *doctor legum* commenced at Bologna about 1130, and the learned Irnerius, the regenerator of the Roman law at that period, is said to have introduced the ceremonial which was afterwards universally adopted. The university of Paris almost immediately followed in the footsteps of Bologna. In England the doctorate was not introduced till the following century. Originally the degree, which is more modern than those of bachelor and master, was granted only in law and divinity; in medicine it was not granted till the 14th century; in philosophy, science, literature, and music, only quite recently. The doctor's degree is granted either on examination, and after the ancient form, at least, of publicly defending a learned thesis in Latin has been observed, or else it is an honorary degree, conferred in consideration of the general reputation of the recipient for eminence in some particular branch of learning, philosophy, or science. The doctorate of laws (whether in the form of LL.D., *Legum Doctor;* D.C.L., Doctor of Civil Law; or J.U.D., *Doctor Utriusque Juris*, Doctor both of Civil and Canon Law) is especially wont to be conferred on eminent men *honoris causa tantum;* the D.D. is often distinguished rather as a pastor or public man than as a divine; the doctorates of medicine, science, and music are usually for ascertained professional attainment. In Germany, learned ladies occasionally shared the honours of the doctorate; and now universities generally, there and elsewhere, give women doctors' degrees. It was a special honour to Cardinal Cullen that, before he was ordained priest, the pope conferred the doctor's hat on him with his own hand. See DEGREE, UNIVERSITY, WOMEN.

Doctors' Commons, formerly the college of the doctors of civil law in London, situated in St Bennet's Hill, St Paul's Churchyard. It was founded by Dr Henry Harvey, Dean of the Arches, in 1568, previous to which time the doctors had lived in Paternoster Row. The original building was burned in the great fire in 1666, when the doctors removed for a time to Exeter House. In 1672 the Commons was rebuilt, and the doctors returned to their former quarters. The college was incorporated by royal charter in 1768. The persons practising

in Doctors' Commons were the doctors, called in the ecclesiastical courts advocates, and the proctors, whose duties were analogous to those of solicitors. Both doctors and proctors were admitted by fiat of the Archbishop, and introduced to the Dean of Arches in court by two persons of their own degree, in their robes. The robe of the doctors was scarlet, with a hood trimmed with taffeta or white miniver. In 1857, on the establishment of the Divorce Court and Probate Court, the charter of Doctors' Commons was surrendered, and the corporation was dissolved, the advocates being merged in the general body of the bar, and the proctors becoming solicitors; the last-surviving advocate died in 1912. The courts which sat at Doctors' Commons were the Court of Admiralty (q.v.); the Prerogative Court, whose powers were transferred to the Probate Court; the Court of Delegates, whose powers are now exercised by the judicial committee of the Privy-council; and two other ecclesiastical tribunals, the Faculty Court and the Archdeacon's Court. The Court of Arches also sat in the same place. The buildings of the College of Advocates were demolished in 1867; and in 1874 the Doctors' Commons Will Office was removed to Somerset House.

Doctrinaire, a term used of pedantic and unpractical views, as opposed to a policy based on precedent, prudence, *laissez faire,* or expediency. It was applied in France, in 1816, by the reactionary court-party to those who supported scientific doctrines of constitutional liberty against the arbitrary will of the monarch. This party, which had its rallying-point in the salon of the Duc de Broglie, was led in the Chamber by Royer-Collard, and supported in the press by De Barante, Guizot, and Villemain. At the Revolution of 1830 they became the advisers of Louis-Philippe.

Doctrine. See DOGMA.

Dodabetta. See GHATS.

Dodd, WILLIAM, clergyman and forger, was born, 29th May 1729, at Bourn in Lincolnshire; entered Clare College, Cambridge, as a sizar, in 1746, and graduated as fifteenth in the mathematical tripos, 1749-50. Shortly after, he removed to London, married, took orders, and ere long became a popular preacher. His sermons in behalf of public charities were particularly successful; those preached as chaplain of the Magdalen Hospital attracted all the fashionable ladies of London. Dodd next published a series of edifying books, edited the *Christian Magazine,* and became in 1763 one of the king's chaplains, and soon after LL.D., and tutor to Philip Stanhope, nephew to Lord Chesterfield. His habits had always been very expensive, and his large income as a successful preacher and writer did not save him from drifting hopelessly into debt. He purchased Charlotte Chapel in Pimlico, and had all his wonted success, but an anonymous letter of his wife to the Lord Chancellor's wife, offering a large sum for the rich living of St George's, Hanover Square, led to Dr Dodd's name being struck off the list of chaplains (1774), and his wife's being taken off by Foote in a farce as 'Mrs Simony.' Dodd left England for a time, and was well received by his pupil, now Lord Chesterfield, at Geneva, and presented to the living of Wing in Buckinghamshire. After his return he sunk deeper and deeper into financial difficulties. He sold his chapel in 1776, and in the February of the following year offered a stockbroker a bond for £4200 signed by Lord Chesterfield. It was discovered that the signature was a forgery, and Dr Dodd was at once arrested. He refunded great part of the money, but was nevertheless sent to trial, convicted, and sentenced to death. Extraordinary efforts were made to secure a pardon; petitions and pamphlets appeared in profusion, and even Dr Johnson, the most rigid of moralists, if the kindest of men, lent the unhappy man the great influence of his support. The sermon preached to his fellow-prisoners in Newgate and his final appeal to the king were both composed by Johnson, whose final letter to Dr Dodd, when his awful doom was certain, thrills throughout its grave phrases with profoundest pity. The king refused to pardon his former chaplain, and Dr Dodd was hanged, 27th June 1777. Of his numerous writings the *Beauties of Shakespeare* (1752) was long popular, and *Thoughts in Prison* is still interesting. See *A Famous Forgery,* by Percy Fitzgerald (1865).

Dodder (*Cuscuta*), a widely distributed genus of phanerogamous parasites, usually regarded as degenerate Convolvulaceæ, and forming the type of a small sub-order Cuscutaceæ. Being entirely parasitic, they have lost all trace of leaves, even the cotyledons of the embryo being no longer distinguishable, while chlorophyll is almost completely absent. The seed germinates very late in spring, and as the seedling rises from the ground its tip soon begins to show the sweeping movements of circumnutation of a climbing plant. If no host be

Dodder, attached to a Geranium and Ivy-plant.

in the neighbourhood for it to take up its quarters on, it falls to the ground, but retains its vitality for some weeks, by which time a victim may probably have germinated. As soon as it touches a living plant it twines firmly round it, and a series of small wart-like adventitious roots are developed, from the centre of each of which a bundle of suctorial cells force their way through the epidermis and cellular envelope into the bast, and press against the woody tissue of the host. The portion of the dodder stem below this attachment now dies off, and there is then no longer any connection with the ground. The growing point again circumnutates until it finds a new base of attachment upon the same or a different stem of the host, there to repeat the formation of suckers. In this way a tangled skein of threads is formed over which, late in the season, the flowers develop in dense clusters, and the ripened seeds are shaken out of the capsule by the wind, or gathered with the crop. This parasite is often very injurious, particularly in Germany, where the fields of flax, clover, and lucerne sometimes show well-marked

patches completely desolated by the pest; these have simply to be mown down and buried before new seed has set; while pains must be taken to procure clover-seed pure from those of the parasite. The temperate species are all annual, but *C. verrucosa* and other tropical forms are perennial. It is a remarkable circumstance that Cassytha, a totally unrelated oriental genus of Lauraceæ, has not only assumed the same general mode of life and twining, leafless habit, but germinates and penetrates in a precisely similar way.

Doddridge, Philip, a great nonconformist divine, was born in London, 26th June 1702, the twentieth child of a well-to-do oilman of good descent. The Duchess of Bedford, to whom his uncle was steward, offered him an education at either university and provision in the church; but though dissuaded by Calamy, he determined to enter the nonconformist ministry on the advice of the famous Samuel Clarke. He was educated at a theological academy at Kibworth in Leicestershire (afterwards removed to Hinckley), presided over by John Jennings, a man not only of great intellect, but of uncommon breadth and toleration. In 1723 Doddridge became pastor of the dissenting congregation at Kibworth. After declining several invitations from congregations whose rigid ideas of orthodoxy he felt would be uncongenial to him, he settled in 1729 at Northampton as minister and president of a theological academy. Here he continued to preach and train young students for the ministry till shortly before his death, which occurred October 26, 1751, at Lisbon, whither he had gone for the benefit of his health. Doddridge was a man of the most amiable character, deep piety, and extensive accomplishments. He was at once liberal and evangelical, and with all his religious earnestness and enthusiasm had humanity enough for such 'levities' as cards and tobacco. His principal work is *The Rise and Progress of Religion in the Soul* (1745). His hymns have carried his name over the English-speaking religious world, perhaps the best known being 'Hark, the glad sound,' and 'O God of Bethel, by whose hand.' His *Correspondence and Diary* was edited by his great-grandson (5 vols. 1829–31). See also Stanford's Memoir (1880).

Dodecanese (Gr., 'twelve islands'), the islands of Kasos, Karpathos, Kharki, Tilos, Symi, Nisyros, Astropalia, Kos, Kalymnos, Leros, Lipsos, and Patmos, which, with Rhodes and Castellorizo, Italy seized in the war with Turkey, and retained as a pledge for the fulfilment of the terms of the treaty of Ouchy (1912). By the treaty of Sèvres (1920) all these islands were to be ceded to Italy, and by the Tittoni-Venizelos agreement of the same date (revoked by Italy in 1922), the Dodecanese was to be passed on to Greece. The treaty of Lausanne (1923) gave all to Italy. Area of the twelve islands, 455 sq. m.; pop. 64,000, nearly all Greeks.

Döderlein, Ludwig, philologist, born at Jena, 19th December 1791, studied at Munich, Heidelberg, Erlangen, and Berlin, and in 1815 was appointed professor of Philology at the academy of Bern. In 1819 he went as second professor of Philology to Erlangen, where in 1827 he became first professor and also director of the philological seminary. He died there, 9th November 1863. His principal works were on Latin synonyms (6 vols. 1826–38), on Latin etymology (1836 and 1841), a Homeric glossary (3 vols. 1850–58), and editions of the *Iliad*, *Tacitus*, &c.

Dodgson, Rev. Charles Lutwidge ('Lewis Carroll'), was born at Daresbury, near Warrington, 27th Jan. 1832, and, entering Christ Church, Oxford, graduated B.A. in 1854 with a first-class in mathematics. He was elected a student of his college, took orders in 1861, from 1855 to 1881 was mathematical lecturer, and died 14th January 1898. He published some valuable mathematical works on Plane Trigonometry (1861), Determinants (1867), *Euclid and his Modern Rivals* (1879) *Curiosa Mathematica* (1888–93), &c. As Lewis Carroll (whom he carefully distinguished from his other self) he issued in 1865 *Alice's Adventures in Wonderland*, which, with its continuation *Through the Looking-glass* (1872), has become a nursery classic; *Phantasmagoria* (1869), *Hunting of the Snark* (1876), *Doublets* (1879), *Rhyme? and Reason?* (1883; new ed. 1897), *A Tangled Tale* (1886), *Game of Logic* (1887), and *Sylvie and Bruno* (1889–93). *Symbolic Logic* (1896), however, bore the name of Lewis Carroll. See Life by Collingwood (1899), Williams's *Bibliography* (1924).

Dodington, George Bubb, a 'person of importance in his day,' was born plain Bubb in 1691, the son of an Irish fortune-hunter or apothecary, and took the name Dodington in 1720, on inheriting a fine property from his uncle. Resolved 'to make some figure in the world,' he had got into parliament in 1715, and from 1722 to 1754 sat for Bridgwater. Otherwise, he was always changing his place, from Walpole's service to the Prince of Wales's, from his to Argyll's, anon back to the Prince's, and so on: his one good action, that he spoke up for Byng. He was sometimes in office, but oftener out of it; and he had not long reached the goal of his ambition, a peerage with the title Baron Melcombe, when he died at Hammersmith, 28th July 1762. A *soi-disant* Mæcenas, he passed for something of a wit and poet, but is best remembered through Browning's *Parleying*, and by his posthumous Diary (1784), that odd self-revelation of a flunkey. See a study by Lloyd Sanders (1919).

Dodo (*Didus ineptus*), a large bird which used to inhabit Mauritius, but became extinct some time after 1681. It appears to have been allied to the pigeons, was a little larger than a turkey, and incapable of flight. Our knowledge of the bird is derived from the reports of travellers, from pictures, and above all from the skeletons disentombed in 1866. It appears also to have been sometimes brought alive to Europe. The bill was large, longer than the head, and covered for half its length by soft naked skin. The end of the bill was hooked and turned downwards. The wings and the tail were rudimentary. The feathers seem to have been gray, with yellow on the wings and tail. The legs were short, thick, and scaly. It probably lived in the thick, tropical woods, and fed on vegetable materials.

Supposed figure of the Dodo.

The extermination seems to have rapidly followed the Dutch colonisation of Mauritius. The bird was helpless and stupid, and withal good for eating. The hungry domestic animals brought by man doubtless helped to destroy the hapless dodo. Though a conspicuous example, the dodo is by no means the only bird which has been exterminated,

in part at least, by human carelessness. The solitaire (*Pezophaps solitarius*) of Rodriguez is another well-known case.

There are rude figures of the dodo in several works of the 17th century, and in particular one, evidently superior to the rest, in Bontius (edited by Piso, 1658)—who calls the bird *Dronte* or *Dodaers*—which perfectly corresponds with the descriptions given of it, with a painting preserved in the British Museum, said to have been drawn in Holland from the living bird, and with a representation of it discovered by Professor Owen in 1838 in Savery's picture of Orpheus and the Beasts at the Hague, which he thinks 'must have been copied from a study of the living bird.' The skeleton has been partially reconstructed, and described by Professor Owen. Many bones of this extinct bird were discovered in 1865, when extensive marshes in the island were partially drained. There are bones at Paris, Copenhagen, and Haarlem. A foot of the dodo is amongst the valued treasures of the British Museum. In the Ashmolean Museum at Oxford are a head and foot; but the stuffed specimen to which these belonged was allowed to decay, and destroyed in 1755 by order of the curators.

See Strickland and Melville, *The Dodo and its Kindred* (1848); Owen in vol. vi. of *Trans. Zool. Soc.*; and L. W. Rothschild's *Extinct Birds* (1907).

Dodo'na, the seat of the oldest Greek oracle, was situated in Epirus, in one of the wildest districts south-west of the Lake of Janina. The Greek and Egyptian accounts of its origin differ. The priests of Egyptian Thebes related that two holy women were carried off from that city by a party of Phœnicians, one of whom was sold in Libya, the other to the Greeks, and that these women founded the oracles at Dodona and Ammon. The inhabitants of Dodona related that two black doves took their flight from the city of Thebes, in Egypt, one of which flew to Libya, the other to Dodona; that the latter perched upon an oak, and with a human voice commanded that an oracle should be founded on the spot. Herodotus thought that if the Phœnicians did actually carry off the two women already alluded to, one of them was probably sold into Greece; that the strange language and dark complexion had caused them to be likened to birds; and that when they became acquainted with the Greek tongue, they were said to have spoken with a human voice. Later authors ascribe the founding of the city to Deucalion. The sanctuary itself was dedicated to Zeus, who made known his will by the wind rustling through the boughs of a grove of lofty oaks or beech trees. This was interpreted by the priests, who were termed *Selloi* or *Helloi*. The goddess Dione, by some said to be Aphrodite, by others Hera, afterwards appeared by the side of Zeus, and the place of the priests was occupied by priestesses (*Peleiades*), who announced the will of the deity. Dodona, though not equal in renown to Delphi, was yet frequently consulted on occasions of importance both by the Spartans and Athenians. Though the city was destroyed in 219 B.C. by the Ætolians, it recovered at a later period, and was in existence in the 6th century A.D. See *Dodone et ses Ruines*, by Carapanos (1878).

Dodsley, ROBERT, author and publisher, was born in 1703 near Mansfield, in Nottinghamshire. His father, who was a schoolmaster, apprenticed him to a stocking-weaver; but the boy was so ill-treated that he ran away, and was afterwards engaged as footman. His leisure he gave to reading, and at length published in 1732 a volume of poems, entitled *A Muse in Livery*, which was patronised by many fashionable ladies. His next production, *The Toy Shop*, a dramatic piece, was submitted in manuscript to Pope, who undertook to recommend it to Rich, the manager of Covent Garden Theatre, under whose management it was acted in 1735 with great success. With his profits, and the interest of Pope, who helped him with £100, Dodsley now commenced business as a bookseller, and was very successful, but still continued to write bright and successful plays, as *The King and the Miller of Mansfield* (1737), *Sir John Cockle at Court* (1738), *The Blind Beggar of Bethnal Green* (1741), and *Rex et Pontifex* (1745), which were republished in a collected edition of his dramatic works with the title of *Trifles* (1748). Meantime, he was conducting his business with such ability and spirit, that in the course of three years after commencement, he was in a position to buy copyrights. In 1738 he bought *London* from the yet unknown Johnson for ten guineas, and among the other famous authors for whom he published were Pope, Young, Akenside, Lord Chesterfield, Horace Walpole, Goldsmith, and Shenstone. Among his schemes were *The Museum* (1742–47), a collection of historical and social essays; *The Preceptor*, a book of instruction for the young; and the *Annual Register*, started in 1759, and long edited by Burke. Dodsley's most successful work was a tragedy called *Cleone* (1758), which was acted at Covent Garden with extraordinary success. With *Cleone* he closed his career of dramatic authorship. Dodsley's name is now chiefly remembered on account of his *Select Collection of Old Plays* (12 vols. 1744; 2d ed. by Isaac Reed, 12 vols. 1780; 3d. ed. by J. P. Collier, 13 vols. 1825–28; 4th ed. by W. C. Hazlitt, 15 vols. 1874–76); and his *Collection of Poems by Several Hands* (3 vols. 1748; 6 vols. 1758). Dodsley died on a visit to Spence at Durham, 25th December 1764. He was not only an honest and able, but an amiable man. See Knight's *Shadows of the Old Booksellers* (1865), Austin Dobson's *Eighteenth Century Vignettes* (2d series, 1894), and R. Straus's *Robert Dodsley* (1910).

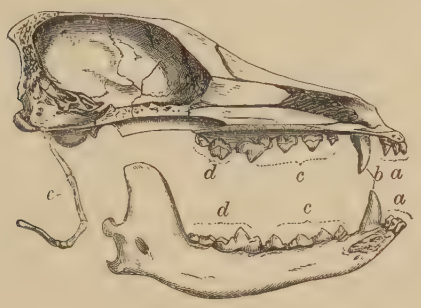
Doe, a female Deer (q.v.), in contrast to buck.

Doe, JOHN, in Law, the fictitious plaintiff in ejectment, whose services (like those of Richard Roe, his opponent) are dispensed with since the abolition of the fiction. See EJECTMENT.

Doesborgh (*Drususburg*), a fortified town in the Netherlands, province of Gelderland, at the confluence of the Old and New Yssel; pop. 5000.

Dog, the popular name of the *Canis familiaris* of Linnæus, as well as of several more or less closely allied forms. The word is not co-extensive with any zoological term, but all the animals to which it is applied belong to the family Canidæ (q.v.), which may be defined as digitigrade carnivora, with small head, pointed muzzle, somewhat contracted neck, slightly compressed body, and slender legs; fore-feet bearing five, hinder four toes, claws not retractile, hair thick, tongue smooth, anal glands wanting, a gland often present at the root of the tail. The teeth usually consist of three incisors, one canine, and four premolars (teeth which are preceded by temporary or milk molars) in each jaw. The upper jaw has two, the lower three molars on each side. The last premolar of the upper jaw, and the first molar of the lower jaw are decidedly larger than any of the others, and bite against one another; they are known as the 'carnassials.' The distribution of the Canidæ is universal; many are nocturnal or semi-nocturnal; they run swiftly and persistently, swim well, and climb and leap, though not so well as the cats. Their senses are acute, especially that of smell, and they possess higher mental qualities than those of any other animal. They frequently combine to procure food, and live on other mammals and birds, devouring fresh meat or carrion with equal avidity; some

kinds will also eat reptiles, fish, crabs, insects, and various kinds of vegetable matter. The period of gestation is sixty-three days; usually from four to eight (occasionally as many as twenty) pups are produced at a birth. These are blind for ten or twelve days, and are tended with the greatest



Section of Skull of Dog:

a, incisor teeth; *b*, canines; *c*, premolars; *d*, molars; *e*, hyoid bone.

solicitude by the mother, though the father is sometimes inimical to them. Full growth is attained in about two years, the average term of life being ten or twelve, and very rarely more than twenty years. The oldest fossil form is *Canis parisiensis*, from the upper Eocene period. The creatures thus characterised are separable into three categories: (i.) Wolves (genus *Canis*), characterised by the round pupil of the eye and the tail having dependent hairs. (ii.) Foxes (genus *Vulpes*), characterised by a slit-like pupil and a bushy tail. Certain minor, but constant, differences in the skull have been pointed out by Huxley. (iii.) The Eared-fox (genus *Otocyon* or Megalotis).

I. The category of wolves (*Canis*) comprises (1) The Domestic Dog (*C. familiaris*), which is, to quote the perhaps extravagant words of Cuvier, 'the most complete, the most singular, and the most useful conquest ever made by man.' The origin of this subjugation is shrouded in immemorial antiquity. Almost the earliest human beings of whom we have any record seem to have been accompanied by dogs, which were apparently the first animals domesticated. In the Danish kitchen-middens belonging to the Neolithic period, canine remains accompany those of man. The birds' bones are those of the legs and wings, which dogs cannot eat, and hence it seems likely that the men, after eating the flesh of the birds, gave their remains to the dogs, who devoured what they could. This has led to the further conjecture that these dogs were domesticated. A similar form of dog has been recorded from deposits of the same age in Switzerland. In the bronze age traces of a larger dog appear. The Egyptian monuments of about 3000 B.C. furnish us with pictures of several varieties of domestic dogs—a wolf-dog, a hound, a greyhound, and a kind of terrier. 'The most ancient dog represented on the Egyptian monuments is one of the most singular; it resembles a greyhound, but has long pointed ears and a short curled tail; a closely allied variety exists in Northern Africa, as the Arab boarhound.'

Assyrian sculptures depict two canine forms, a greyhound and a mastiff, described as 'the chained-up, mouth-opening dog' (watch-dog), and several other kinds are alluded to in the cuneiform inscriptions. The first mention of the dog in the Bible occurs in connection with the sojourn of the Israelites in Egypt, and the earliest allusion to it as the companion of man is in the Book of Tobit. The detestation with which the Hebrews regarded the dog was possibly due to its being an object of adoration to the Egyptians. Xenophon records two species of Spartan dogs. Many references are found to their use in battle, for which purpose they were sometimes provided with spiked collars, so that the 'dogs of war' was no mere figure of speech. At Marathon, one of these four-footed warriors gave such assistance to its master, that its effigy was engraved upon his tablet. Among the Romans, we have evidence of their use for many purposes, and their study had so far advanced, that a classification of them was drawn up. Three main divisions are recognised: (1) *Canes villatici* (watch-dogs); (2) *C. pastorales* (sheep-dogs); (3) *C. venatici* (hunting-dogs); which were again subdivided into *pugnaces*, to attack the quarry; *nare sagaces*, to track it out; and *pedibus celeres*, to overtake it. Between the Roman period and the middle ages materials for the history of the dog are scanty, but from this time onwards there is an extensive literature of the subject, more especially in regard to those kinds which were used in various forms of sport.

Dogs still play an important part in folklore everywhere, whether as *revenants* whose intention is merely to warn or foretell, or as hell-hounds of purely malignant nature. They are represented as quick to detect the presence of invisible spirits, and, in connection with this aptitude for seeing into the spirit-world, they are often the outward objects through which devils and demons make their appearance, and they have often been associated with such masters of unhallowed arts as the great Cornelius Agrippa. The Wild Huntsman with his train of hounds is one of the most widespread superstitions in Europe, and in the dim mythological histories of the early world we find many dogs of supernatural strength and courage who give material aid to the heroes in their exploits. Such are Fingal's companions, Bran and Luath, the Gelert of the Welsh story, Arthur's hound Cavall, and Hodain, the hound linked so strangely with the fates of Tristrem and Ysolde. St Eustace was the patron of dogs in the south of Europe, as St Hubert was in the north, and the invocation of the latter was especially efficacious in cases of hydrophobia (see Gaidoz, *La Rage et St Hubert*, 1887). In Egypt, where in ancient times the dog was a sacred animal, his name is the most insulting term of reproach at the present day; yet by some Orientals, as the Parsees, he is held in strange respect; while Kitmer, the dog of the Seven Sleepers, with Balaam's ass and the camel that bore Mohammed in his flight from Mecca, have a place in the Moslem paradise. From the old Argus that first recognised his master in the *Odyssey* down to Pope's Bounce and the Maida of Sir Walter Scott, dogs have been celebrated in the history of letters, and have been depicted in art, by none more admirably than by Velázquez, Veronese, and Landseer. Among famous historical dogs may merely be mentioned the mastiffs of the Knights of Rhodes, who knew a Turk from a Christian by the smell, the Spanish bloodhounds who helped in the conquest of Mexico and Peru, and the spaniel which saved the Dutch republic by waking William the Silent during the night attack on the camp before Mons. Punch's dog Toby, and the famous dog of Montargis that avenged his master's death upon his murderer, are among the best-known animals of Europe. See 'The Dog in History and Folklore' in R. J. King's *Sketches and Studies, Descriptive and Historical* (1874).

The question of the origin of our various domestic dogs may now be considered. Buffon supposed that the sheep-dog was their progenitor; Bell, the

wolf. Neither of these earlier views, however, takes a sufficiently wide survey of the whole subject to be worthy of much consideration. Put very briefly, the principal facts which help us to the solution of this problem are the following: The different breeds are very unlike each other, which would suggest the likelihood, though it would not prove, that they were descended from different ancestors. This variety of breeds obtains even in the earliest domestic dogs of which we have any record. There is no difficulty in imagining that various races of men have domesticated dogs in different places and at different periods. Wild canine species are scattered over the whole world; they are social animals, hunting in packs, and such are most easily tamed. When first in contact with man, too, animals are not as a rule shy. Savages are known to value dogs highly, and it has been suggested that perhaps the sight of their combined pursuit of their prey may have given man the idea of employing them. Furthermore, the dogs of semi-civilised or barbarous peoples often present a very close resemblance to the wild forms surrounding them; thus, the Indian dogs of North America so closely resemble the wolves of that region, that they have been mistaken for them even by well-trained naturalists. The Eskimo dogs are very like the gray Arctic wolves, with which their owners not unfrequently cross them to improve the breed. The dog of the Hare Indians differs but very slightly from the prairie-wolf or coyote (*C. latrans*). The natives of Guiana seem to have partially domesticated two aboriginal forms. Many European varieties approximate closely to the wolf, as, for instance, the Hungarian sheep-dog. The Indian pariah dogs are but little removed from the native wolf, whilst some other breeds show a close affinity to the jackals. These latter, when tamed, wag their tails, crouch to their masters, and behave in other respects like domestic dogs. From these statements, and many others which might be added, it seems fair to conclude that the various domesticated canine forms have arisen from the following separate sources: two well-defined species of wolf (*C. lupus* and *C. latrans*); certain doubtful species, European, Indian, and North African, from several species of jackal, and perhaps also from some extinct forms.

It must not, however, be supposed that the differences between the various breeds are entirely due to this difference of parentage, for there can be no doubt that they are largely the effect of careful breeding and selection. Variations occur in almost every part of the animal's organisation. As regards size some are six times as long as others (the tail being excluded); the ratio of the height to the length varies from 1 : 2 to 1 : 4. The number of caudal vertebræ, the number of teats, and the number and disposition of the teeth, are all subject to modifications. Among peculiarities which are confined to domestic as opposed to wild dogs may be mentioned the drooping ears and the curled up tail; the former correlated with a diminished need for watchfulness; the latter with a decreased use of the tail as a helm. Barking, too, is almost universal in domestic breeds, but does not characterise a single wild form. Certain tame dogs, which were left on the island of Juan Fernández, were found after thirty years to have quite lost the faculty, and only gradually reacquired it on renewed contact with man.

No account of the domestic dog would be complete without an allusion to his mental qualities, which lift him high above all other animals, and pre-eminently fit him to be the companion of man. Anecdotes illustrative of his keenness of sense, reasoning faculties, fidelity, and conscientiousness, might be multiplied indefinitely. For these we may refer our readers to the pages of Jesse, Walsh ('Stonehenge'), and Gordon Stables; for their scientific treatment, to the works of Darwin, Avebury, and Romanes. See also INSTINCT.

The natural qualities of the dog enable him to be of service to man chiefly in the chase, but he has been utilised also (to say nothing of his consumption by the Chinese and certain barbarians as food) as a guardian and a guide, as a saviour of life from drowning, and a beast of draught; he has ministered to a depraved curiosity in the ancient sports of bull and bear baiting, and has even acted as an instrument of torture and as a minister of justice. Dog-farming is regularly pursued in Manchuria for the sake of the skins, the breed cultivated being remarkable for the length and fine quality of the hair. There are thousands of such dog-farms, keeping from a score to several hundreds of dogs. The dogs are strangled in mid-winter, that the furs may be got in the best condition, but they must be at least eight months old.

(2) The Wolf (*Canis lupus*) will be considered in a special article.

(3) The Indian Wild Dogs (*C. dukhunensis*, *C. primævus*, *C. rutilans*) are sometimes separated as a distinct genus (*Cuon*). They occur in different parts of India, and are variously known as Kolsun, Buansuh, or Dhole. They are generally reddish-brown in colour, with a moderately long tail, full below, not a round brush like the fox; the pupil is round, and the ears erect, large, and hairy. They hunt in packs of from six to thirty, with such keen scent and pertinacity that competent observers declare that, 'when once a pack of them put up any animal, no matter whether deer or tiger, that animal's doom is sealed; they never leave it.' Certain half-domesticated individuals are employed for coursing and pig-sticking.

(4) The Australian Wild Dog or Dingo (*Canis dingo*) is particularly interesting, as being the only higher mammal found in that country. It was formerly believed that it was sprung from some domestic form which had run wild, but this opinion is now abandoned owing, amongst other reasons, to the discovery of fossil dingoes in the diluvial deposits. It resembles the larger varieties of shepherds' dogs. The forehead is flat, and the ears short and erect. The body has two kinds of hair, silky and woolly. When running, the head is carried high and the tail horizontally. The earliest settlers in Tasmania suffered much from the loss of their sheep owing to these animals; now the dingoes are almost destroyed. They are sometimes domesticated by the aborigines, who, however, never capture the adults, but secure a litter of pups, which they bring up by hand. They are easily tamed, but almost invariably run wild again when the breeding season comes on. See DINGO.

(5) The Jackals (*Canis anthus*, *C. aureus*, &c.). See JACKAL.

(6) The Pariah Dogs form a nondescript breed of animals, which inhabit the towns and villages of the East, where they act as general scavengers. They associate in bands, each of which has its own allotted territory, beyond whose bounds no member dares to pass.

(7) The Racoon Dog (*Canis procyonoides*) is so called because it presents a superficial likeness to the racoon. It is, however, a true dog, and it is more than doubtful whether the generic name (*Nyctereutes*) proposed for it should be allowed to stand. The body is arched, the legs short and slender, the tail also short but bushy. It is found in Japan and Northern China.

(8) The Hyæna Dog (*Canis* or *Lycaon pictus*) occurs in South Africa. It is about the size of a

wolf, with blunt muzzle and sloping back. There are only four toes on each foot. Its colour varies greatly, consisting of very irregular patches of black, white, and yellow. It is partly diurnal, partly nocturnal. Large packs of these animals hunt together, and run with an untiring gallop which will overtake the swiftest antelope. They have three different calls, the most curious of which is a soft and melodious cry, something like the second note of the cuckoo, and appears to serve as a rallying note for the pack.

II. The Foxes (genus Vulpes) will be the subject of a special article (q.v.).

III. The Long-eared Fox (*Otocyon* or *Megalotis lalandii*) is also a native of South Africa. It has a short bushy tail, not more than half the length of the body and head, which measure about two feet. The ears are very large, and the snout short and pointed. It has six more teeth than most of the Canidæ, two in each upper and one in each lower jaw.

Law as to Dogs.—In Britain, dogs cannot be kept without a license, which, for each dog, costs 7s. 6d. Dogs not six months old, dogs for tending sheep and cattle, and dogs for guiding blind men are exempt. Certificates of exemption may be obtained from the Commissioners of Inland Revenue. At common law a dog is entitled to its first bite; that is, the owner is not liable for its attacking a person or animal, unless he knew of its propensity. But by the Dogs Act, 1906, this defence is not open in case of injury done to cattle, horses, &c. A dangerous dog may be destroyed by order of court. Dog stealing; having stolen dogs, or the skins of stolen dogs, in one's possession in the knowledge that they are stolen; taking money to restore a stolen dog under pretence of aiding the owner to recover it; and unlawfully and maliciously killing or wounding or maiming dogs, are offences under various criminal statutes, and are punishable summarily, and by indictment for misdemeanour. A gamekeeper may seize a dog within the limits of a manor, but is not allowed to kill a dog there following game, even although its owner has received notice that trespassing dogs will be shot; and a man is liable in damages if he places on his land traps scented with strong-smelling bait, so as to influence the instinct of another man's dogs, and draw them irresistibly to destruction. Stray dogs may be detained and sold or destroyed by the police. For the employment of dogs to draw carriages or carts, see ANIMALS (CRUELTY TO).

In the United States, the statutory regulations of most States empower a person to have property in a dog, not only sufficient for the owner to be indemnified for injury done to the dog, but also to make theft of the dog liable to punishment as a crime. Some States require that the dog shall be duly licensed or registered and collared, and therefore subject to taxation, before these results follow. Unless duly authorised by law to kill unlicensed dogs, no citizen may kill a dog belonging to another, unless he, or some one under his protection, or his animal, is in immediate danger of injury from the dog, or the dog is rabid, or has been bitten by a rabid animal. In general, the owner of a dog is liable in damages for injuries done by his dog; but the master can plead ignorance of the vicious habits of the dog as a complete defence, except where it has been expressly excluded by statute, as is the case in some States. The owner of a vicious dog may be indicted for keeping a nuisance, and compelled to kill or muzzle his dog. Dog-racing is not illegal when for training purposes only, but if chance is the principal element, it becomes a crime within the statutes against gaming.

In some countries it is usual to compel the dogs living in towns to be muzzled; the civic authorities in Britain sometimes, and in the United States generally, issue edicts that all dogs be kept muzzled for a certain number of weeks, and occasionally the police make raids on ownerless dogs and destroy them. It is now not unusual to have homes maintained for stray dogs, the least valuable of the unclaimed ones being ultimately destroyed.

For the various breeds of dogs, see BEAGLE, BLOODHOUND, BULLDOG, COLLIE, GREYHOUND, MASTIFF, NEWFOUNDLAND DOG, TERRIER, &c. For the diseases of the dog, see DISTEMPER, MANGE, RABIES. See also COURSING, FOX-HUNTING, STAG, &c.

Dogbane (*Apocynum*), a small north temperate genus of Apocynaceæ, perennial herbs or undershrubs. The Dogbane of North America (*A. androsæmifolium*), often called Fly-trap, from the throat appendages of its corolla closing upon the flies which enter it, is of medicinal repute; similarly also its congener *A. cannabinum*, or Canadian Hemp, which yields a fine fibre. See APOCYNACEÆ.

Dog-days (*Dies Caniculares*) is a name given by the ancient astronomers to the 20 days before and 20 days after the rising of the *Dog-star* or Sirius (q.v.), at present reckoned from 3d July to 11th August. It is a mere accident that the rising of Sirius falls in the hottest season of the northern year; in time it will be in the dead of winter. But the ancients attributed the heat and the accompanying diseases directly to the influence of the star—as also in Egypt the highest rising of the Nile.

Doge (the Venetian form of the late Lat. *dox*, *docis*, equivalent to *dux*, 'leader,' 'duke') was the name of the chief-magistrate, possessing princely rank, in the republics of Venice and Genoa. For the history of the office and its powers, see GENOA, VENICE; also BUCENTAUR.

Dog-fish, the popular name for a number of cartilaginous (Elasmobranch) fishes in the shark sub-order. They belong to the genera Scyllium, Pristiurus, Acanthias, &c., and have the general characters noted under Cartilaginous Fishes (q.v.). (1) The 'rough hound,' or Lesser Spotted Dog-fish (*Scyllium canicula*), is common off European coasts, feeding chiefly among rocks at the bottom. It measures from 16 inches to over 2 feet in length; is reddish-gray, with brown spots

Lesser Spotted Dog-fish (*Scyllium canicula*).

above, and dirty yellow below. The eggs, which in the oviparous dog-fishes are large and few in number, are inclosed in pale yellow, horny purses, with long mooring tendrils, and are laid throughout summer and autumn. These envelopes are known as mermaids' purses, sailors' purses, or sea purses. The animals are sometimes cooked for soup, and their flesh even may be eaten. (2) The 'nurse hound,' or Larger Spotted Dog-fish (*S. stellare*

or *catulus*), is a larger species, 3 to 4 feet in length, of a reddish-gray colour, with large, round, brown spots. The eggs are laid late in the year. The flesh is too coarse to be edible. The skin of both spotted dog-fishes is studded with tubercles of dentine capped with enamel, and when prepared is used as 'rubskin' for polishing. (3) The Black-mouthed Dog-fish (*Pristiurus melanostomus*) measures a little over 2 feet, and is of a brownish-yellow colour above, and paler below. The dark spots are large, oblong, and disposed in two rows. The snout is longer, and there is a row of small spines on each side of the upper margin of the tail. (4) The Picked Dog-fish (*Acanthias vulgaris*), belonging to a different family (Spinacidæ), is more abundant off British coasts than any of the others. It measures about 3 feet in length, and is a voracious, prolific, hardy animal. It is not oviparous, and is said to produce young almost daily for eight or nine months a year. Its skin is not so rough as that of the spotted dog-fishes. The colour is slaty-gray or reddish-brown above, and whitish beneath. The two dorsal fins are each provided with a strong spine, which the fish uses with great accuracy as weapons. It gets a variety of names, such as bony dog, hoe, &c., and is much and justly hated by the fishermen for the damage it does to nets and lines, and for the voracity with which it attacks the shoals of herring and other food fishes. The names 'dog,' 'hound,' &c. are characteristic of all the set, but are particularly applicable to Acanthias. As many as 20,000 have been caught at a time, and their consequent destructiveness can be readily imagined. The young are born alive, two at a time, but in very rapid succession for prolonged periods. The flesh, though coarse, is sometimes eaten; and the eggs are said to be appreciated. The livers yield oil. To numerous related genera of wide distribution—e.g. Centrophorus, Spinax, Scymnus, the title dog-fish might also be applied. See CARTILAGINOUS FISHES, SHARK.

Dogger (Dutch *dogger-boot*, 'codfish-boat'), a vessel something like a galliot or a ketch, used by the Dutch as a fishing-boat in the German Ocean.

Doggerbank, an extensive flat sandbank in the North Sea, between England and Denmark, about 100 miles off the Yorkshire coast. It is about 170 miles long by 65 broad, with an average depth of from 8 to 16 fathoms. Its fisheries are valuable (see FISHERIES). The bank saw in 1781 an indecisive fight between the Dutch and English fleets. The 'incident' caused by the attack on Hull fishing-boats off the Doggerbank by the unfortunate Russian fleet on its way to Japanese waters in October 1904 was brought to an end by a Commission in February 1905. For the battle of 1915, see TACTICS, WAR (GREAT).

Doggett, THOMAS, a capable English actor who died in 1721, but is chiefly kept in remembrance as the founder of a prize—'Doggett's Coat and Badge,' still annually competed for by watermen at a sculling-match on the Thames on the 1st August. The original bequest, made in 1716 in honour of the accession of George I., has been supplemented from other quarters. See a book by Cook and Nickalls (1908).

Dog-grass. See COUCH-GRASS.

Dogma. There is the utmost diversity of opinion among theologians as to the exact meaning of the term 'dogma' and the relation between dogma and doctrine. The majority of writers seem to regard doctrine as a simpler form of dogma—a belief which has not yet been finally adopted and authenticated as a fundamental article of faith. In other words, doctrine is dogma in the making. Writers, moreover, are not agreed as to what it is that lifts doctrine into dogma. Many hold that a dogma is a doctrine which has received the sanction of some church council or ecclesiastical court, or which has been accepted by some Christian community as a test of membership. Others maintain that it is a doctrine which has been expounded in philosophical or metaphysical terms before its acceptance by some duly constituted authority. Harnack, for instance, says the distinguishing element in dogma is the result of the intrusion of Greek ideas into the Christian Church, and McTaggart asserts that some metaphysical idea is involved in every dogma. In contrast to these theories Dr Forsyth has recently developed a quite different view. He maintains that dogma represents the fundamental principles—the basic truths—of Christianity stated in their simplest form, and that doctrine is always an explication and elaboration of dogma.

These different interpretations of the term may be easily explained from its history. (1) The term 'dogma' is a Greek word which originally meant 'that which has been approved or decided.' In medical circles it was used to denote the scientific method of treatment as opposed to quackery and empiricism. In philosophical circles—among the Stoics, for instance—it was used to describe the fundamental axiomatic principles which form the data of all true thinking. In the legal sphere it was applied to provisions and enactments which had duly received the sanction of the court or legislative assembly. It occurs in the last sense several times in the New Testament, e.g. of the decisions of the Council of Jerusalem (Acts, xvi. 4), of the enactments of the Jewish law (Col. ii. 14; Eph. ii. 15), of the decrees of emperors (Luke, ii. 1; Acts, xvii. 7). There is no instance in the New Testament of the word being used to denote Christian beliefs or doctrines, since the passages already cited in Colossians and Ephesians cannot possibly bear that meaning.

(2) Different meanings were assigned to the word at different stages in the development of Christian theology. What was a dogma, for instance, in the 1st and 2nd centuries, was not a dogma in the 4th and 5th, and the character of dogma was altogether revolutionised by the Reformation. We may briefly indicate the different stages as follows:

(*a*) In the first stage, which we may roughly identify with the period 100–300 A.D., the term dogma was undoubtedly used to denote the universally admitted principles and truths which formed the basis of Christianity. 'Take pains to be established in the dogmas of the Lord and his Apostles,' writes Ignatius to the Magnesians, and he is not thinking of any theological doctrine, but rather of the ethical principles and rules of conduct which Jesus laid down for the guidance of his followers. The earliest dogmas were therefore ethical precepts and laws of conduct, and simple statements of Christian belief. As time went on, however, in view of Gnostic and other heretical movement, it became necessary to formulate the Christian position. The first attempt at creed-making is found in the outline of belief, which was drawn up at Rome probably about 140 A.D., and which afterwards formed the basis of the Apostles' Creed.

(*b*) It was in the second period (from 300 to 700) that the great change came over the conception of dogma. The Arian and the Christological controversies of the 4th and 5th centuries compelled the Church to define its belief upon the points in question. In the search for these definitions the Church was bound to go beyond the statements of the New Testament, and adopt philosophical terminology. The decisions which were reached by the œcumenical councils of Nicæa and Chalcedon were subsequently regarded as tests of orthodoxy, and from this point onward dogma came to signify

the theological interpretation of the Christian facts rather than the facts themselves. The authority upon which dogma rested was at this stage the decision of the œcumenical council, and it could be claimed that each dogma had received the sanction of the whole Church.

(3) The third period (700–1500) is marked by the cleavage between the eastern and western divisions of Christendom, which resulted nominally from a difference of opinion on the doctrine of the Procession of the Holy Spirit. Henceforth the Church spoke with two voices, and it was obviously impossible to establish any new dogma which had the authority of a united Christendom behind it.

(4) The Reformation resulted in still further divisions in the western Church, and a radical separation between Protestantism and Roman Catholicism on many points of doctrine, as may be seen from a comparison between the Creed of the Council of Trent and the Augsburg Confession. After the Reformation it became more impossible than ever to secure the sanction of the whole Church for any dogma. If this consent is a necessary condition, we are bound to agree with Harnack that the history of dogma ends at the Reformation. As a matter of fact, if we press the condition at all absolutely, no new dogma was possible after the separation of the eastern and western churches. Henceforward we find a large number of different confessions of faith, which we may regard as embodying the dogmas of different sections of the Church. Sometimes these dogmas were expressed in the form of articles of belief, e.g. the Thirty-nine Articles of the Anglican Church—sometimes in books which were regarded as authoritative by particular churches. The Roman Catholic position was expounded, for instance, in Bellarmine's *Disputationes*, the Lutheran in Melanchthon's *Loci Communes*, the Reformed in Calvin's *Institutes*, the Methodist in Wesley's *Journal* and *Sermons*. It should be stated that all these churches accept the authority of the creeds which were drawn up by the undivided Church in the 4th and 5th centuries. They differ, however, on many other dogmas, e.g. predestination, the doctrine of grace, the interpretation of the sacraments, &c.

See CREED, and the Histories of doctrine by Harnack, Hagenbach, Shedd, G. P. Fisher, Thomasius; McTaggart, *Some Dogmas of Religion* (1906); Kaftan, *Glaube und Dogma* (1889); Dorner, *System of Christian Doctrine*; W. N. Clarke, *Outline of Christian Theology*; W. Adams Browne, *Christian Theology in Outline*; and P. T. Forsyth, *Theology in Church and State* (1915).

Dogberry. See DOGWOOD.

Dogrose. See ROSE.

Dogs. See ANDIRON.

Dogs, ISLE OF, a district of London, metropolitan borough of Poplar, formed by a sudden bend in the Thames opposite Greenwich. It contains the West India and Millwall docks. Royal kennels are said to have been formerly situated here, but this, and the derivation from 'dogs' as a corruption of 'docks,' are equally unsatisfactory.

Dogskin, used for Gloves (q.v.), may be the skin of the dog, or sheepskin specially prepared to resemble it.

Dog's Mercury. See MERCURY.

Dog's Parsley. See FOOL'S PARSLEY.

Dog's-tail Grass (*Cynosurus*), a small genus of meadow grasses, of which *C. cristatus* is esteemed for pastures and lawns. See GRASSES, PASTURE.

Dog-star. See SIRIUS.

Dog's-tongue. See HOUND'S TONGUE.

Dog's-tooth Grass. See CYNODON.

Dog-tooth, in Architecture, an ornament or moulding used from late Norman to early Decorated. See TOOTH-ORNAMENT.

Dog-tooth Spar. See CALCITE.

Dog-tooth Violet (*Erythronium dens-canis*). See ERYTHRONIUM.

Dog-whelk. See WHELK.

Dogwood, or DOGBERRY, the name usually given to some of the trees and shrubs of the genus Cornus (see CORNEL, CORNACEÆ). The Common Dogwood of Europe (*C. sanguinea*) is a shrub of

Common Dogwood (*Cornus sanguinea*): *a*, flower.

remarkable beauty in autumn from the deep redness of its foliage. The wood makes the very best charcoal for gunpowder. It is very hard, and is made into skewers, cogs for wheels, &c., and in former times it was in request for making arrows. The small bitter fruit yields as much as one-third of its weight of an oil resembling that of olive. The wood of *Rhamnus frangula*, the berry-bearing alder, is also used by gunpowder makers, and called by them dogwood.—The Dogwood of North America (*C. florida*) is a very ornamental little tree with whitish flowers, surrounded by large white bracts, which appear before the leaves in early spring, and scarlet berries in winter. The wood is white and fine grained, and suitable for inlaying, and the bark, like that of some allied species, is a useful febrifuge.—Jamaica Dogwood is *Piscidia erythrina*, a papilionaceous timber-tree; the cortex of the root is powerfully narcotic, used for stupefying fish or deadening the pain of toothache. See also LEPTOSPERMUM, SUMACH.

Dohnanyi, ERNST VON, composer and pianist, was born at Pressburg, 27th July 1877, studied at the Hungarian Academy of Music at Budapest, and for a short time with Eugen d'Albert. From 1897 he made tours in Europe and America, proving himself a pianist of very high accomplishment. Later he gave himself more to composition. His works, which are of real value, include chamber-music, symphonies, pianoforte pieces, and opera.

Dohrn, ANTON (1840–1909), zoologist, was born at Stettin, studied at Königsberg, Bonn, Jena, and Berlin, lectured for a time on Zoology at Jena, and in 1870 founded the great zoological station at Naples. As an embryologist, he devoted himself mainly to the development of insects and

crustaceans; and, besides reports, he published works on the origin of the vertebrates.

Doiran, a shallow circular lake of Macedonia, in Greece, bordering on Yugoslavia, drains to the Vardar. The town of Doiran stands on its south side.

Doit, a small copper coin current, though illegally, in England in the sixteenth century. It was a Dutch coin (*duit*), in value equal to the eighth of an English penny, or half a farthing.

Dol, an antique walled town in the French department of Ille-et-Vilaine, 10 miles SE. of St Malo by rail. Its former cathedral is a striking granite building of the 13th century. To the north is the isolated Mont Dol (213 feet). Pop. 4500.

Dolabella, Publius Cornelius, Cicero's profligate son-in-law, was born about 70 B.C., and in 49 had to seek a refuge from his creditors in the camp of Cæsar. In the following year he obtained the tribuneship, and at once brought forward a bill, cancelling all debts, which led to bitter and bloody struggles in Rome. He accompanied Cæsar to Africa and Spain, but on his leader's death promptly usurped the consular insignia, approved of the murder, and made a great display of republican sentiments, which he professed until Antony gave him the province of Syria. At Smyrna he murdered C. Trebonius, the proconsul, in February 43, and proceeded to wring money and troops from the towns of Asia with a recklessness that speedily brought about his outlawry. Within the year, Laodicea, in which he had shut himself up, was taken by Cassius, and Dolabella, to escape his enemies, ordered one of his own soldiers to kill him, 43 B.C.

Dol'ce, an Italian term in music, meaning softly and with tenderness.

Dolci, Carlo or Carlino, a celebrated painter of the Florentine school, was born at Florence in 1616. He received his first instructions in art from Jacopo Vignali, a pupil of Roselli, and a remarkably skilful teacher. After an uneventful life spent entirely in his native city, Dolci died January 17, 1686. His works, which consist chiefly of madonnas and saints, exhibit the character attributed to him. The faces are full of a pleasing and tender softness, which, however, is often carried so far as to rob them of all character. Dolci's drawing is generally correct, his colouring exquisitely delicate and transparent, and in the nicety and laborious care of his finish he approaches the most characteristic examples of the Dutch school. His works are numerous, and scattered over all Europe. Besides his madonnas, the most famous are his 'St Cecilia,' 'Christ Blessing the Bread and Wine,' and 'Herodias with the Head of John the Baptist,' in Dresden.

Doldrums. See Wind.

Dôle, a town in the French department of Jura, on the Doubs, 29 miles SE. of Dijon by rail. It contains a Gothic cathedral, a college, and a library; and it has quarries, foundries, manufactures of metal wares, and a trade in grain, flour, wine, and cheese. Pop. 16,000. Dôle, the birthplace of Pasteur, is the *Dola Sequanorum* of the Romans, of whom many traces remain. It was in the 15th–17th centuries a strong and oft-disputed fortress, and the capital of the Franche-Comté (q.v.), with a university and a parliament.

Dolerite. See Basalt.

Dolet, Étienne, 'the martyr of the Renaissance,' was born at Orleans, in France, in 1509. The circumstances of his birth were somewhat mysterious, and it was even asserted that he was the natural son of Francis I. But this story is rejected by all his trustworthy biographers. At the age of twelve Dolet went to the university of Paris, where his attention was directed to the study which became the chief interest of his life—the writings of Cicero. Proceeding to Italy in 1526, he continued his studies at Padua and Venice, and after six years returned to France, settling in Toulouse. Here Dolet's troubles began. In Italy he had thoroughly imbibed the spirit of humanism, with its zeal for the study of the classics, and its indifference to the teaching of the church. As orator of the French 'nation' in the university of Toulouse, he delivered a harangue 'which laid the first fagot of the pile that consumed him.' On this occasion he was punished with three days' imprisonment. In 1534 Dolet left Toulouse for Lyons, where, under circumstances that have not been explained, he killed a person of the name of Compaing. Having received the royal pardon, he still continued to reside in Lyons, always under strong suspicion of heresy. In 1542 he received the royal permission to set up a printing-press, but soon brought himself into trouble on account of the heretical books he published. He was arrested more than once on this charge, but always succeeded in escaping the last penalty of the law. At length, in 1544, he was found guilty of heresy on a charge mainly based on an alleged mistranslation of Plato, in which he was accused of denying the immortality of the soul. After two years' imprisonment, Dolet was burned in the Place Maubert, Paris, 3d August 1546. Dolet's fate has given him an interest and importance he would not otherwise have had. At the same time, by his indefatigable industry as a writer and printer, he did valuable service to the cause of learning in the 16th century. His most important work is his *Commentaries on the Latin Language.* See Richard C. Christie's *Étienne Dolet* (1880; new ed. 1889; French trans. with 'appendix bibliographique,' 1885), and O. Galtier, *Estienne Dolet* (1908).

Dolgelly, or Dolgelley ('dale of hazels'), the capital of Merioneth, North Wales, on the Wnion, 62 miles SW. of Chester by rail. It lies in a rich and picturesque valley, at the foot of Cader Idris, and during the summer months is much frequented by tourists. It has manufactures of coarse woollens and flannels; its Welsh tweed is in great repute. Pop. 2000. Here, in 1404, Owen Glendower held a parliament, and signed a treaty of alliance with Charles VI. of France.

Dolgoruky, Katharina, Princess, the favourite of the Russian Tsar, Alexander II., who married her in July 1880, after the death of his first wife, Marie, and made her Princess Yurievskaia. She was born at Moscow, 2d November 1847. After the Tsar's tragical death she lived abroad, and published at Geneva in 1882, under the pseudonym of Victor Laferté, *Alexandre II., Détails inédits sur sa Vie Intime et sa Mort.* Her *Mémoires* (1890) were suppressed by the Russian government. She died at Nice, 15th February 1922.

Dolichocephalic. See Skull.

Dolichos, a large genus of Leguminosæ, suborder Papilionaceæ, closely allied to Phaseolus (see Bean), annual or perennial. Some are cultivated on account of their edible seeds or pods, notably *D. Lablab* of India and Egypt, *D. soya* (or *Soja hispida*), the Soy-bean of China and Japan, and many others. See Soy. The Horse-gram, *D. biflorus,* is cultivated in India, &c., for horse and cattle food.

Doll, an imitation human figure used as a toy, especially by girls. The word is probably a form of *Dorothy.* The use of dolls as an assistance to the operations of the young mind dates from the most remote times, and is common in all countries, barbarous as well as civilised,

springing from the early mental process which requires some object to increase the definiteness of the child's ideas. Thus, however roughly made the doll may be, it answers a purpose—setting the child's brain to work, and enabling it, by the association of ideas, to form a mental picture of what it is intended to resemble. With many uncultured tribes the doll is not confined to children. Among the Bechuanas, married women carry a doll with them till they have a child, when it is discarded; a similar practice being observed by Basuto women. In many parts of Africa, whenever twin children are born, one of them is killed; and among the Wanyamwezi, it is usual for the mother 'to wrap a gourd or calabash in skins, to place it to sleep with, and feed it like the survivor.' Even the European child's love for the doll by no means depends on its artistic excellence; a bit of stick dressed with a few rags is often hugged as heartily as the finest toy-baby.

Roman Ivory Doll.

As in the case of most other Toys (q.v.), dolls were at one time imported into Great Britain chiefly from the Netherlands; and hence not an unusual name for a doll was a Flanders baby. These old Flemish or Dutch dolls were made of wood, with neatly formed faces and flashy dresses, the cheaper kinds having slender wooden legs.

Dollar, a pleasant town of Clackmannanshire, at the foot of the Ochils, and near the Devon's right bank, 6 miles NE. of Alloa, and 12 ENE. of Stirling. It has bleachfields, but owes its chief well-being to its academy, a domed Grecian edifice (1818–67), which, founded under the will of Captain John M'Nab (1732–1802), a Dollar herdboy and London shipowner, gives higher and secondary education to 800 pupils of both sexes. A mile north of Dollar are the noble ruins of Castle Campbell or Castle Gloom, crowning an almost insulated knoll, amid mountain-rivulets and bosky woods, with King's Seat (2111 feet) rising behind. It belonged to the family of Argyll from 1465 till 1805, in 1556 sheltered John Knox, and in 1645 was burned by Montrose. At Dollar in 877 the Danes won a victory; and in 1538, its 'good vicar,' Thomas Forrest, was burned at Edinburgh for heresy. Pop. (1851) 1079; (1881) 2014; (1921) 1584. See Beveridge's *Between the Ochils and the Forth* (1888).

Dollar, the familiar unit of the monetary system of the United States, as well as of Canada and Bolivia, Liberia, and, under the name of peso, of Mexico and Uruguay. The name *dollar* is a variant of the German *thaler* and Danish *daler*. The name arose about the year 1600 in Germany. The Counts of Schlick were then coining ounce-pieces from silver obtained in their mines at Joachimsthal (Joachim's Dale) in Bohemia, which gained such high repute as to become standard coins; whence the name *Joachims-thaler*, which finally, for shortness, took the form of *thaler*—literally, a 'valley-piece.' The name was soon extended to other coins of similar size—notably to the old Spanish 'piece of eight,' the *peso* of eight reals. From 1873 to 1878 the gold dollar was the sole standard of value in the United States. This coin contains 25·8 grains of gold of the United States standard of fineness—namely $\frac{9}{10}$ pure gold; the British standard being $\frac{11}{12}$ pure gold. The gold dollar is thus worth about 4s. 2d. sterling. In 1878 the United States government remonetised silver, since which time the United States have had a double standard. The standard silver dollar contains 412½ grains troy of silver, of which $\frac{1}{10}$ is alloy. The silver dollar (like a paper dollar) is exchangeable anywhere in the United States for a gold dollar; although the bullion value of the silver it contains was, prior to 1919, considerably less. It varies, in fact, with the market price of silver. The dollar is divided into 100 cents; there are silver half and quarter dollars, and dimes (ten cents), nickel half-dimes, and copper cents, the coins of least value in the United States currency. The U.S. trade-dollar of 420 grains had ceased to be a legal tender, but till 1883 was specially coined for export to China and other Asiatic regions. It is very nearly equivalent in intrinsic value to the Mexican dollar, so long recognised as the standard of values in the Chinese trade. The British at Hong-kong and the Japanese government coin trade-dollars also. The Canadian dollar is about equivalent in value to that of the United States. Among other coins that are, or may be, called dollars from their approximation in value to the United States standards, are the *boliviano* of Bolivia (silver, about 72 cents); the *peso* of Spain (97 cents), of Chile (78 cents), of Cuba (92 cents), of the Central American Republics, and of Colombia (80 cents); the *sucré* of Ecuador (72 cents); the *gourde* of Haiti (80 cents); the *yen* of Japan (gold, one dollar; silver, 80 cents); the dollar of Liberia (worth one American dollar); the Mexican *peso* (75 cents); and the *sol* of Peru (80 cents); all of them of silver, except when otherwise stated. The *thaler*, equalling 3 marks, or 71 cents, till 1875 formed the standard of value of almost all northern Germany. The double florin of Great Britain (first struck in 1887) has a value of 4s., and is approximately a dollar.—The derivation of the *dollar mark* ($) has been variously ascribed to (1) a combination of the initials U.S.; (2) a modification of the figure 8, a piece of eight being formerly indicated by the character 8–8; (3) a form of HS., which marked the Roman unit; (4) the contraction of P and S employed in Spanish accounts to indicate *peso;* (5) a device formerly seen on the reverse of the Spanish dollar, and again, since 1848, on the *peso duro*, representing the Pillars of Hercules, and round each a scroll displaying the inscription *Plus ultra.*

Dollart, The, a gulf of the German Ocean, at the mouth of the river Ems, between Hanover and Holland. It is 8 miles long by 7 broad, and was formed by inundations of the sea (1277–1362), which submerged 50 villages and several towns. Of late years much territory, especially on the flat German coast, has been won back from the sea.

Dolling, Robert William Radclyffe (1853–1902), destined as 'Father Dolling' to secure love and enormous influence as a social reformer in the slums of Landport and Poplar, was the son of a landlord at Magheralin, in County Down, and was educated at Harrow and Trinity College, Cambridge. He settled in London in 1878, was ordained in 1883, and was closely associated with Father Hanlon, A. H. Mackonochie, and the militant ritualists. In his charges at Southwark, Portsmouth, and Poplar he showed the same magnetic power with reputables and disreputables, the same evangelical fervour combined with advanced ritualism and radical politics, and the same impatience of ecclesiastical authority. See Lives by Osborne (1903) and Clayton (1902).

Döllinger, Johann Joseph Ignaz, one of the most scholarly and eminent of recent German Catholic theologians, was born at Bamberg on 28th February 1799. After teaching for three years in the Lyceum at Aschaffenburg, he was appointed (1826) professor of Ecclesiastical History and Law in the university of Munich, a chair which he held,

with the exception of a short interval (1847–49), down to 1871, when he was elected rector of his university. He also represented the same university in the Bavarian chamber from 1845 to 1847, and onwards from 1849, and was elected by a Bavarian constituency to the Frankfort parliament of 1848–49. His life and labours may be conveniently divided into three periods. During the first of these, which extended from 1826 to 1857, he was one of the most energetic defenders of Ultramontanism in Germany, the champion of the independence of the church from the state, and an enemy of Protestantism, formidable not only on account of his energy and indefatigable zeal, but also on account of his learning, his eloquence, and his skill as a writer. The views which he held at this period of his life find expression in his public acts, especially as leader of the Ultramontane party at Frankfort, and in two works, *Die Reformation, ihre innere Entwickelung und ihre Wirkungen* (Ratisbon, 3 vols. 1846–48); and *Luther, eine Skizze* (1851). In 1857 Döllinger visited Rome, and what he saw there, together with the outbreak of the Italian war of 1859, produced a change in his opinions, which he first announced publicly in two addresses delivered at Munich in 1861, in which he propounded his belief that the temporal sovereignty of the pope was not essential to the continuance and progress of the Roman Catholic Church. The enunciation of this view brought down upon his head several fierce attacks from the writers of the Ultramontane party, to which he replied in *Kirche und Kirchen, Papsttum und Kirchenstaat* (1861); and this was followed, two years afterwards, by *Vergangenheit und Gegenwart der katholischen Theologie* (addressed to a conference of Roman Catholic divines at Munich), and by *Die Papstfabeln des Mittelalters*. Whilst the Vatican Council was being summoned to deliberate on the dogma of papal infallibility, Döllinger, along with his colleagues, Professors Friedrich and Huber, assailed the new doctrine in the anonymous *Janus* (1869; 2d ed. as *Das Papstthum*, 1891). In July 1870 the council proceeded to promulgate the decree of papal infallibility; and in the following March Döllinger published a letter, withholding his submission, alike as 'a Christian, a theologian, an historical student, and a citizen.' Excommunicated three weeks afterwards, he took a leading part in the summoning of the congress which met at Munich in September, and out of which arose the Old Catholics (q.v.). The year 1872 marks the beginning of the third period in the learned theologian's career. The position he now took up was indicative of a desire to bring about the union of the various Christian churches, a cause which he advocated, not only in a series of lectures (1872), but also by the active part he took in the Old Catholic conference at Bonn (1874–76). He never officiated as a priest of the new communion, though he defended its position. With Reusch he edited Cardinal Bellarmine's autobiography (1887), and a work on moral controversies in the Catholic Church since the 16th century (1888). In 1888 he published academic lectures (Eng. trans. of first series, *Studies in European History*, 1890), and in 1889 materials for a history of sects. Besides works already named, Döllinger wrote *Hippolytus und Kallistus* (1853), *Heidentum und Judentum* (1857), a treatise on Christianity and the Church in the earliest period (1860), and a collection of documents illustrating the history of the Council of Trent. In 1873 he was made president of the Munich Academy. In 1889 his ninetieth birthday was celebrated by the university with great éclat; and he died at Munich, 10th January 1890.

Dollond, John, a distinguished optician, inventor of the achromatic telescope, was descended from a French refugee family of Dutch extraction, and was born in London, June 10, 1706. Brought up to his father's occupation of silk-weaving, and engaged at the loom all day, he devoted great part of the night to his favourite studies of mathematics, optics, and astronomy; and even made himself acquainted with anatomy, theology, Greek, Latin, French, German, and Italian. In 1752 he joined his eldest son, Peter (1730–1820), who had started as an optician, and devoted himself to the improvement of the dioptric telescope, in which he was encouraged by the most distinguished scientific men of the time. After a series of well-contrived experiments and researches, carried on for several years, he succeeded in constructing lenses that produced images without any coloured fringe (see Achromatism). This was undoubtedly the greatest improvement that the telescope had received since its first invention, though it came out in action for infringement of patent, that in 1733 it had been anticipated by Chester More Hall, who had not, however, made his invention public. The Memoir (published in the *Philosophical Transactions* for 1758) in which he gave an account of his investigations was rewarded by the council of the Royal Society with the Copley Medal. In 1761 Dollond was elected an F.R.S.; he died 30th November of the same year. His two sons continued to carry on the business with great reputation and success. See Kelly's privately printed Life, reproduced in the *Philosophical Magazine* (1804).

Dolmen (from the Celtic words *daul*, 'a table,' and *maen*, 'a stone') is a modern term applied in archæology to the megalithic framework of the chambers of chambered cairns, which often survive the removal of the covering mounds of stones and earth for agricultural or other utilitarian purposes, or which may never have been completely enveloped in such a covering. In England, such constructions, consisting of three or more stone props supporting a massive roof stone, were formerly styled Cromlechs (q.v.), but this use of the term is now obsolete. The best-known English dolmen is that known as Kits Coty House (q.v.), near Aylesford, in Kent. The term dolmen is almost universally employed on the Continent to designate not only the denuded megaliths of a sepulchral chamber, but the whole construction, inclusive of the covering mound or cairn. It is thus synonymous with the descriptive appellation of chambered Cairn (q.v.), and may be taken as a generic name for such sepulchral constructions of the stone age. In France there are thousands of more or less complete dolmens in the wider sense of the term, many of these in Brittany.

Dolomite, or Bitter Spar, a mineral consisting of double calcium and magnesium carbonate. The proportions of the two carbonates are very variable, and occasionally the mineral contains a considerable percentage of ferrous carbonate. It crystallises in rhombohedral forms, the faces of the crystals being often curved; its lustre is somewhat pearly or vitreous, and its colour usually white, but variously coloured kinds are not uncommon, such as reddish, brown, green, gray, and black. It effervesces feebly with cold acid. The pure crystallised varieties are known as Pearl Spar. Those which contain a notable proportion of ferrous carbonate are called Brown Spar or Ankerite. Besides these, columnar fibrous and granular or saccharoid varieties are known. Magnesian limestone—a rock occurring abundantly in the Permian System (q.v.)—is composed essentially of bitter spar, and hence is often called dolomite. It is usually white, gray, or yellow in colour, and finely crystalline. In some varieties cellular spaces occur which are often lined with crystals of dolomite.

Other varieties are composed of botryoidal or irregularly-shaped concretionary masses. Most limestones contain some magnesium carbonate, but it is only when the percentage of this salt is considerable that they are called magnesian limestones or dolomites. Magnesian limestone is often used as a building-stone; and it is also burned and made into mortar, but the lime obtained from it remains much longer caustic than lime from common limestone, and is considered of less value for agricultural purposes. In some districts, however, this lime is preferred to purer limes for application to hill-pastures.—Dolomite is named after the geologist Déodat Guy de Dolomieu (1750–1801), who was born at Dolomieu in Dauphiné.

Dolomite Mountains. The distinctive peculiarities of dolomite mountain-scenery, with its jagged outlines and isolated peaks, may be seen on the grandest scale in the south-east of Tyrol and in the Carinthian Alp masses. When the Dolomites *par excellence* are spoken of, it is the Dolomite Mountains of this region that are meant. See books by Gilbert (1862), Miss Tuckett (1870), Amelia B. Edwards (1870), Sinigaglia (1896), and S. H. Hamer (1910), and monograph by Mrs Ogilvie-Gordon (Edinburgh Geol. Soc. 1910).

Dolphin, a name applied to various members of the Cetacean family Delphinidæ, but especially to the species of the genus Delphinus. This genus is large and heterogeneous, and is split up by some naturalists. The snout is more or less elongated and pointed; the teeth are very numerous, uniform, close-set, and sharp; the fore-limbs are narrow and pointed; there is usually a conspicuous dorsal fin. Like other toothed Cetaceans, the dolphins have a somewhat unsymmetrical skull with many peculiarities, and a single crescentic blow-hole (nostril) on the top of the head. They occur in all seas, and sometimes in rivers, such as the Amazon. None exceed 10 feet in length. They feed principally on fish, but some do not disdain lower animals, such as molluscs, crustaceans, medusæ. In habit they are active, and usually occur in gregarious 'schools.'

The Common Dolphin (*Delphinus delphis*) occurs in the Mediterranean and North Atlantic, and is probably identical with forms from the North Pacific and Australia distinguished as separate

Common Dolphin (*Delphinus delphis*).

species. It is usually not more than 6 to 8 feet in length, of a gray or greenish-black colour above, and white below. The moderately long snout is separated by a transverse pad from the slightly arched forehead. The jaws bear on each side twenty-five to fifty small, conical, sharp teeth, curved slightly backwards. The crescent-shaped tail is keeled above and below. The dolphin feeds chiefly on fishes, which it pursues with graceful gambolings. One young one is born at a time, and tended with much affection. The animals have a peculiar lowing cry. Their agile evolutions are much observed and admired by voyagers. The flesh is sometimes eaten by sailors. Like other dolphins, it is often called a 'porpoise,' and the French give it the names of *Bec d'Oie* (goose-beak) or *Oie de Mer* (goose of the sea). In ancient times the dolphins were sacred to Apollo, and invested with numerous kindly and marvellous attributes. They drew the car of Amphitrite, and carried Arion upon their willing backs. Its image has been often used as a symbol, from the 'shield of Ulysses' to that of the heir-apparent or Dauphin (q.v.) of France. The anchor and dolphin, the printer's device of Aldo Manuzio, with the motto, '*Festina lente*,' was adopted by him, at Erasmus' suggestion, from a silver coin of Vespasian I. The flesh of the dolphin was formerly esteemed for food. The name has been curiously transferred to the little Coryphenes (q.v.); and it is these scomberoids that are meant when reference is made to the 'dying dolphin's changing hues.'

A rarer species off British coasts is the much larger and heavier Tursio (*D. tursio*), the nesarnak of the Greenlanders. In the North Atlantic, *D. albirostris* and *D. leucopleurus* also occur. There is a pure white dolphin (*D. sinensis*) in the Chinese seas, and a South Sea form (*D. peronii*) without the usual dorsal fin.

In the same family as the dolphin are many well-known forms: the Narwhal (*Monoceros*), the Beluga (*Delphinapterus*), the Porpoise (*Phocæna*), the Grampus (*Orca*, &c.), the Caaing Whale (*Globicephalus*), &c. See these articles.

Dolphin, Black (*Aphis fabæ*). See Aphides and Bean.

Dōmbōc (book of dooms or sentences), the code of laws attributed to King Alfred, contains few if any orig nal laws, but restores, renovates, and improves those already in existence. A peculiarly Christian character is strongly impressed on the code, which begins with extracts from the Bible, 'The Lord spake all these words, saying, I am the Lord thy God.' Then follow the ten commandments, the part of the Mosaic law relating to criminal offences, and passages from the New Testament. It was ratified by the Witan. Thorpe gives it in his *Diplomatarium Anglicanum ævi Saxonici* (1865).

Dombrowski, John Henry (1755–1818), a distinguished Polish general, was born near Cracow, and, after serving under the Elector of Saxony, returned to take part in the Polish campaigns against Russia and Prussia in 1792–94. Next entering the French service, he organised a Polish Legion at Milan, and in the campaigns which followed played a distinguished part. After the fall of Napoleon he returned to Poland, and was appointed a general of cavalry and Polish senator.

Domdaniel, a magicians' meeting-place in a cave under the sea, adopted by Southey (*Thalaba*) from the French continuation of the *Arabian Nights*, and often alluded to by Carlyle.

Dome (Ital. *duomo*). Since the time of the Renaissance this term is commonly applied to the external part of the spherical or polygonal roof, of which the cupola (*cupo*, or cup) is the internal part. In Italian usage, however, it has a wider signification than even the first, being used to denote the cathedral or chief church of a town, *the house* (domus) *par excellence*, or house of God; and in Germany, *dom* or *domkirche* is a cathedral. In tracing the historical origin of the dome, we are usually in the habit of regarding it as originating with the architecture of the Eastern empire, because it was at Constantinople and in the Byzantine provinces that its use in ecclesiastical

structures was principally adopted. But it was the Romans who developed the dome, as well as all the other applications of the semicircular arch. Of their success in applying it to large buildings, we have abundant proof in the ancient domes still to be seen in Rome and its neighbourhood. The dome of the Pantheon is still probably the most magnificent dome in existence, and others of smaller size are to be seen in the temples of Bacchus, Vesta, Romulus, Hercules, &c. From Rome it went to Constantinople, and from the same source, also, according to Fergusson, came the few insignificant attempts at domes in the Western empire. The external form of the dome of the church of St Sophia at Constantinople, which became the typical Christian structure of the kind, will be seen in the illustration appended to BYZANTINE ARCHITECTURE (see also ARABIAN ARCHITECTURE, and the illustration of the Taj Mahal at AGRA). The dome of San Vitale, at Ravenna (q.v.), is said to be still more ancient than that of St Sophia, and is a very remarkable structure of the same class. On the church of St Mark, at Venice, there are no less than five domes, the centre one, as is usual in Eastern structures, being much larger than the others. The interior of these domes is covered with Mosaic (q.v.). So far from being peculiar to the few churches we have mentioned, domes occur in those of almost every town along the western shore of the Adriatic, and form, in fact, the chief architectural feature of that side of Italy. From St Mark's the dome was introduced in the 11th century into Périgueux in the south of France, and thus influenced the architecture of a considerable part of that country. The construction of domes in modern times was revived in Rome, by the building of that of Our Lady of Loretto in 1507. But the three most celebrated modern domes are those of St Peter's (q.v.) at Rome, of St Paul's in London, and of the Pantheon in Paris. The following are the dimensions of some of the most important existing domes :

	Feet diam.	Feet high.
Pantheon at Rome	142	143
Baths of Caracalla, Rome	112	116
St Sophia, Constantinople	115	201
St Maria delle Fiore, Florence	139	310
St Peter's, Rome	139	435
St Paul's, London	112	404
St Geneviève, Paris	67	190

In modern times, domes have been constructed with iron of still larger dimensions. Thus that of the Great Exhibition in Vienna was 360 feet in width, and that of the Albert Memorial Hall in London, which is oval, measures 219 by 185 feet in diameter. For a class of ancient dome-roofed structures, see BEEHIVE HOUSES.

Domenichi'no, or DOMENICO ZAMPIERI, a celebrated painter of the Bolognese school, was born at Bologna in 1581. He began his studies under Denis Calvaert, and completed them under the Caracci. During the whole of his career, Domenichino had much to suffer from the jealousy of rivals, who are not free from the suspicion of having caused his death by poison (1641). Though his artistic fame has greatly diminished during recent years, it must be admitted that his works are distinguished by correctness of design, that the heads of his figures in particular are expressive and forcible, and that his draperies are rich and varied in arrangement. The masterpiece of Domenichino, the 'Communion of St Jerome,' 1614 (an easel-picture in the Vatican), though suggested by Agostino Caracci's rendering of the subject, is an accomplished and powerful production. His 'Diana and her Nymphs,' 'Guardian Angel,' 'St John,' and 'St Sebastian,' also rank among his finer productions, and the 'Cure of the Demoniac Boy,' at Grotta Ferrata, is one of the most admired of his frescoes. Out of Italy, the museum of the Louvre possesses the largest number of Domenichino's works.

Domesday Book, or DOOMSDAY BOOK, one of the oldest and most valuable records of England, contains the results of a statistical survey of that country made by William the Conqueror in 1085–86. The Old English name, *Dómes Dæg*, 'day of judgment,' has obvious reference to the supreme authority of the book in doom or judgment on the matters contained in it. It was also anciently known as the *Liber de Wintonia*, or Book of Winchester; the *Rotulus Wintoniæ*, or Roll of Winchester; the *Liber Regis*, or King's Book; the *Scriptura Thesauri Regis*, or Record of the King's Treasury (where it was long kept, together with the king's seal, under three locks and keys); also the *Liber Censualis Angliæ*, or Rate-book of England; and the *Liber Judiciarius*, or Book of Judgment.

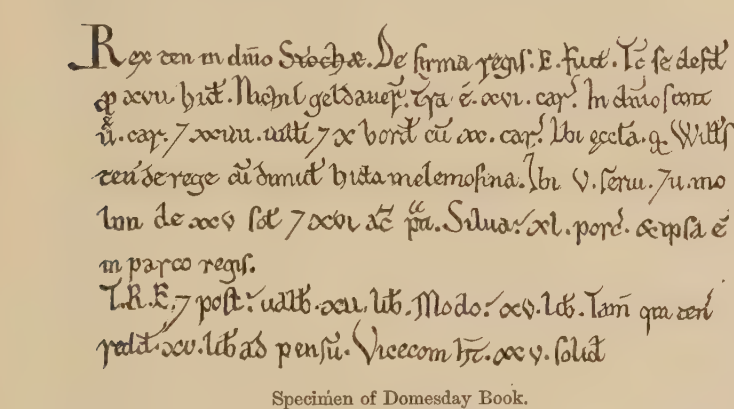
The way in which the survey was made will be best described in the words of the contemporary writer in the Anglo-Saxon Chronicle. At midwinter in 1085, when the king was at Gloucester, 'he had a great consultation, and spoke very deeply with his witan [i.e. great council or parliament] concerning the land, how it was held, and what were its tenantry. He then sent his men all over England, into every shire, and caused them to ascertain how many hundred hides of land it contained, and what lands the king had in it, what cattle there were in the several counties, and how much revenue he ought to get yearly from each. He also caused them write down how much land belonged to his archbishops, bishops, abbots, and earls, what property every inhabitant of all England possessed in land or in cattle, and how much money this was worth. So strictly did he cause the survey to be made, that there was not a single hide, nor a yardland of ground, nor—it is shameful to say what he thought no shame to do—was there an ox, or a cow, or a pig passed by, that was not set down in the accounts; all these writings were brought to him.'

The survey was made by commissioners called the king's justiciaries, who had the help of the chief men of every shire. By a sworn assize or jury of the sheriffs, lords of manors, presbyters of churches, reeves (i.e. grieves or overseers) of hundreds, bailiffs, and six villeins (i.e. servile tenants) of every village, they made inquest as to the name of the place; who held it in the time of King Edward (1041–66); who was its present possessor; how many hides there were in the manor; how many ploughgates in demesne (i.e. reserved in the lord's own hand); how many homagers or vassals; how many villeins; how many cottars; how many serfs; what freemen; how many tenants in socage (i.e. tenants who rendered services of husbandry); how much wood; how much meadow and pasture; what mills and fish-ponds; how much had been added or taken away; what was the gross value in Edward's time; what the present value; and how much each freeman or socman has or had. They were also to state the value of the land (1) as held in Edward's days; (2) as it had been given by William; (3) as it stood at the time of this survey; and (4) if its value could now be raised.

The returns thus gathered in the several shires, and their hundreds and other subdivisions, were arranged and digested in the record which is now called the Great or Exchequer Domesday. The enumeration of the cattle and swine, which so moved the indignation of the Anglo-Saxon chronicler, though regularly made, was in some cases omitted from the record, because of its ever-fluctu-

ating quantity. By this valuable census there was provided not only exact information of the land and its inhabitants, but also a trustworthy register of appeal for litigious proprietors, a reliable guide for military service, and a practical basis for regulating taxation. The taxes were levied according to the divisions of the country given in the Domesday Book, until 1522, when a new survey, popularly called the *New Domesday Book*, was made.

This great English record was published at the national cost in 1783, in two folio volumes, printed with types cast for the purpose, so as to represent the contractions of the original manuscript; it was ten years in passing through the press. In 1811–16 two supplementary volumes were published, one containing an excellent general introduction, by Sir Henry Ellis of the British Museum, with indices to the places and persons mentioned in the work; the other containing four other records of the same nature: (1) The Exon or Exeter Domesday, being a transcript of the Exchequer Domesday for the counties of Wilts, Dorset, Somerset, Devon, and Cornwall; (2) the Inquisitio Eliensis, a transcript of the survey of the lands of the monastery of Ely, in the counties of Cambridge, Hertford, Essex, Norfolk, Suffolk, and Huntingdon; (3) the Winton Domesday, containing two surveys of the city of Winchester, one made between 1107 and 1128, the other in 1148; and (4) the Boldon Book, a survey of the posesssions of the see of Durham, made in 1183. This fourth record is especially valuable, as partially supplying a deficiency in the Domesday survey, which did not extend to the counties of Durham, Northumberland, Westmorland, and Cumberland, either, it would seem, because they had been lately laid waste by the Conqueror, or because his dominion was not fully established in them. A new and better edition of the Boldon Book was issued in 1852 by the Surtees Society, which, in 1857, printed *Bishop Hatfield's Survey*, another record of the possessions of the see of Durham, compiled between 1345 and 1381. A new and enlarged edition of Sir Henry Ellis's *General Introduction to Domesday Book* was published in 1833, in two vols. 8vo. See also Stubbs's *Select Charters*, and Freeman's *Norman Conquest* (vol. v. 1876). In 1861–63 a fac-simile copy was published by the Ordnance Survey, by photozincography; and the *Victoria History of the Counties of England* has gone on publishing the Domesday Book in translation, county by county, with introductions and maps. In 1872 government ordered a general return of owners of lands, to be prepared by the Local Government Board. This modern 'Domesday Book' was published in 1874–76.



Specimen of Domesday Book.

The reading, freed from contractions, runs as follows:

Rex tenet in dominio Stochæ. De firma regis Edwardi fuit. Tunc se defendebat pro xvij hidis. Nichil geldaverunt. Terra est xvj carucatæ. In dominio sunt ij carucatæ & xxiv villani & x bordarij cum xx carucatis. Ibi ecclesia quam Willelmus tenet de rege cum dimidia hida in elemosina. Ibi v servi & ii molini de xxv sol. & xvi acræ prati Silva xl porcorum & ipsa est in parco regis.
Tempore Regis Edwardi & post valebat xij lib. Modo xv lib. Tamen qui tenet reddit xv lib. ad pensum. Vicecomes habet xxv solid.

Of books on Domesday there are not a few—amongst them Maitland's *Domesday and Beyond* (1897); Birch's *Domesday Book* (1887), a succinct and popular account, with a copious bibliography; Léchaudé d'Anisy, *Recherches sur le Domesday* (1842); *Domesday Studies* (1888–91); the Rev. W. R. Eyton's notes on several sections (Dorset, Somerset, Stafford, 4 vols. 1877–81, &c.); Freeman's *Norman Conquest of England* (vol. v. 1876); Round's *Feudal England* (1895); Ballard's *Domesday Boroughs* (1904), and *Domesday Inquest* (1906).

Domestic Architecture. The variety of requirements to be fulfilled by the architecture of the house, whether as regards the climate, habits, or employments of different countries, is very great, and the designs and arrangements must therefore throughout the world's history have been infinitely varied. But the construction is generally much less substantial than that of temples and public buildings, and the remains of ancient houses are in consequence comparatively scarce. There are considerable remains, however, of Egyptian and Cretan dwellings (see CRETE), and some idea of those of the Etruscans may be obtained from the arrangement of their tombs. Greek and Roman houses were generally only one story in height, and contained an open atrium with small chambers around it. Beyond this was the peristyle or private department, surrounded with a colonnade, and opening on a garden. In connection with the peristyle were dining-rooms and family apartments. The preservation of the houses of Herculaneum and Pompeii brings before us with great vividness all the domestic arrangements of the classic period.

The Roman dispositions were followed during a great part of the middle ages, but became modified about the 11th century. Thus the peristyle was imitated in the cloister of the medieval monastery, and the Roman 'villa' or country-house became the model of the early castles of southern Gaul. In the villa the large outer courtyard was called the *villa rustica*, containing the granaries, stables, &c., while an inner court formed the *villa urbana*, or residence of the proprietor. The castles were on the same plan, the courts being surrounded with a ditch and palisaded mound, and the owner's house being a wooden redoubt on the top of an artificial mound in the inner inclosure.

During the middle ages and up to the 17th century, the greater part of the houses of the people, including those in the towns, were constructed with wood, the corbelled-out and overhanging upper floors of which are amongst the most picturesque features of medieval architecture both in England and on the Continent. The Normans were the first to introduce stone and mortar construction into castle-building in the 11th century. The well-known Norman keeps were the residences of the nobility in Normandy and England till the 13th century. There are still, however, remains of smaller manors in England dating from that period. These consisted of a two-story plain block, the ground-floor being vaulted, and the upper floor,

which contained the living-rooms, entering by a separate outside stair. In the following centuries additions were made to the accommodation to suit the enlarged requirements of the times, until the buildings came finally to surround a courtyard and form a quadrangle. Most of the great castles and mansions of the 15th and 16th centuries were erected on this plan, and those built in the time of Queen Elizabeth were often on a great scale, and contained nearly all the accommodation required at the present day. Smaller mansions and houses were on various plans, and in town-houses the interior court, surrounded with projecting balconies or galleries, was common.

Under the Renaissance, town-houses in streets lost their distinctive qualities, being all designed so as to form as it were one flank of an extensive palace or single edifice. This monotonous arrangement is now being gradually departed from, and each house is beginning to be designed, as it should be, independently.

The domestic architecture of modern times has this peculiarity, that it extends its influence so as to include all classes of dwellings, even the humblest; and the houses of farm-servants and town artisans now receive as much care in their design, in order to render them comfortable and sanitary abodes, as the palaces and mansions of the wealthier classes.

See the articles BUILDING, CASTLE, GOTHIC ARCHITECTURE, ELIZABETHAN ARCHITECTURE, QUEEN ANNE STYLE, and other articles cited at ARCHITECTURE in this work; also Fergusson's *Handbook of Architecture;* Viollet le Duc, *Dictionnaire de l'Architecture, Histoire d'une Maison, &c.;* John Henry Parker, *Some Account of Domestic Architecture in England;* T. Hudson Turner, *Domestic Architecture of the Middle Ages;* D. MacGibbon and T. Ross, *Castellated and Domestic Architecture of Scotland.*

Domestication, the modification of animals by deliberate human interference with their food and surroundings, with the work or functions they perform, but especially with their breeding. The influence of man on animals extends, however, far beyond those usually regarded as domesticated, and it is not possible to draw a perfectly hard and fast boundary line. Man has exterminated some animals—e.g. birds, and propagated others—e.g. fishes; he has made many become rare, shy, and cunning, while others (e.g. crickets) find shelter in his dwellings; he has kept some captive, like the fish in the pond; tamed others individually for his service, like falcons and cheetahs; he has preserved some artificially from their enemies, because of their rarity, and others because of their utility, but without in any of these cases much modifying them. None of these are in the strict sense domesticated. It is only when a distinct breed has been produced by human interference, in most cases deliberately by artificial selection, that we are justified in calling the result domestication. Strictly 'domesticated animals' correspond to strictly 'cultivated plants;' in both cases the organisms have been modified, more or less fixedly, from their natural or wild state, by changes in food and environment, function and breeding.

Domestication began long before the dawn of history (see AGRICULTURE, ANTHROPOLOGY, DOG, STONE AGE). The domestic animals are discussed under separate articles; but a list of representative forms may be given here. Among lower animals, Silk-moths (see SILK) and hive Bees (q.v.) have been for long controlled, and to a limited extent modified. Among fishes, Goldfish (q.v.) may certainly be regarded as domesticated for decorative purposes. Birds include many illustrations of domestication—pigeons, fowls, ducks, geese, peacocks, turkeys, guinea-fowls, canary-birds, &c. Among mammals, dogs and cats, horses and asses, cattle, sheep and goats, camels, llamas, reindeer, pigs and rabbits, &c., have been domesticated, and have given rise to many different breeds. The complete list is not a long one, though it will probably be increased. To admit of domestication, animals must generally be social and docile in their habits, and must be capable of retaining fertility under changed conditions.

The process of domestication, as far as deliberate control is concerned, is for the most part equivalent to selective breeding. Forms with useful varieties are isolated from the mass, and allowed to breed together, the most desirable results are again selected for breeding, and so on, till a domesticated breed of the same animal is established (see BREED). Different breeds differ from natural species in being usually mutually fertile. In other words, while two domestic races may be externally more different than are two nearly related species in nature, the reproductive elements in the first case cannot differ as they must do in the second. Thus crossing is usually successful between domestic breeds, only rarely between adjacent natural species. When we pass beyond selective breeding to inquire into the conditions of variation, a much more difficult problem is raised. We cannot do more than refer to the probably inherent variability of the germ-cells, to the oscillations in their nutrition which probably provoke changes, to deeply saturating environmental and functional influences which may serve as variational stimuli to the germ-plasm, and to the opportunities for new permutations and combinations that are afforded by the intricate changes that go on in connection with maturation and fertilisation. Modern work has made it clear that in many cases man simply assists in the 'unpacking' of the extremely complex inheritance of the wild type. What look like very novel products are sometimes the result of the dropping out of certain factors in the old or the result of rearrangement. What is called reversion of domesticated breeds is often at least a process of 'repacking' when factors that have been analysed apart come together again.

The results of domestication are very varied. Sometimes the changes induced and cultivated have been comparatively slight, in other cases they have amounted to the evolution of new species. Superficial alterations of colour and skin, hair, and feathers; deeper changes in the less plastic skeletal, muscular, alimentary, and other systems; increased fertility on the one hand, sterility on the other; alteration in mental and emotional characters; the perfecting of a racial characteristic in one case, its loss in another; general progress in some forms, utilitarian degeneration or extraordinary abnormality in others, are abundantly illustrated in Darwin's classic work on variation under domestication. The constant tendency to Atavism (q.v.) or reversion; the danger of carrying selection of a given character too far (see BREED); and the relations to Heredity (q.v.) and Evolution (q.v.) are discussed elsewhere.

See ACCLIMATISATION, CULTIVATED PLANTS, VARIATION; Darwin, *Animals and Plants under Domestication* (1868); Victor Hehn, *Kulturpflanzen und Hausthiere* (new ed. 1902); N. S. Shaler, *Domesticated Animals* (1896); Keller, *Naturgeschichte der Haustiere* (1905).

Domestic Economy is a tautological but convenient expression. *Oikonomia*, the Greek word from which *economy* is directly derived, means simply household management. But the reference to the household having gradually been lost, the art of managing domestic affairs in the best and thriftiest manner was, as *Domestic* Economy, distinguished from *Political* Economy. As a subject of education in schools, the term is made to cover many matters treated separately in this work—

food, the value of the various kinds, the functions of food, and its preparation; clothing, its various kinds, the making and repairing of it; washing; domestic utensils; the lighting, warming, ventilation, and sanitation of houses; hygiene, the laws of health, sickness, and nursing; as well as thrift, the more especial subject of domestic economy. Information on most of these subjects will be found in very many articles throughout the work: see amongst others those on FOOD, DIET, GERM THEORY, DIGESTION, COOKERY, BREAD, HYGIENE; INDIGESTION, CONSTIPATION, CATARRH, and the other articles on ailments; NURSING, BUILDING, SEWAGE, VENTILATION, WARMING.

Domett, ALFRED (1811–87), poet and premier of New Zealand, where he lived from 1842 to 1871. He was born at Camberwell, like his lifelong friend Browning, who refers to him as 'Waring.' He studied at St John's College, Cambridge, and was called to the bar in 1841.

Domfront, an old town of the French department of Orne, on a rock overlooking the Varenne, 43 miles WNW. of Alençon, has an old church and ruins of a castle; pop. 4000.

Domicile, a man's legal place of abode, or the place which the law will hold to be his residence. In determining questions of domicile, the law endeavours to follow the facts of each case, and, consequently, the legal as well as the natural view of the matter is expressed in that definition of a domicile in the *Corpus Juris*, which says 'Every man has his domicile where he has placed his hearth, and centred his fortunes and affairs; whence he goes not forth without an occasion; from which, when he is absent, he is said to be abroad; and to which, when he returns, he is said to cease to be abroad.'—Cod. 10, tit. 39, s. 7. Even in Rome, questions of domicile were not without importance, for the empire was divided for purposes of domestic government, and the inhabitant of one province was not subject to the magistrates of another. But it was in modern times, when Europe was divided into many independent kingdoms, and America was formed out of states having different local customs and laws, that the law of domicile assumed its full importance. It now constitutes one of the most difficult branches of private International Law (q.v.). The following are its most general rules: (1) The place of birth is the original domicile of every one, provided that, at the time of his birth, it was the domicile of his parents; but if his parents were then on a visit or on a journey, the home of the parents will be the domicile of birth, nativity, or origin (*domicilium originis*). (2) If the child is illegitimate, it follows the domicile of its mother. (3) The domicile originally obtained continues till a new one is acquired. (4) Minors are generally deemed incapable of changing their domicile of their own accord, but it may be changed by a change in the domicile of the parents, which it follows. (5) If the husband and father dies, his last domicile is that of his widow and children. (6) A wife follows the domicile of her husband. (7) No person can have more than one domicile in the proper sense of the term at any given moment. (8) If a person of full age, having a right to change his domicile, takes up his abode in a new place, with the acknowledged intention of remaining permanently fixed there (*animo manendi*), that place immediately becomes, and that which he has quitted ceases to be, his domicile. Questions as to what amounts to intention, or what circumstances constitute sufficient proof of intention of remaining, or quitting a place of residence, are amongst the most difficult in the law of domicile. Most persons who are resident abroad have a sort of floating intention that, in certain conceivable circumstances, they will return to their native country, and to these vague feelings they give expression in a manner more or less vague.

One of the most important effects of the law of domicile, which formerly gave room for litigation, was as to the validity of the will which a deceased person leaves—the English rule being, that it must be according to the law of the domicile, wherever the will was made, though the law of Scotland allowed a will also to be good if it was executed according to the law of the country where it was made. A statute, however, was passed in 1861, by which the law was made uniform, so that the will of a British subject, as regards personal estate, made out of the United Kingdom, is now deemed valid, wherever his domicile may be, if the will is conformable to the law of the country where made, or to the law of the domicile of origin. And by a later statute passed in 1868, it has been provided that even as regards real or heritable estate, an English will is to have effect given to it as regards property situated in Scotland. In each case the presumed intention of the testator will determine by which law the will is to be construed. It is impossible here to enumerate the various other effects of the law of domicile. Generally, it may be stated that it regulates the succession to property. As regards personal or movable property, this is universally conceded. It is said to follow the person (*mobilia inhærent ossibus*). Accordingly, such property is everywhere distributed after death according to the law of the country of which the deceased died a domiciled citizen. In the case of heritable or real property, however, the same rule is not universally applied. By the legal systems of the Continent, domicile as a rule governs the succession, but in Great Britain and the United States, real property descends in accordance with the law of the land in which it is situated (*lex rei sitæ*). The transmission of a debtor's estate upon divestiture by bankruptcy stands in a similar position to that of succession by death—British and American laws making the same distinction as regards distribution between movable and heritable estate.

Besides domicile proper, of which we have just been treating, the term is sometimes applied in a special and restricted sense. Thus the expression 'Matrimonial Domicile' was occasionally used to express the character of residence supposed to be sufficient to constitute jurisdiction in questions of marriage and divorce. Although the courts in one or two cases sustained their jurisdiction where the evidence of domicile was slender, it was doubtful how far these cases were authoritative, and the doctrine of 'Matrimonial Domicile' was finally repudiated by the House of Lords in 1895 (see MARRIAGE). Another common expression is 'Domicile of Citation,' which simply signifies residence for forty days within the territory of a particular court. Such residence is sufficient to constitute jurisdiction for citation of a defender in all personal actions. Again, the term domicile is sometimes used quite incorrectly to describe the kind of residence required for the purposes of parish relief in Scotland (see POOR LAWS; SETTLEMENT, LAW OF). But the rules for determining such residence have little bearing upon questions of domicile proper. See Dicey on *Domicile;* and notes to the French translation of Dicey by M. Stocquart.

Dominant, in Music, the fifth above the tonic: the ruling or governing tone of the key. See HARMONY.

Dominant, in Mendelism. See HEREDITY.

Dominic, ST. See DOMINICANS.

Dominica (Fr. *Dominique*), the largest and most southerly British island in the Leeward group of the Lesser Antilles, lies midway between the French islands of Martinique and Guadeloupe, and has an area of 300 sq. m. The population (37,000) is mostly negro. The Caribs (400), who occupy a large reserve on the Windward side of the island, are gradually becoming so intermixed with the negroes that the pure Carib, the 'Franc Carib,' will soon be non-existent. They are very peaceable and retiring, and live on fish, and vegetables and fruits which they cultivate. Dominica is of volcanic origin, with many hot and sulphureous springs. In 1880 there was a great eruption of volcanic ash from the 'Boiling Lake' at the southern extremity of the island. The temperature is cool and even chilly in the mountains, but sultry on the coast, where the yearly mean is 89° F.; rain falls nearly every month, and the annual rainfall is 83 inches. Nearly one-half of the surface consists of wooded mountains and deep ravines, and at one point the surface attains an elevation of 5300 feet. Dominica has one of the best tropical botanic gardens in the world. Attractive as it is to the artist and traveller, the rugged, broken, and precipitous character of Dominica is very disadvantageous to the settler, and long confined agriculture to a narrow strip along the coast, the pathless forests of the interior remaining practically as much a *terra incognita* as when Columbus first sighted the island. Trade is chiefly with the United States, Canada, and Britain. The principal products are fruit, cocoa, essential oils, lime-juice, coffee, sugar, and timber. The fisheries are valuable. About a third of the area is now cultivated. The capital of the island is Roseau, a port on the west coast, with a pop. of 7000. Dominica is a member of the Leeward Islands colony, and sends representatives to the general legislative council; but it has its own administrator and legislature, since 1925 partly elected. The majority of the inhabitants are Roman Catholics; religious equality now prevails, but till recently the clergymen of the Church of England were paid from the public funds. Dominica was discovered by Columbus, on his second voyage, on Sunday (whence its name Dominica—i.e. 'the Lord's Day'), 3d November 1493. It was a source of strife to French and English until 1648, when it was formally declared by the treaty of Aix-la-Chapelle a neutral island; but in 1759 it was captured by England, and in 1763 ceded by France, which, however, held it again in 1778–83, and in 1802–14, when it was finally restored to England. See Froude, *The English in the West Indies* (1888); Grieve, *Notes upon Dominica* (1907).

Dominical Letter, or SUNDAY LETTER, is one of the seven letters, A, B, C, D, E, F, G, used in almanacs, &c., to mark the Sundays throughout the year. The first seven days of the year are marked in their order by the above letters in their order, then the following seven, and all consecutive sets of seven days to the end of the year, are similarly marked; so that the 1st, 8th, 15th, 22d, &c. days of the year are all marked by A; and the 2d, 9th, 16th, 23d, &c., by B; and so on. The days being thus marked, it is evident that on whatever day the first Sunday of the year falls, the letter which marks it will mark all the other Sundays in the year, as the number of the letters and of the days in the week is the same.

As the common year consists of fifty-two weeks and one day over, the dominical letters go backwards one day every common year. If the dominical letter of a common year be G, F will be the dominical letter for the next year. As a leap-year consists of fifty-two weeks and two days, the letters go backwards two days every leap-year. If in the beginning of a leap-year the dominical letter be G, E will be the dominical letter for the next year. This extraordinary retrocession, however, is made to take place at the intercalary day (the 29th February) by the artifice of marking it by the same letter as the day preceding it, and thus the next Sunday is marked by the letter preceding that which marked the Sundays before the intercalary day. Suppose the 28th February in a leap-year to be a Sunday, and marked by F, it is evident that the dominical letter for the rest of the year will be E. As every fourth year is a leap-year, and the letters are seven in number, it is clear that the same order of letters must return in four times seven, or twenty-eight years, which would, but for the leap-years, recur in seven years, and hence the Solar Cycle (see PERIOD). The dominical letters were first introduced into the calendar by the early Christians, to displace the nundinal letters in the Roman calendar. They are of use as a means of discovering on what day of the week any day of the month falls in a given year (see EASTER). Rules and tables for finding them are given in prayer-books, breviaries, &c., as well as in works on dates. See CALENDAR, CHRONOLOGY.

Dominican Republic, or SANTO (commonly SAN) DOMINGO, a state formed of the eastern portion of Hayti (q.v.), and embracing about 19,000 sq. m., or over two-thirds of the whole island. The pop. at the census of 1921 was 897,405; most of these are negroes or mulattoes, but the whites are comparatively more numerous and influential than in the Haitian Republic. The state religion is Roman Catholic, others being tolerated; the prevailing dialect is Spanish. Civilisation has not reached a high level; primary instruction, however, is now gratuitous and obligatory, and of late years the country has made considerable progress under the impulse of American enterprise and guidance. Except on the coasts, not much timber has been cut. The forests furnish mahogany, satin-wood, dye-woods, cedar, and pine. Large sugar plantations and factories have been developed in the south and west; tobacco, coffee, bananas, and cocoa are grown. Maize and tropical cereals are successfully cultivated. Cattle are raised, and beeswax produced. Copper is worked. Gold, silver, quicksilver, nickel, iron, petroleum, salt, and coal are found; and there are 150 miles of railway. Commerce is mainly with the United States, England, France, and Germany. The executive of the republic is vested in a cabinet consisting of the president and seven ministers, and the legislative power in a congress of twenty-four deputies and twelve senators. The capital is San Domingo (q.v.).—The early history of this portion of the island, which remained Spanish when the western part was ceded to France in 1697, and which was united with the neighbouring state in 1795–1808 and 1822–43, properly belongs to that of Hayti. In 1843 it assumed a separate standing as the Dominican Republic, the anarchy and misrule of which it exchanged in 1861 for the despotism of its former masters. But the harsh Spanish rule brought on a revolt in 1863, and the republic, reconstituted in 1865, has since maintained a troubled existence. Owing to the heavy foreign debt, the customs were submitted to the United States in 1907. The prosperity that followed was broken by a series of revolutions. The United States sent commissioners to advise, and in 1916 placed the administration in the hands of American naval officers. American control, except in the matter of customs, was withdrawn in 1925.

See Keim, *San Domingo* (1870); Hazard, *Santo Domingo* (1873); Hesketh Prichard, *Where Black Rules White* (1900); Schönrich, *Santo Domingo* (1918); the Military Governor's Report (U.S. Navy Dep., 1920).

Dominicans, an order of preaching friars founded at Toulouse in 1215–16 by Dominic de Guzman. Dominic was born in 1170 at Calaruega in Old Castile, and studied at Palencia. Here he acquired a great name for piety and learning; so much so that in his twenty-fourth year his diocesan, the Bishop of Osma, made him a canon of his cathedral, and relied mainly on Dominic's aid in his design of reforming the whole chapter according to the rule of St Augustine. The young man led a life of rigorous asceticism, and devoted himself at the same time to missionary labours among Mohammedans and 'heretics.' In 1204 he accompanied his bishop on a political mission, and had to pass three times through the south of France. That part of the country was almost entirely peopled by Albigenses (q.v.), and the labours of papal legates and Cistercian abbots for their conversion had been all in vain. The turning-point of Dominic's life had come. He undertook the care of the work; he substituted poverty for the prelatic pomp, love for force. He travelled from place to place on foot, bearing St Paul's epistles in his hands and preaching everywhere. He continued his labours for ten years, gathered like-minded companions round him, whom he trained after his own heart, and for whom he afterwards (1215) founded the first house of his followers at Toulouse. He also set up at Prouille an asylum for women who had been heretics or were in danger from heretical influence, and this institution developed into an order of nuns. Unhappily, events occurred which have had an evil influence on the history of his order. Innocent III., incensed by the murder of his legate, Peter of Castelnau, called the barons of northern France, led by Simon of Montfort, to a crusade against the 'heretics.' Dominic participated in many of the doings of the crusaders, though it is maintained that his influence was directed towards mercy, and that his own character was peculiarly gentle and kindly. In 1215 Dominic, now in high favour with ecclesiastical authority, went with Fulbo, Bishop of Toulouse, to the fourth Lateran Council. The council was averse to the foundation of new orders. Still Innocent III. promised approval, on condition that the new order adopted an old rule. Dominic chose the rule of St Augustine, borrowing some additional statutes from the Premonstratensians, and authorisation was given in the following year by Honorius III. A little later he became 'Master of the Sacred Palace,' an office which has continued in the order. In 1220 the Dominicans, in imitation of their Franciscan brethren, adopted a poverty so rigid that not even the order as a corporation could hold houses or lands, and thus they forced themselves to become mendicants or beggars. Next year Dominic died. He had lived to see his order occupying sixty houses and divided into eight provinces. It had spread to England, where the first foundation was at Oxford, and where from their dress they were called Black Friars; to northern France, where their house of St James earned for them the name of Jacobins; to Italy, to Spain, to Austria. He was canonised in 1233 by his friend Gregory IX.; his festival falls on 4th August.

We have identified the Dominicans in general with the friars, and this is justified by ordinary language, but strictly speaking the friars are only the first order of St Dominic. They are bound by the usual solemn vows of poverty, chastity, and obedience; they are forbidden ever to eat flesh-meat; they rise in the middle of the night for prayer. They are subject to a general, elected, according to a recent enactment, for twelve years. Under him are the provincials, each of whom rules in a province; lastly, there are the priors of the individual houses. All these officers are elected by popular vote and for a limited term. Their constitutions were put into shape by Raymond of Pennafort, third general; but even since then great changes have been made, among which the permission to hold immovable property, initiated by Martin V., and extended by Sixtus IV. to the whole order in 1477, is especially noteworthy. The function of the order is indicated by their name, 'the order of preachers.' They are therefore missionaries in foreign lands and missionaries at home, and everywhere they have made the rosary popular in the Catholic world. They are the order which has concerned itself specially with the guardianship of the faith. The scholastic theology is almost the creation of great Dominicans, such as Albertus Magnus and Aquinas, and among their illustrious preachers was the martyr Savonarola. They have been the favourite inquisitors, and a Dominican always presided over the Inquisition. But their influence is now a thing of the past, except for the power still exerted by their great writers of the middle ages. The Jesuits have displaced them as teachers and preachers; though the fame of the order was revived for a time by the genius, the eloquence, and noble character of Lacordaire, who restored it to France. At present the order is chiefly engaged in preaching missions and retreats. They have several houses in the United Kingdom—e.g. at London, Newcastle, Woodchester, &c. They wear a dress of white wool, with a black mantle and pointed hood.

The second order consists of nuns, bound by solemn vows, and engaged to strict inclosure, perpetual abstinence from flesh-meat, &c. They were, as we have seen, instituted by St Dominic.

The Tertiaries or third order are said to have arisen from the "militia of Jesus Christ,' drawn together by St Dominic to assist in resisting and persecuting the Albigenses. In their present form they are an imitation of a similar institution among the Franciscans. They are either people in the world, free to marry, but following certain ascetical rules; or else are women living as nuns in community under simple vows. They are also known as the Brothers and Sisters of Penance.

See Lives by Lacordaire (1841), Alemany, Miss Drane, Herkless, and Guiraud (trans. 1901); and for the order, works by Helyot, D'Anzas (1874–76), Devas (1913), Jarrett (1921).

Dominie. See DOMINUS.

Dominion, a term for the self-governing British colonies, specifically Canada and New Zealand. See Professor A. B. Keith's *Responsible Government in the Dominions* (1912), and his articles in this work, COLONY, FEDERATIONS AND UNIONS.

Dominis, MARCO ANTONIO DE, born in 1566 in the Dalmatian island of Arbe, was carefully educated by the Jesuits. From Bishop of Segni he had become Archbishop of Spalato, when, getting involved in the great quarrel between the papacy and the Republic of Venice, he found it expedient to resign his see. His reasons he gave in his *Consilium Profectionis* (1616). In 1616 he came to England, where he was hospitably received, and in 1618 was by James I. appointed Master of the Savoy, and in 1619 Dean of Windsor. In 1617 he published the first part of his *De Republica Ecclesiastica*, a work in which he endeavoured to show that the pope had no supremacy over other bishops, but was only *primus inter pares*. In 1619 he published without authority Sarpi's famous *History of the Council of Trent*. His enemy Paul V. died in 1620, and was succeeded by Gregory XV., a relative and fellow-countryman of De Dominis, who moreover began to find himself unpopular from his avarice, his pretentiousness, and his corpulence, and from interest, much more than

conscience, began to intrigue with Rome for a return to the bosom of the church. These negotiations had to be carefully kept secret from the king, but at length in the January of 1622 De Dominis wrote to James expressing his intention to leave England. The king was indignant, and when the negotiations of the ecclesiastics whom he sent to reason with him failed, De Dominis was commanded to leave the kingdom within twenty days. While waiting at Brussels for the pope's permission to go to Rome, he published his *Consilium Reditus*, in which he frankly gave the lie to every statement in his former tract, and denounced the Church of England as a wretched schism. His tract was replied to by Crakenthorpe in his *Defensio Ecclesiæ Anglicanæ*. De Dominis now went on to Rome, but was at once seized by the Inquisition, and flung into prison, where he soon died in 1624. Being subsequently condemned as a heretic, his body was exhumed and burned. While yet a professor of Mathematics at Padua, De Dominis wrote his *De Radiis Visus et Lucis in Vitris Perspectivis et Iride* (Venice, 1611). He was the first to point out that in the phenomenon of the rainbow the light undergoes in each rain-drop two refractions and an intermediate reflection.

Dominium, a Roman law term, which has been received into the technical language of most of the legal systems of Europe. It may be described as a full legal right in and to an object—as the right from which alone legal possession could flow, but which actual possession alone could never confer, unless such possession had endured for the period of legal prescription. The right to possess is thus distinguished from the right arising from possession, which is the usufruct. See EMINENT DOMAIN.

Domino, the name formerly given to the hood or cape worn in winter by priests while officiating in cold edifices. It is now used to signify a masquerade costume, consisting of an ample cloak with wide sleeves and a hood. See MASQUERADE.

Dominoes, the name of a game, usually played with 28 oblong, flat pieces of ivory or bone, &c., called *cards*, each of which bears two numbers marked by points from blank to six. The player wins who has first played out his cards, or, if this has been found impossible, who has the fewest points on the tablets still remaining. Regular domino players recognise only the two-handed games—viz. the *draw* game, and its variation the *matador* game, for a description of which a manual of games should be consulted. The game is seemingly of Italian origin, and has spread into all countries of the world; but nowhere is it so popular as in the cafés of France and Belgium.

Dominus, the Latin word which we commonly render by 'lord,' but which more properly signifies the master of a house, and his eldest son, as opposed to slave (*servus*). The term is applied by Christians to God and to Jesus as himself God. The Scottish 'dominie,' in the sense of schoolmaster, is of course taken from it, as is the same term in America, where in some places it is the title of a minister of the Dutch Reformed Church, and in others is applied to Protestant clergymen generally. Don (q.v.) also is a derivative.

Domitianus, T. FLAVIUS, emperor of Rome from 81 to 96 A.D., was the son of Vespasian, and younger brother of Titus, whom he succeeded on the throne. The earlier years of his reign were on the whole advantageously occupied for the public benefit. Many good laws were passed, the provinces carefully governed, and justice rigidly administered. As he grew older, however, his ambition, his jealousy, and his pride, wounded by the failure of his campaigns against the Dacians and the Marcomanni, in 87, began to instigate him to the most atrocious cruelties. By murder or banishment, he deprived Rome of nearly every citizen conspicuous for talent, learning, or wealth. It was his jealousy that recalled Agricola from his career of conquest in Britain, and most likely caused his death. The horror of the time is reflected in the pages of Tacitus and Juvenal. To win the army, he greatly increased the pay of the soldiers, and secured the favour of the people by prodigal largesses and gladiatorial shows and games, in which he sometimes took part in person. His cruelties became at length so intolerable, that a conspiracy—encouraged, if not organised—by his wife Domitia, whom he had doomed to death, was formed against him, and the tyrant fell under the dagger of the assassin, 18th September 96.

Domo d'Os'sola, a charming little town in the extreme north of Piedmont, at the foot of the Simplon, near the right bank of the Toce. It has a cathedral, and is a starting-point for tourists in the southern Alps. Pop. 6000.

Domremy-la-Pucelle, a village in the French department of Vosges, on the Meuse, 8 miles N. of Neufchâteau, interesting as the birthplace of Joan of Arc (q.v.), of whom there is a statue, and whose house contains relics.

Don, a river of the West Riding of Yorkshire, rising in the Penistone moors on the borders of Derbyshire and Cheshire, and running 70 miles south-eastward and north-eastward past Sheffield, Rotherham, Doncaster, and Thorne, till it falls into the Ouse at Goole. It is navigable below Sheffield by the aid of artificial cuts and canals.

Don, a river of Aberdeenshire, rising close to the Banffshire boundary in a peat-moss 1980 feet above sea-level, and winding 82 miles eastward till it falls into the German Ocean, 1 mile NE. of Old Aberdeen, and not far below the 'Auld Brig o' Balgownie' (*circa* 1320), commemorated in Byron's *Don Juan*. Its chief affluent is the Ury. The Don is a capital salmon river.

Don (ancient *Tanais*), a river of Russia, having its source in a small lake in the government of Tula. It flows in a general southerly direction through the governments of Tula, Riazan, Tambov, Voronej, and the country of the Don Cossacks, and enters the Sea of Azov by several mouths, of which the Aksai is the most considerable. The Don has a length of 1125 miles, and drains an area of 165,500 sq. m.; its numerous affluents include the navigable Voronej, Donetz, Khoper, and Medvieditza, and the Vasovka, the Sosna, and the Manytch. The course of the main stream is obstructed by frequent sand-banks; and when the ice melts it overflows its banks for miles, so that in many places the village houses are raised on piles. The Don is navigable for large boats below Voronej, and in its upper course is connected by canal and railway with the Volga, by which means the produce and manufactures of the interior are conveyed to the southern provinces of Russia. A great canal from the Don to the Volga, at the point where the lower courses of the two rivers most closely converge, has recently been proposed. The waters of the Don abound in fish; but a monopoly of the fisheries has been enjoyed since 1637 by those dwelling on the river's banks. See COSSACKS.

Don, or DOM (Lat. *dominus*, 'lord') a title originally assumed by the popes, from whom it descended to bishops and other dignitaries, and finally to monks. In France, the title *dom* was conferred on the Carlovingian kings; in Portugal and Brazil it became the universal title of the higher classes. The Spanish *don* was originally confined to the nobility, but is now bestowed by courtesy as indiscriminately as the English *Mr* or

Esq., or the German *Herr*. The feminine is *doña* (Ital. *donna*). The *Dan* in 'Dan Chaucer' is a form of the same word, and we still speak of 'college dons.' Roman Catholic dignitaries, especially Benedictines, are called *Dom*.

Donabyú, a small town of Burma, on the right bank of the Irawadi, 35 miles S. of Henzada.

Dona Francisca, a German colony in the Brazilian province of Santa Catharina, lying between the Serra do Mar and the ocean, 14 miles inland from the port of São Francisco. Chief town, Joinville.

Donaghadee, a seaport and bathing-place in the north of County Down, on the Irish Channel, 19 miles ENE. of Belfast, and 21½ miles across from Portpatrick in Scotland, with which it is connected by a submarine telegraph cable. It lies in a crescent round the harbour, and exports cattle and farm-produce. Its fine lighthouse shows a fixed light visible 12 miles; a conical mound near (140 feet high) commands a fine prospect. Pop. 2200.

Donaldson, JAMES (1751–1830), an Edinburgh newspaper proprietor and bookseller. His father, Alexander Donaldson, took a leading part in the issuing of cheap editions of works newly out of copyright, which led to a famous litigation, decided in his favour by the House of Lords in 1774. James Donaldson added largely to the wealth acquired by his father, and left about £240,000 to found a hospital or school for 300 poor children, many of whom from the beginning were taken from the class of the deaf and dumb. The hospital was built in 1842–51 from designs by Playfair, at a cost of about £120,000.

Donaldson, JOHN WILLIAM, D.D., philologist, was born in London, 7th June 1811. A merchant's son, of Scottish ancestry, he was articled as a boy to his uncle, a solicitor; but his success in an examination at University College, London (1830), changed his plans, and next year he went up to Trinity College, Cambridge. He graduated in 1834 as second classic and senior optime, and became a fellow and tutor of his college. From 1841 to 1855 he was headmaster of Bury St Edmunds grammar-school (he almost emptied it); thereafter he tutored at Cambridge with great success, till his death, from overwork, in London, 10th February 1861. Donaldson's *New Cratylus, or Contributions towards a Knowledge of the Greek Language* (1839), is a work remarkable for research, erudition, and boldness, and as being the first attempt on a large scale to familiarise Englishmen with the principles of comparative philology, established by the great scholars of Germany. In *Varronianus* (1844) he undertook to accomplish for Latin what in the *New Cratylus* he had done for Greek. Unluckily, Professor Key had here in a measure forestalled him. *Jashar; Fragmenta Archetypa Carminum Hebraicorum* (Berlin, 1854) sought to distinguish by critical tests the fragments of the lost Book of Jashar or Jasher (q.v.), imbedded in the Hebrew Pentateuch. It is a too clever piece of rash and ingenious speculation, which not only roused much 'odium theologicum,' but was severely handled by Ewald; nor did Donaldson better his position by his *Christian Orthodoxy reconciled with the Conclusion of Modern Biblical Learning* (1857). The *Theatre of the Greeks*, though originally by Buckham, was so recast by Donaldson as to be practically his; to him, too, belongs the completion of K. O. Müller's *History of Greek Literature;* and his Latin and Greek grammars claim mention. Crabb Robinson, in his Diary, gives a vivid conception of Dr Donaldson's kindliness, ready wit, and great conversational powers.—His youngest brother was the Australian statesman, Sir Stuart Alexander Donaldson (1812–67).

Donatello (properly called DONATO DI BETTO BARDI), the greatest of the early Tuscan sculptors, was born at Florence in 1386, the son of a wool-merchant, and was apprenticed to a goldsmith, probably Bartolo, the stepfather of Ghiberti. He became the friend of Brunelleschi, ten years his senior, who directed and influenced his art. At the age of fifteen he visited Rome in his company, and for several years the pair supported themselves as goldsmiths, and so were enabled to study the remains of antiquity in sculpture and architecture. Among the works probably executed before he left Florence are the wooden crucifix in Santa Croce; the wooden statue of the Magdalene, in the Baptistery; and the marble St John at the Bargello; while among the earliest of his productions after his return are the marble figures of the prophets for the cathedral, and an Annunciation in the Cavalcanti Chapel in Santa Croce. A higher level was reached in the marble statues of Saints Peter, Mark, and George, for the exterior of San Michele (1408–16). These were followed by the tombs of Pope John XXIII. in the Baptistery (1426), of Cardinal Brancacci in St Angelo a Nilo in Naples (1427), and of Bartolomeo Aragazzi at Montepulciano (1427–29), works in which he was aided by Michelozzi. The influence of his study of the antique is very visible in his bronze statue of David, now in the Bargello Museum, Florence, where also are his celebrated marble bas-reliefs of singing and dancing children, originally designed as a balustrade for the organ of the cathedral; while the bronze statue of the Condottiere, Erasmo da Nari, called Gattamelata, at Padua, is a noble example of his equestrian portraiture. He died at Florence, 13th March 1466, and was buried in San Lorenzo, where his last works, two bronze pulpits, were completed by his pupil Bertoldo. The life of Donatello marks an epoch of art. He may be regarded as the founder of sculpture in its modern sense, as the first producer, since classic times, of statues, complete and independent in themselves, and not mere adjuncts of their architectural surroundings. He was also a perfect master of work in relief, admirable in the gradation of tone which he attained, and in his beautiful treatment of various planes. The distinction which marks his work was caught from the antique; but all that he did is stamped with his individuality, and vivified by his powerful grasp of character and expression.

See, besides Vasari's *Lives*, the biographies by Müntz (Paris, 1885) and Semper (Innsbruck, 1887); and in English the short Life by Hope Rea (1900) and the more exhaustive work by Lord Balcarres (1903); also books by Tschudi (Turin, 1887), Schmarzow, Reymond, Bode, A. G. Meyer (1903), and Maud Crutwell (1911).

Donati, GIAMBATTISTA (1826–73), astronomer, born at Pisa, was appointed in 1852 assistant at the observatory in Florence, of which he became director in 1864. Here he discovered, *inter alia*, the brilliant comet of 1858, which is known as Donati's comet (see COMET). A spectroscope of twenty-five prisms was one of his inventions.

Donation of Constantine. See CONSTANTINE.

Donatists, a sect of North Africa which took its rise in 311, when, disapproving the election of Cæcilian as Bishop of Carthage, they elected Majorinus in his stead. On his death (313), Donatus Magnus succeeded, who is to be distinguished from another of their leaders, Donatus of Casæ Nigræ. Their main contention was that those who, during persecution, yielded up the sacred books (*traditores*) had fallen from grace,

and that the treatment of the 'lapsed' should be much severer than the Catholic Church demanded. Several church synods (of the lax, as they contended) condemned their unyielding Puritanism and their practice of rebaptising heretics. St Augustine diligently confuted them, and approved of their coercion by the Emperor Honorius. A synod at Carthage in 411 deprived them of civil rights; and in 415 their religious meetings were forbidden under pain of death. Along with the Catholics, they suffered heavily at the hands of the Vandals in the 5th century; and they were annihilated by the Saracens in the 7th.

See the works referred to under AUGUSTINE; Neander's History, vol. ii.; Monceaux, *Histoire Littéraire de l'Afrique Chrétienne* (vols. iv.–vi. 1912–22); also Optatus of Milevi, *De Schismate Donatistarum adversus Parmenianum* (written about the end of the 4th century; ed. by Dupin, Paris, 1700); Walch, *Historie der Ketzereien*, vol. iv. (1768); Ribbeck, *Donatus und Augustinus* (Elberfeld, 1858); Völter, *Der Ursprung des Donatismus* (Freiburg, 1883); H. v. Soden, *Urkunden zur Entstehungsgeschichte des Donatismus* (1913)

Donative. See ADVOWSON.

Donatus, ÆLIUS, a well-known grammarian and commentator, who taught grammar and rhetoric at Rome about the middle of the 4th century, and was the instructor of St Jerome. He wrote treatises, *De Literis, Syllabis, Pedibus et Tonis, De Octo Partibus Orationis*, and *De Barbarismo, Solecismo*, &c., which are collected by Keil in vols. iv. and v. of the *Grammatici Latini* (1864–65). These writings form together a pretty complete course of Latin grammar, and in the middle ages formed the only text-book used in the schools, so that Donat came, in the west of Europe, to be synonymous with grammar, or with the elements of any science. *The Donat into Religion* is the title of a book by an English bishop, and there was an old French proverb, *Les diables estoient encore à leur Donat* ('The devils were yet in their grammar'). The Latin grammar of Donatus has formed the groundwork of the elementary treatises on that subject to the present day. Donatus was one of the first books on which the art of printing by means of letters cut on wooden blocks was tried, and copies of these are reckoned among the greatest of bibliographical curiosities. The author also wrote a commentary on Terence, of which we possess only a part extending to five comedies, to be found in many editions of Terence.—From him must be carefully distinguished a later grammarian, TIBERIUS CLAUDIUS DONATUS (about 400), from whom we have a very worthless life of Virgil, prefixed to many editions of that poet, and fragments of a commentary on the *Æneid*.

Donauwörth, an ancient town of Bavaria, situated at the confluence of the Wörnitz and the Danube, 25 miles NNW. of Augsburg by rail. It was formerly a free imperial city of considerable importance, but it has now sunk into an insignificant place of 5000 inhabitants. In 1606 the inhabitants, who had adopted the Reformed doctrines, attacked a Roman Catholic procession of the Host, for which in 1607 the town was placed under the ban of the empire, and severely punished in consequence. In the Thirty Years' War that followed it was twice stormed, by the Swedes and by the Bavarians. It is likewise associated with the name of Marlborough, who carried the intrenched camp of the French and Bavarians near here in 1704; and, on the 6th October 1805, the French, under Soult, obtained a victory here over the Austrians, under Mack.

Don Benito, a town of Spain, near the left bank of the Guadiana, 69 miles E. of Badajoz by rail, in a district rich in grain and fruit. Pop. about 21,000.

Don Carlos. See CARLOS.

Doncaster, a municipal borough in the West Riding of Yorkshire, and an important railway junction, on the right bank of the Don, and on the Great North Road, 33 miles S. of York, and 156 NNW. of London. The country around is flat, but beautiful. Fine old elms line the broad and level road from the town to the racecourse, about a mile to the south. Doncaster is well built, and the High Street is a mile long. The parish church of St George was rebuilt by Sir G. G. Scott, after destruction by fire, in 1853–58, at a cost of £43,128. Its noble tower is 170 feet high. Doncaster possesses an elegant market-hall, a guild-hall, a corn exchange, a wool-market, a cattle-market, an art gallery, a technical college, and a mansion-house. The borough free library was built in 1888–89. The water-works, constructed in 1880, were opened at a cost of £180,000, and since greatly extended. The town has manufactures of iron, brass, and agricultural machines. There are locomotive and carriage works. The agricultural trade is large; and there is a corn-market. Sinking of coal-mines has led to a great and rapid increase of population, met by an enlightened scheme of regional planning. Pop. (1851) 12,042; (1881) 21,130; (1911) 30,516; (1921) 54,052. Doncaster was the ancient *Danum*, and lay on the Roman road from York to Lincoln. Roman coins, urns, and a votive altar have been found. It was the *Dona Castre* of the Saxons. The Saxon Northumbrian kings had a palace here. Doncaster was burned by lightning in 759, and frequently ravaged by the Danes. During the Civil War it was for some time the headquarters of the Earl of Manchester after the battle of Marston Moor. It has long been famous for its annual races, begun in 1703, and held a mile south-east of the town in the second week of September. Colonel St Leger, in 1776, founded stakes which have been yearly run for by the best horses in England. On an eminence 5 miles WSW. of Doncaster are the ruins of Conisborough Castle, the stronghold of Athelstan in Scott's *Ivanhoe*. A Norman-Saxon round tower, it is 37 feet in diameter and 86 feet high, with walls 15 feet thick, strengthened by square buttresses reaching the whole height. The door is arrived at by an external flight of 37 steps. See Tomlinson's *History of Doncaster* (1887).

Donders, FRANZ CORNELIUS (1818–1889), oculist and professor of physiology at Utrecht. See EYE.

Dondra Head. See CEYLON.

Donegal (*Dun-nan-G'al*, 'the fort of the stranger'), a seaport in the south of Donegal county, at the mouth of the Eske, on a shallow creek of Donegal Bay (a valuable fishing-ground, especially for herrings), 157 miles NW. of Dublin. It lies in a rich alluvial tract, surrounded on three sides by hills, behind which rise lofty picturesque mountains. Pop. (1851) 1580; (1911) 1104. Donegal exports corn and butter. A railway connects the town with Stranorlar, thence to the city and port of Londonderry. On the river is Donegal Castle, formerly belonging to the O'Donnels of Tyrconnel. The remains extant are those of the castle as rebuilt in 1601, on the former foundations, by Sir Basil Brooke. On the shore are the ruins of a Franciscan monastery, founded in 1474 by Hugh O'Donnel. Here was compiled the *Annals* of the Four Masters (q.v.). Near Donegal is a frequented sulphureo-chalybeate spa.

Donegal, a maritime county in Ulster province, washed by the Atlantic on the north and west. Its greatest length is 84 miles, its greatest breadth, 41; area, 1870 sq. m. The bold and rugged coast-line (166 miles long) is indented by

many deep bays and loughs; and there are numerous islands and islets off the coast, many of them inhabited. The surface generally is mountainous, moory, and boggy, with many small lakes and rivers, associated with endless fairy tales and traditions; here is excellent fishing. The highest hill, Erigal, rises 2462 feet, and several other hills exceed 2000 feet. The largest stream is the Foyle, running 16 miles north-east into Lough Foyle. Lough Derg is the largest lake. There is enormous wealth in beautiful granites, prior to 1889 almost unworked; and at Mountcharles there is a freestone unsurpassed by any other. White marble occurs at Dunlewy. The climate in most parts is moist, raw, and boisterous from violent west and north-west winds. There are manufactures of woollens, worsted stockings, worked muslins, and kelp (now greatly depreciated), and extensive fisheries. Successful efforts have been made by philanthropists to revive and extend home industries. Trade is chiefly through Londonderry. Pop. (1841) 296,448; (1851) 255,160; (1871) 218,334; (1881) 206,035; (1901) 173,625; (1911) 168,537—79 per cent. Catholics. Donegal is represented by six members in the Irish Free State parliament. The towns are small, the chief being Lifford, the county town, Ballyshannon, Letterkenny, Bundoran, Rathmelton, Donegal, Glenties, Raphoe, Ballybofey and Stranorlar (twin towns), and Killybegs. Substantial farmers and artisans occupy the low fertile tracts, the home of the 'planted' race. The population of the mountain districts, said to be the remnant of the old Irish septs or clans, has been much diminished by emigration. Till 1612, when James I. planted Ulster with English and Scottish settlers, the south part of Donegal was called Tyrconnel, and belonged to the O'Donnels, who, from the 12th century, were inaugurated as Princes of Tyrconnel on Doune Rock, near Kilmacrenan. Donegal has many ruins and traces of forts, of religious houses and castles, and of the palace of the North Irish kings on a hill near Lough Swilly. Near Derry is the coronation-stone of the ancient Irish kings. Donegal contains many memorials of St Columba. Off Tory Isle, towards the entrance to Lough Swilly, which contains the remains of seven churches, two stone crosses, and a round tower, Warren, in 1798, captured a French fleet. Amongst the prisoners of war was the rebel, Theobald Wolfe Tone. St Patrick's Purgatory, a famous place of pilgrimage, is on an isle in Lough Derg. See Stephen Gwynn's *Donegal and Antrim* (1899).

Donets, a river of Ukraine, flows SSE. to the Don. In its basin is the principal coalfield of south-eastern Europe.

Dongarpur (*Dúngarpur*), a town of Rajputana, 340 miles N. of Bombay. It is the capital of a protected state of the same name, with an area of 1440 sq. m., and a pop. of 180,000, nearly 40 per cent. Bhils.

Don'gola, New, called by its inhabitants Ordé, a town of Nubia, on the left bank of the Nile, above the third cataract, and about 750 miles S. of Cairo, with a citadel, and a population of about 10,000. Under Egyptian rule it became the capital of a province of the same name, embracing a district which had from early in the Christian era formed an independent kingdom. In the operations against the Mahdi, in 1884–85, the town was employed by the British as a base; in March 1886 the British forces were withdrawn, and Dongola fell into the possession of the Sudanese. Trade utterly decayed till after the reoccupation of the province in 1896 by the Anglo-Egyptian forces.—Old Dongola, 75 miles SSE., on the right bank of the Nile, was the capital of the kingdom, but was destroyed by the Mamelukes in 1820, and is now a mere village.

Donizetti, Gaetano, a famous Italian composer, was born at Bergamo, in Lombardy, 29th November 1797. He studied music first under Simon Mayr, the head of the then recently founded Conservatorio of Bergamo, and subsequently for three years at that of Bologna, where he had been preceded only a few years by Rossini. Though educated in the composition of the more scholarly church music, he at length determined to devote himself to the precarious career of a dramatic composer, and to carry this out, entered the military service of Austria. His first opera, *Enrico di Borgogna*, was produced in 1818 in Venice, with some success, and was followed by numerous others in rapid succession. *Zoräide di Granata*, brought out in 1822 at Rome, gained him freedom from military service. But the first work which carried his fame beyond his own country was *Anna Bolena*, produced at Milan in 1830, when Pasta and Rubini took leading parts. On his first visit to Paris, in 1835, his *Marino Faliero* met with little success, but immediately afterwards, *Lucia di Lammermoor*, which he wrote in six weeks, took the Neapolitan public by storm. In 1840 he returned to Paris, and produced, among others, *La Fille du Regiment*, at first with comparatively little effect, *Lucrezia Borgia*, and *La Favorita*, the last act of which is considered to be his masterpiece, and was written in from three to four hours. Leaving Paris, he visited Rome, Milan, and Vienna, returning to Paris in 1843, when were produced his comic opera *Don Pasquale*, and *Dom Sebastien*, whose gloomy theme almost precluded its success, and the anxious work upon which helped to bring on an attack of cerebral disease, from which he never completely recovered. His last opera, *Catarina Cornaro*, given at Naples in 1844, was a failure. Stricken by paralysis in that year, he fell into a condition of mental imbecility; and he returned to his native town in 1848, only to die (in April). His music was at first modelled after that of Rossini, and subsequently of Bellini, and is only second to theirs in the flow of beautiful and expressive melody, which is his principal source of effect, the orchestra being treated as little more than a 'big guitar.' Some of his concerted pieces, however, are very skilfully constructed, and he often anticipates the strong passion of Verdi. He had pre-eminent skill in suiting the voices for which he wrote, and penetration as to their capabilities. His nervousness as to the success of his works compelled him always to absent himself from the first three representations. His operas are over sixty in number; of these comparatively few are known here, but their melodious character is likely for long to preserve to them their great popularity.

Donjon, or Dungeon, the principal tower or keep of a Castle (q.v.) or fortress. It was probably so called because, from its position, it dominated (Low Lat. *domnio*) or commanded the other parts of the fortress. From the circumstance that the lower or underground story of the donjon was used as a prison has come the modern meaning of the word.

Don Juan, a celebrated dramatic figure, the hero of a Spanish story, who stands as the southern realisation of the same subordination of the whole nature to self-gratification which under the colder northern skies has found expression in the conception of Faust. In Faust the development of the idea proceeds in the region of the intellectual as contrasted with the sensuous in Don Juan; and accordingly the former has found its highest expression in poetry, the latter in music. The ideal of the Don Juan legend is presented in the life of

a profligate who gives himself up so entirely to the gratification of sense, especially to the most powerful of all the impulses, that of love, that he acknowledges no higher consideration; and partly in wanton daring, partly to allay all uneasy misgiving, he then challenges that Spirit in which he disbelieves to demonstrate to him its existence in the only way he holds valid—through the senses.

This ideal career is aptly enough localised in one of the most luxurious cities of the once world-monarchy of the Saracens—Seville, and the characters wear the names of the ancient noble families of the place. The hero of the story, Don Juan, is described as a member of the celebrated family Tenorio, and is sometimes represented as living contemporary with Peter the Cruel, sometimes with Charles V. His chief aim is the seduction of the daughter of a governor of Seville, or of a nobleman of the family of the Ulloas. Being opposed by the father, he stabs him in a duel. He then forces his way into the family tomb of the murdered man, within the convent of San Francisco, causes a feast to be prepared there, and invites the statue which had been erected to his victim to be his guest. The stone guest appears at table as invited, compels Don Juan to follow him, and, the measure of his sins being full, delivers him over to hell. At a later period the legend came to be mixed up with the story of a similar profligate, Juan de Maraña, who had in like manner sold himself to the devil, but was at last converted, and died as a penitent monk in the odour of sanctity.

The story is probably a very old one. It is said that a poem with the like moral, *El Ateista Fulminado*, by an unknown author, was familiar in the monasteries long ere, in the first half of the 17th century, the legend of Don Juan was put into form by the monk Gabriel Tellez (Tirso de Molina), in *El Burlador de Sevilla y Convivado de Piedra*. This drama was transplanted to the Italian stage, and soon found its way to Paris, where numerous versions of it, among others Molière's *Don Juan, ou le Festin de Pierre* (first acted 1665), made their appearance. The latter provoked virulent criticism, and its full text was not printed for many years. It was put on the English stage by Shadwell under the title of *The Libertine* (1676). In the end of the 17th century, a new Spanish version of Tellez's play was prepared by Antonio de Zamora, and brought out on the stage. It is this version that forms the groundwork of the later Italian versions and of Mozart's opera. It was first put into an operatic form by Vincenzo Righini (1777); the text of Mozart's *Don Giovanni* was written by Lorenza da Ponte (1787). Through this famous opera the story became popular all over Europe, and has since furnished a theme for numbers of poets, playwrights, and writers of romance. Alexander Dumas has a drama, *Don Juan de Marana;* Byron's *Don Juan* follows only the name, and character; and Prosper Mérimée's novel, *Les Âmes du Purgatoire*, is founded upon it. Mr G. B. Shaw has made paradoxical use of the story in *Man and Superman*. See De Bévotte, *La Légende de Don Juan*.

Donkey, a word of doubtful etymology, confined to slang dictionaries until so late as 1821, but now in current use as a synonym for Ass (q.v.). A *donkey-engine* is a small engine used for some subsidiary purpose, as for raising weights on board steam-vessels.

Donn, Rob. See Mackay (Robert).

Donnay, Maurice, French dramatist, born in Paris, 12th October 1859, was admitted to the Académie in 1907. His plays include *Amants* (1895) and *L'Autre Danger* (1902).

Donne, John, a striking figure among English poets, was born in London in 1573. His mother was daughter of John Heywood, the epigrammatist, himself related to Sir Thomas More; his father, who belonged to a good old Welsh family, was a prosperous London ironmonger, who died early in 1576, leaving a widow and six children. Young Donne was brought up a Catholic, as his mother and her family were resolute adherents of that faith. In 1584 he was admitted at Hart Hall, Oxford, and here began his lifelong friendship with Sir Henry Wotton. There is documentary evidence for Izaak Walton's statement that he migrated to Cambridge, and for his taking his M.A. there. He appears to have spent some years in foreign travel, returning to be admitted at Lincoln's Inn in 1592. After a careful examination of the points at issue betwixt the Roman and Anglican churches, he joined the latter. In 1596 he accompanied the Cadiz expedition of Essex, and after his return from the Islands Voyage (1597), was appointed secretary to the lord-keeper, Sir Thomas Egerton, who set the highest value upon his services. Here Donne made the acquaintance of many of the chief men of his day, and wrote, without printing it, great part of his poetry. His wit, his personal beauty, and the charm of his personality brought him the warmest friendships, and the passionate love withal of Anne, the young daughter of Sir George More, brother of the lord-keeper's wife. The pair were secretly married about the close of 1601, the bride being but seventeen years old. Sir George More was violently enraged, at once caused Donne and his confidants to be committed to prison, and persuaded the lord-keeper into dismissing him from his office. The young couple were, however, befriended by the wife's cousin, Sir Francis Wooley, whose house at Pyrford was their home until 1604. Donne's knowledge of theology and of civil and canon law, and his general erudition, found him employment in 1605–8, when, living at Mitcham, he assisted Morton in refuting the arguments of Catholic political recusants. In 1610 his *Pseudo-Martyr* was an independent contribution to the same controversy. During this period also Donne wrote much verse. His *Divine Poems* he sent in 1607 to George Herbert's mother. The first poem to be printed was his famous elegy on Sir Robert Drury's daughter (1611), which procured him the friendship of a powerful patron, who carried Donne abroad with him for some months. It was at Paris that he saw pass twice before him the famous vision of his wife with a dead child in her arms, which was verified by a messenger twelve days later. (It was not John Donne but Sir Samuel Donne that Somerset employed in the Essex divorce.) His friend Morton, afterwards Bishop of Durham, had long urged Donne to take holy orders. At the king's solicitation he was at length ordained early in 1615. The king appointed him a royal chaplain, and fourteen country livings, it is said, were offered him within a year. He accepted in 1616 the rectory of Keyston, in Huntingdonshire, as well as that of Sevenoaks, keeping the latter until his death. As reader also at Lincoln's Inn, he quickly took the front rank among the preachers of the time, 'weeping,' says Izaak Walton, 'sometimes for his auditory, sometimes with them; always preaching to himself like an angel from a cloud, but in none; carrying some, as St Paul was, to heaven in holy raptures, and enticing others by a sacred art and courtship to amend their lives: here picturing a vice so as to make it ugly to those that practised it; and a virtue so as to make it beloved, even by those that loved it not; and all this with a most particular grace and an unexpressible addition of comeliness.' In the August of 1617 the death of his much-loved wife, the mother of his seven living

and five buried children, left him almost detached from the world, his soul 'elemented of nothing but sadness;' yet he continued to preach with saint-like fervour for ten years after his elevation to the deanery of St Paul's in 1621. He died 31st March 1631, and was buried in St Paul's, under a monument representing him wrapped in his shroud, which survived the Great Fire, as Cotton's poem conceitedly notes.

Ben Jonson told Drummond that he esteemed Donne 'the first poet in the world in some things,' but that he would perish 'for not being understood;' and Dryden's judgment was that he was 'the greatest wit though not the best poet of our nation.' His poems were assiduously handed about among his contemporaries, with whom his influence was supreme, but Ben Jonson's prophecy threatened to come true. Many readers now again have eyes to discern poetry of rare quality, hidden like precious jewels in the midst of a dross of distressing obscurities of thought and imagery, elaborate ingenuity or rather fantasticality, and the most perversely far-fetched allusiveness, shallow philosophising, and laborious unrhythmical wit. His early amatory poems are lava-streams aglow with passion at white-heat, which cannot flow freely for the cinders that obstruct the current, although ever and anon revealing with startling unexpectedness the purity and intensity beneath. Peculiarly characteristic of Donne's poetry is that swift transition at will from the fleeting images of voluptuous pleasure to the abiding mystery of death. Amid much that is hardly poetical at all, Donne's saving grace as a poet is, in Mr Saintsbury's phrase, his 'fiery imagination shining in dark places, the magical illumination of obscure and shadowy thoughts with the lightning of fancy.'

Donne's poems were first collected in 1633. The editions of Dr Grosart, in his 'Fuller Worthies Library' (1872), of E. K. Chambers (1895), and of the Grolier Club (N.Y. 1895) have been superseded by the critical edition of Professor Grierson (1912). Selections from the sermons were edited by Pearsall Smith (1919), and Keynes (1923); his *Devotions* by Sparrow (1923). Alford's edition of his works in six volumes (1839) is far from satisfactory, but includes most of the sermons, of which Dr Jessopp accounts for no less than 180, written and preached within sixteen years, but its pious editor thought fit to leave out many of the earlier poems—Donne's real claim to a permanent place in English letters—although indeed he could claim for countenance the fact, as Walton tells us, that the dean himself in later life 'wished they had been abortive, or so short-lived that his own eyes had witnessed their funerals.' For his life see Walton's masterpiece (ed. Causton); Saintsbury, in Chambers's edition; Dr Jessopp in the *D.N.B.*, his monograph on Donne (mainly as churchman, 1897), Gosse's *Life and Letters of Donne* (2 vols. 1899). See also Ramsay, *Les doctrines médiévales chez Donne* (1920); Aronstein, *John Donne als Dichter* (1922); Studies by Fausset (1924), Mrs Simpson (1924), Praz (Italian, 1925); and Keynes's Bibliography (1914).

Donnybrook, now part of Dublin, at one time celebrated for a fair notorious for fighting, chartered by King John, and abolished in 1855.

Don Quixote. See CERVANTES.

Doo, GEORGE THOMAS, was born in the parish of Christ Church, Surrey, 6th January 1800. From an early age he practised as an engraver in London, and in 1825 he proceeded to Paris, where he studied under Suisse. He has made himself best known by his famous plates of 'Knox Preaching,' after Wilkie; of Eastlake's 'Italian Pilgrims coming in Sight of Rome;' by his exquisitely finished heads of women and children, after Lawrence; and by his engravings from Raffaelle, Correggio, and others. His plate of the Calmady Children, titled 'Nature,' after Lawrence, produced in 1830, ranks as his masterpiece. In 1851 he was elected a Fellow of the Royal Society; in 1857 an Academician. He was appointed chairman of the Engravings Committee of the London International Exhibition of 1862. About 1853–55 he painted in oils, his works of this class being mainly portraits. In 1864 he completed, after eight years' work, a large engraving of the 'Raising of Lazarus,' by Sebastian del Piombo, his last important work. He died 13th November 1886.

Doolittle, HILDA, known as 'H. D.,' was born 10th September 1886, at Bethlehem, Pennsylvania, daughter and sister of two successive professors of astronomy in Pennsylvania University. Educated at a private school in West Philadelphia and Bryn Mawr College, she went to Europe in 1911. A visit to London developed into permanent residence. She was associated with Mr Ezra Pound in founding the Imagist school of poetry. In 1913 she married another Imagist poet, the Englishman Richard Aldington (born 1892). Her polished, classical art, applied to *vers libre*, made her the most outstanding of the Imagist group, whose ideals of the exact word, concentration, 'poetry that is hard and clear, never blurred or indefinite,' may be studied in her contributions to *Some Imagist Poets* (1915–16–17), and her own volumes, *Sea Garden* (1916) and *Hymen* (1921).

Doom, the old name given to the last judgment, and to those representations of it in churches which have a religious rather than an artistic object. Many of the dooms are executed in distemper. In the reign of Edward VI. most of them were washed over, or otherwise obliterated, as superstitious.

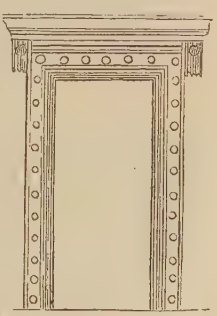
Doom Palm. See DUM PALM.

Doomsday Book. See DOMESDAY BOOK.

Doomster. See DEEMSTER.

Doon, a famous river of Scotland, rising in the south-east of Ayrshire in Loch Enoch. It runs north-west through Loch Doon, a gloomy sheet of water, 6 miles long by ¾ of a mile wide, surrounded by bare treeless mountains, past Dalmellington, Burns's Monument, and Alloway Kirk, to join the Firth of Clyde 2 miles S. of Ayr. Its whole length is about 30 miles. On leaving Loch Doon the river flows through the picturesque Glen Ness, a rocky and beautifully wooded ravine. On an islet in the loch are the ruins of a castle. Burns has made this one of the world's most classic streams.

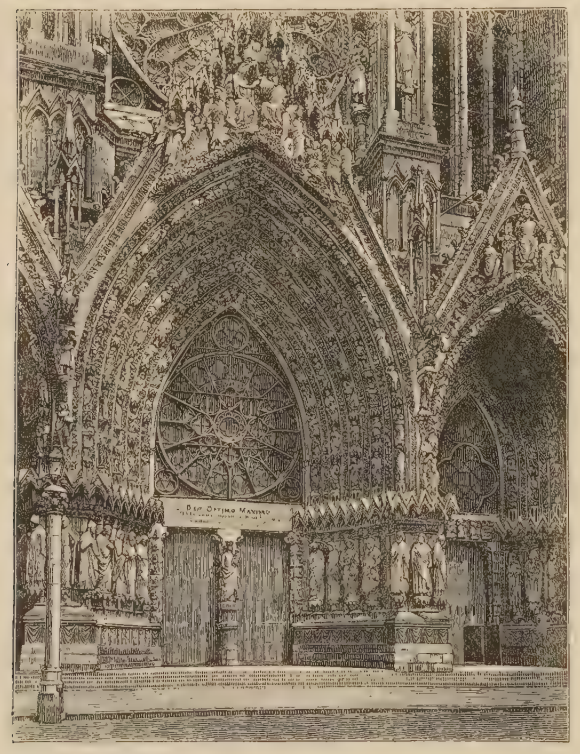
Door (O.E. *duru* and *dor*, related to Lat. *fores*, Gr. *thyra*). The doorway has always been regarded in all countries as a most important feature of any structure, and is therefore generally made more or less ornamental. The doorways of the Egyptian and Assyrian temples and palaces were of great size and magnificence, and were adorned with colossal statues. Those of the Greek and Roman temples were likewise large, and in the Roman were often the only aperture for the admission of light. Classic doorways are invariably surrounded with mouldings, which form the architrave.



Doorway of Erechtheum.

In the doorways of the Greeks the jambs generally incline inwards towards the top, and the lintel juts out at the ends—the mouldings being returned round it. Over the architrave there is frequently a frieze and cornice supported on trusses, which serve to give dignity and to protect the door from the weather. In the later Roman architecture,

when the arch became an admitted element in the style, doorways were naturally treated with an arched head. The medieval styles derived from the Roman, such as the Byzantine, Romanesque, and Gothic, as well as the Saracenic, followed the same course, and the arched doorways were amongst their most characteristic features. In Romanesque architecture the doorway is always semicircular, and the arched head is enriched with mouldings springing from shafts in the jambs. The derivation of the mouldings and ornamentation of the arch and of the caps of the pillars is, in the earlier examples, clearly traceable to the classic prototypes; but the Roman details gradually give place to Teutonic features. The arched head is frequently filled in with a flat stone, so as to reduce the height of the doorway to that of the caps and give it a square head, which is a more convenient form for the door. The flat stone or



Portal, Reims Cathedral.

tympanum is usually ornamented with sculpture representing our Saviour, or some Scripture subject. When the doorway was wide it was generally divided into two openings with a central pilaster.

In the various Gothic styles the doorway is invariably a prominent object. This is especially the case in French architecture, in which the portals of the cathedrals and churches are of great size, and richly ornamented with large sculptured figures and bas-reliefs. One of the most notable of these is the majestic deeply-recessed triple portal of Reims Cathedral. Those of the English edifices, although highly ornamented, are not on so great a scale. A favourite decoration of all periods is a series of niches filled with figures carried round the jambs and archway. In early Gothic the doorways are pointed and surmounted with a gable, in the later periods the pointed arch is often inclosed with square mouldings or labels, and in the Flamboyant and Tudor styles the four-centred arch and the ogee or reversed arch are commonly employed. Of course in all periods the mouldings and enrichments of the doorway are those of the time, and in late examples become very attenuated.

The doors themselves are generally of timber—the early ones having the frame covered on the outside with plain lining and ornamented with iron-work, the scrolls of which sometimes extended over the whole surface. In later examples the doors were usually panelled, and often partly covered with tracery—especially in Perpendicular work. Doors of chambers were also sometimes beautifully carved with bas-reliefs in the panels. Doors were occasionally made of metal, the bronze gates of the Baptistery of Florence and Pisa Cathedral being well-known examples.

Doora. See DURRA.

Doornboom (*Acacia horrida*), a common tree in the wastes of South Africa. The name ('thorn-tree') given to it by the Dutch colonists, and the botanical specific name, are due to the number and sharpness of its spines. It seldom much exceeds 30 feet in height, but its timber is hard and tough, and is much used for house-carpentry, &c. See ACACIA.

Doppler, CHRISTIAN (1803–53), born at Salzburg, became professor of physics at Vienna (1851). 'Doppler's principle' explains the shift of lines in the Spectrum (q.v.) of a star approaching or withdrawing from the observer; and likewise the drop in pitch of (say) a locomotive whistle as it passes the hearer. See STARS.

Doquet. See DOCKET.

Dor. See MONT-DORE-LES-BAINS.

Dor, a negro people of Central Africa, also called Bongo, between 6° and 8° N. lat., and bordering on the Dinka and Niam-Niam stocks.

Dor. See DUNG-BEETLE.

Dora, SISTER. See PATTISON.

Dora, or DOR (now *Tantura*), a great Phœnician city on the coast of Palestine, 8 miles N. of Cæsarea, with remains of the Hyksos period.

Dora d'Istria. See GHIKA.

Dorak-el-Atek, a town of Persia, in the province of Arabistan, situated in a marshy plain on the Jerrahi, 55 miles E. of Basra. Pop. 8000. It is the seat of the sheikh of Dorakistan or Kaban.

Doran, JOHN, Ph.D., born in London 11th March 1807, brought out a melodrama, *Justice, or the Venetian Jew*, at the Surrey Theatre in 1824. His *Sketches and Reminiscences* appeared in 1828, and in 1835 a History of Reading. In 1854 he published *Habits and Men*, followed by *Table Traits, Queens of England of the House of Hanover* (1855), *Monarchs retired from Business* (1857), *History of Court Fools* (1858), *The Princes of Wales* (1860), *Memoir of Queen Adelaide* (1861), *Their Majesties' Servants* (1864, a history of the stage from Betterton to Kean; new ed. by Lowe, 1887), *A Lady of the Last Century* (1873, an account of Mrs Montagu), *Mann and Manners* (1876, the letters of Sir Horace Mann to Horace Walpole), *London in Jacobite Times* (1877), *Memories of Our Great Towns* (1878), and *In*

and About Drury Lane (1885). Dr Doran was repeatedly acting-editor of the *Athenæum;* edited the *Church and State Gazette* (1841–52); and at his death, 25th January 1878, was editor of *Notes and Queries.*

Dorat. See DAURAT.

Dorcas Society, the name given to an association of ladies who make or provide clothes for necessitous families. The name is taken from Acts, ix. 39: 'And all the widows stood by him weeping, and showing the coats and garments which Dorcas made while she was with them.'

Dorchester, a municipal borough, the county town of Dorsetshire, on the Frome, 8 miles N. of Weymouth, and 110 by rail (by road 119) WSW. of London. Till 1867 it returned two members to parliament, till 1885 one. It has a trade in ale and beer, a large agricultural market of cattle and cereals, and sends much butter to London. The free grammar-school founded in 1579 has been rebuilt and reorganised. The county museum is rich in geological specimens found in the county, including the fore-paddle of a Pleiosaurus 6 feet 3 inches in length, discovered at Kimmeridge. The museum also contains a fine piece of Roman pavement (almost perfect) found on the site of the old Dorchester Castle, when the county prison was built in 1793. Pop. (1841) 3249; (1921) 9554. Dorchester was the Roman *Durnovaria* or *Durinum*, a walled town with a fosse, and a chief Roman British station. Part of the wall, 6 feet thick, still remains, and is carefully preserved. Near Dorchester are the remains of the most perfect Roman amphitheatre in England, 218 by 163 feet, and 30 feet deep, the seats rising from the arena, cut in the chalk, and capable of holding 13,000 spectators. There is also a Roman camp with a ditch and high vallum. Near Dorchester is a large British station with three earthen ramparts (one 60 feet high), a mile and a half in circuit, and pierced by intricate passages. Its name, 'Maiden Castle,' has nothing to do with a castle for defending maidens, or strong enough to be defended by girls; but is the Celtic-British *maidun*, 'hill fort.' (There are four or five other 'Maiden Castles' in England and Scotland.) In March 1645 Cromwell held the town as his head-quarters with 4000 men, and in 1685 Judge Jeffreys held his 'bloody assize' here, when 292 received sentence of death as being implicated in Monmouth's rebellion. In the porch of St Peter's Church the Rev. John White is buried. A leading Puritan, and known as 'the Patriarch of Dorchester,' he was the projector of the colony of Massachusetts, in New England, but did not join the expedition. He was a member of the Westminster Assembly and minister in Dorchester, with a short interruption from 1606 till his death in 1648. The original edition of Case's *Guide to Dorchester* was written by the Dorchester pastoral poet, William Barnes (q.v.); but Dorchester is better known as the home of Thomas Hardy (q.v.), and the centre of his Wessex.

Dorchester, now an unimportant village of Oxfordshire, 9 miles SE. of Oxford, was the seat of the Mercian bishops from the 7th century till 1073, when the see was transferred to Lincoln. The Augustinian abbey church (mainly 13th century; restored) is lavishly ornamented, and has an interesting 'Jesse' window.

Dorchester, formerly a separate town of Massachusetts, 4 miles S. of Boston, was in 1869 annexed to that city. The fortification of Dorchester Heights by Washington, in March 1776, compelled the British to evacuate Boston.

Dorchester, GUY CARLETON, 1ST BARON (1724–1808), was governor of Quebec, 1766–70 (acting), 1775–77, 1786–91, and 1793–96, and defended that city against the Americans, whom he defeated at Lake Champlain, 1776. In 1782–83 he was British commander-in-chief in America.

Dordogne, a department in the south-west of France, formed of the ancient Guiennese district of Périgord, with small portions of Agenais, Limousin, and Angoumois. Area, 3530 sq. m. Pop. (1861) 501,687; (1921) 396,742. The department derives its name from the river Dordogne, which, after a course of 305 miles, 185 of them navigable, unites with the Garonne to form the large estuary of the Gironde. The climate is mild and healthy, except in the west. The soil is generally poor, the surface for the most part hilly, and covered with forests or, more frequently, heath and underwood; but here and there is a valley of extraordinary beauty and fertility, inclosed with hills, the sides of which are usually clothed with vineyards. Among the most noted productions are the truffles of Périgord. The iron industry is the most important in the department. Other manufactures are paper, woollens, chemical manures, and glassware, and there is an active trade in wine, brandy, oil, fruits, walnuts, hams, and cattle. Dordogne has five arrondissements — Bergerac, Nontron, Périgueux, Ribérac, and Sarlat. The capital is Périgueux. The Dordogne basin is rich in palæolithic remains.

Dordrecht. See DORT.

Doré, GUSTAVE, painter and illustrator of books, was born at Strasburg, 6th January 1833. In 1845 he came to Paris, at the age of fifteen began to exhibit landscape subjects in pen and ink in the Salon; in 1848 he became a contributor to the *Journal pour rire*, and he was afterwards on the staff of the *Journal pour tous.* He first made his mark by his illustrations to Rabelais (1854), to Sue's *Wandering Jew*, and to Balzac's *Contes Drolatiques* (1856), which fully displayed his facility of execution and his fantastic power of invention. These were followed by innumerable illustrated editions of other well-known works; in 1861 by Dante's *Inferno*, in 1863 by the *Contes* of Perrault, in 1863 by *Don Quixote*, in 1868 by the *Purgatorio* and *Paradiso* of Dante, in 1865–66 by the Bible, in 1866 by *Paradise Lost*, in 1867–68 by Tennyson's *Idylls of the King*, in 1867 by La Fontaine's *Fables*, and many other series of designs, the latest of which became poor and feeble in character, the artist having exhausted himself by incessant over-production. Doré was also ambitious of ranking as an historical painter, and he executed much in colour. He himself said that between 1850 and 1870 he earned £280,000 by his pencil. Among the earliest of his pictures are 'The Battle of the Alma,' and 'The Battle of Inkermann,' shown in the Salons of 1855 and 1857. Two of his most successful oil-pictures are 'Paolo and Francesca da Rimini' (1863), and 'The Neophyte' (1868). His 'Tobit and the Angel' is in the Luxembourg Gallery. For many years there was a Doré gallery in London, filled with his works, which were more popular there than in France, among which the enormous canvases of 'Christ leaving the Prætorium' (1867–72) and 'Christ's Entry into Jerusalem' figured prominently. He is, however, seen at his best in his book-illustrations, for his colouring is unreal and wanting in delicacy and harmoniousness, and he had no technical mastery over the methods of oil-painting. He is most successful in subjects of a weirdly humorous or grotesque class; but he fails completely in the religious scenes which he so often set himself to depict. He displayed

some ability as a sculptor. He exhibited a colossal vase decorated with figures at the Exposition Universelle, Paris, 1878; and at the time of his death, 23d January 1883, he was engaged upon a monument to the elder Dumas. See Lives by Miss Roosevelt (Lond. 1886) and B. Jerrold (1891).

Doria, ANDREA, a Genoese of noble family, and admiral of the Emperor Charles V., was born of comparatively poor parents, in November 1466 or 1468, at Oneglia, where his ancestors had been princes for centuries. The Dorias had long held a foremost place in the republic; they had again and again led the fleets of Genoa to victory over Pisa and Venice. Andrea took to the profession of arms at the age of nineteen, when he entered the pope's guards, in which his uncle held a command. On the accession of Alexander VI. he took service with the Duke of Urbino (whose son he subsequently saved from the Borgia), and then with Alfonso of Naples, on whose departure Doria went to the Holy Land till the troubles should be over. On his return he joined the Prince of Sinigaglia in resisting the Spaniards, who were then triumphing over Italy. Doria dreaded the extinction of the Genoese state before the overmastering tide of imperial conquest, and devoted himself with all his energy to restoring the ancient naval renown of his countrymen. He returned to Genoa in 1503, his military exploits procuring him immediate employment; in 1513 he was appointed commander of the galleys of the republic, and soon his name was a terror to the Turkish corsairs, who were now beginning their ravages in the Mediterranean. In 1519, with six ships, he captured thirteen of their galleots off Pianosa; but his connection with Genoa was suddenly broken by a revolution, which in 1522 restored the faction of the Adorni, who favoured the imperial interest. Doria transferred his allegiance to Francis I., as much to save his country from Charles V. as to serve his personal ambition. The French fleet rode the seas supreme so long as Doria commanded, and Charles V. sustained several defeats. Doria blockaded Genoa, turned out the Adorni, and proclaimed the independence of the republic, where he was hailed as the liberator of his country. Once more he changed sides in 1529, and fearing the predominance of Francis, or thinking himself slighted, went over with his twenty private galleys to Charles V. The imperial fleet soon felt his influence, and now it was not France but the empire that held the seas. Genoa welcomed him as its father: he peacefully entered the city, and, refusing the title of sovereign, established a form of popular government, with a strong aristocratic element, which lasted to the end of the republic. The emperor gave him the order of the Golden Fleece and the princeship of Melfi. Doria's career now became one long duel with his great rival the corsair Khair-ed-din Barbarossa (q.v.). In 1531 the Genoese admiral descended upon the latter's stronghold at Shershel on the Barbary coast, but lost many of his men without holding the place. In 1532 he sailed with a great fleet to the Ionian waters, and took Coron and Patras from the Turks; one of his most brilliant feats was the revictualling of Coron in the teeth of the Turkish navy in the following spring. (See Jurien de la Gravière, *Doria et Barberousse.*) In 1535 he accompanied Charles V. to Tunis, where his galleys took a prominent part in the bombardment of the Goletta forts and the destruction of Barbarossa's fleet, but failed to capture the corsair himself. Barbarossa now commanded, as Kapudan Pasha, the navy of Turkey; collecting a fleet of 150 sail, he ravaged the islands about Greece, which chiefly belonged to Venice; and in 1538, meeting the combined fleets of the emperor, the pope, and the Venetians, off Prevesa, he offered battle. Doria's conduct in manœuvring out of range, not without the loss of his heavier sailing-vessels, was severely criticised, and Barbarossa came off decisively with the honours of war. Thenceforward, for a quarter of a century, the Turks were masters of the Mediterranean, and the power of Venice was crippled. Doria's expedition to Algiers with Charles V. in 1541 was a disastrous failure, and in 1560 he suffered a terrible reverse at Jerba, near Tunis, at the hands of one of Barbarossa's pupils, the renegade Ochiali (Uluj Ali). On the whole, Doria was outmatched by the corsairs. His later years had been disturbed by the conspiracy of Fieschi, and stained by the savage revenge he took upon those who were associated with the murder of his favourite nephew Gianettino. Prince Andrea Doria died at Genoa without issue, 25th November 1560, in his ninety-third or ninety-fifth year. He was the idol of his people, and the honoured counsellor of Charles V. and his son Philip, a born adventurer, personally very valorous, a man of great heart, a great admiral, but a greater soldier. See Richer, *Vie d'Andrea Doria;* Sandoræ; Capelloni: Brantôme; Celesia; *Conspiracy of Fieschi.*

Dorians, one of the great Hellenic races who took their name from the mythical Dorus, the son of Hellen, who settled in Doris; but Herodotus says that in the time of King Deucalion they inhabited the district Phthiotis; and in the time of Dorus, the son of Hellen, the country called Histiæotis, at the foot of Ossa and Olympus. But the statement of Apollodorus is more probable, according to which they would appear to have occupied the whole country along the northern shore of the Corinthian Gulf. Indeed, Doris Proper was far too small and insignificant a district to furnish a sufficient number of men for a victorious invasion of the Peloponnesus. It is doubtful whether the descent of Dorus from Deucalion and the assumption of Herodotus that the Dorians alone were true Hellenes, is based upon any real tradition. Plato in the *Laws* suggests that the Dorians were Achæans, who returned from the siege of Troy under a leader named Dorieus. The views of Herodotus, Apollodorus, and Plato, however, must be read in the light of the discoveries of the archæologist in the 20th century. The immigration of the Dorians into Greece, like that of the Æolians and Ionians, belongs to the Mycenæan period; and by the Dorians Mycenæan civilisation was brought into Greece. Of old they were known as Achæans; and that fact is readily explained if we assume that Thessaly was the point from which they dispersed over Greece. The first district populated by them in the Peloponnese thus acquired the name of Achæa. This is confirmed by the fact that the Achæan dialect is close akin to that of Phocis and Locris on the one side, and that of Argolis on the other. The name of the Dorians, like the names of the Ionians and Æolians, probably originated in Asia Minor, and thence travelled to Crete and the Peloponnese. For the Dorian mode, see HARMONY, PLAINSONG.

Doric Order. The oldest and simplest of the three orders of Greek architecture. See COLUMN, GREEK ARCHITECTURE.

Doris, a small mountainous district of ancient Hellas, between Phocis, Ætolia, Locris, and Thessalia, was the home of the Dorians (q.v.). It is now a part of the modern government of Phocis.—Doris was also the name of a district in Asia Minor on the coasts of Caria, inhabited by colonists from the Peloponnesus.

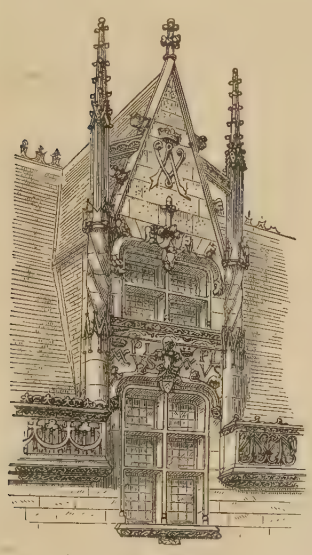
Doris, a genus of gasteropod molluscs in the sub-order Nudibranchiata, the type of a family called Doridæ, and sometimes popularly Sea-

lemons. The body has an elongated oval form, a flat ventral and more or less arched dorsal surface, a whitish, yellowish, or brownish colour, and usually a warty skin. Two retractile club-shaped tentacles on the back of the head, and feathery respiratory processes, sometimes retractile, round the anus, are also marked characteristics. There is no distinct mantle or adult-shell, but the skin of the back is slightly broadened out over head and 'foot,' and limy particles occur in the skin. The radula is broad, and many-toothed. Numerous species occur in British and other seas, but more abundantly in the southern hemisphere. Some of them attain a considerable size. Few of them inhabit deep water. They crawl on rocks, seaweeds, &c., where they are often left by the tide; or swim in a reversed position, the foot, made concave by muscular action, serving to buoy them up. Some of them are pretty and interesting inmates of the aquarium.

Doris: *a*, gills.

Dorislaus, Isaac, born in 1595 at Alkmaar, in Holland, came about 1627 to England, where for some time he held a history lectureship at Cambridge, and afterwards was appointed judge-advocate. He sided with the parliament, helped to bring Charles I. to his doom, and in the spring of 1649 was sent back to his native land to bring about an alliance between the republic and England. He had just reached the Hague, when on 12th May he was assassinated by a Scottish colonel and eleven other royalist conspirators. His body was brought to England, and buried in Westminster Abbey, whence it was ejected in 1661.

Dorking, an old-fashioned market-town of Surrey (with a suffragan bishop since 1904), stands in a picturesque valley near the base of Box Hill (590 feet), 24 miles SSW. of London. Its church, with a spire 210 feet high, is a memorial to Bishop Wilberforce, who met his death riding over the Downs near Dorking (1873). Deepdene, the lovely seat of 'Anastasius' Hope, where Beaconsfield wrote *Coningsby*, is close to the town. Flint Cottage (near Burford Bridge) was George Meredith's. The battle of Dorking, vividly described by General Chesney in 1871, is happily still unfought. Pop. (1851) 3490; (1881) 6328; (1921) 8058. — For Dorking breed of Fowls, see Poultry.


Dormer Window.
(From the Château de Josselin, Brittany, end of the 15th century.)

Dormant Vitality and cognate states are treated in the articles on Anæsthesia, Coma, Desiccation, Hibernation, Latent Life, Mud-fish, Rotatoria, Suspended Animation, Trance.

Dormer, or Dormer Window, is a window placed in a small gable rising out of a sloping roof, often made use of for the purpose of enlarging and lighting the attic or garret-rooms of modern houses. It is also popularly known as a storm-window. *Dormers* do not appear to have been in use before the middle of the 14th century. After that date they were greatly employed, especially in the later domestic Gothic edifices. Those of the Hôtel de Ville at Rouen are amongst the most splendid examples.

Dormitory (Fr. *dormitoire*, from Lat. *dormire*, 'to sleep'), a sleeping apartment in a monastery, or other similar establishment. Dormitories are usually of considerable size, sometimes having a range of cells or 'cubicles' partitioned off on each side. In schools, the dormitories are bedrooms.

Dormouse (of doubtful etymology), a common name applicable to any member of the rodent family Myoxidæ, but especially used with reference to various species of Myoxus and Muscardinus. The dormice may be described as arboreal rodents, squirrel-like in form and habit, but are classified in the mouse-like or Myomorph section of the order Rodentia. They have long hairy tails, short fore-limbs, tolerably large eyes, and large, almost naked ears. The head is narrow, the upper lip cleft, the body compressed, the thumb rudimentary, the molars with more or less marked transverse enamel folds. They live among trees and bushes, are principally twilight animals, and as their name (sleeping-mice) implies, hibernate. In their distribution they are confined to the Old World, in its palæarctic and Ethiopian regions. The family includes four genera—Myoxus, Muscardinus, Eliomys, and Graphiurus. Remains of dormice are found in Miocene strata.

The Common Dormouse (*Muscardinus avellanarius*) is a pretty little animal, about three inches in length, not including the bushy tail, which is almost as long as the body. The general colour is a beautiful tawny yellow, but there is white on throat and breast. It is widely distributed from Britain and Scandinavia to Tuscany and Turkey, and is especially fond of hazel-copses. It feeds on nuts, seeds, berries, buds, &c., grows very fat in autumn, sleeps intermittently through the winter in a round grassy nest a little above the ground. It breeds in spring, but, in some cases at least, also in autumn. It is the only British dormouse.—The Loir or Fat Dormouse (*Myoxus glis*)

Dormouse (*Muscardinus avellanarius*).

is about twice the size of the common dormouse, and has the hairs of the tail in two rows, as in squirrels. It is ashen-gray, sometimes brownish above and white below. In its distribution the loir is restricted to the south. The favourite haunts are in oak and beech woods. It is very fond of fruit, and is said even to become carnivorous. The Roman epicures esteemed its flesh, and fattened it in their *gliraria*. It is still cooked by the Italians.

—The Garden Dormouse (*Eliomys nitela*) is a destructive thief, smaller and more active than the last, common in Central and Western Europe. It is justly persecuted for the damage it does in orchards, where it is said to destroy much more than it eats.—In the genus Graphiurus the tail is shorter, and ends in a brush-like tuft of hairs. The molar teeth are very small, and the cross enamel folds are hardly developed. See RODENT.

Dornbirn, a town in the Austrian land of Vorarlberg, on a small affluent of the Lake of Constance, 7 miles S. of Bregenz by rail, with important cotton-factories, and large iron and brass foundries, brick and lime kilns, and sawmills. Pop. of the four villages which form the town, 14,000.

Dorner, ISAAK AUGUST, a great Protestant theologian, born 20th June 1809, near Tuttlingen, in Württemberg, studied theology and philosophy at Tübingen, next travelled in England and Holland, and had already filled chairs at Tübingen, Kiel, Königsberg, Bonn, and Göttingen, when in 1861 he was called to be professor at Berlin. There he died, 8th July 1884. Dorner for many years took an active share in the administration of the church, but was saved from ever becoming a partisan by a singularly fair and well-balanced mind, and by his strong grasp of a real historical spirit, which he did much to impress on modern German theology. His greatest work is the *History of the Development of the Doctrine of the Person of Christ* (Eng. trans. 5 vols. 1861–63). Besides this, his *History of Protestant Theology* (1867), his *System of Christian Doctrine* (1880–81), and his *Christian Ethics* (1885), through their English translations, became handbooks in England and America.

Dornick, a species of figured linen, named from Tournay or Doornik, in Flanders. The 'mystery,' introduced into England, was long confined by law to inhabitants of Norwich and Pulham.

Dornoch, the county town of Sutherland, 7 miles SSE. of the Mound station, and 40 NNE. of Inverness, stands near the entrance to Dornoch Firth, which, running 22 miles inland, separates Sutherland from Ross-shire. It has splendid golf-links, a tower of the old bishop's palace, handsome county buildings, and the former cathedral of the see of Caithness (1245), which, burned in 1570, was rebuilt for the parish church in 1837, and contains a statue by Chantrey of the first Duke of Sutherland. The last witch burned in Scotland suffered at Dornoch in 1727. It was made a royal burgh in 1628, and with Wick and four other towns returned one member to parliament till 1918. Pop. (1861) 647; (1881) 497; (1891) 514; (1901) 624; (1921) 768.

Dorohoi (*Dorogoi*), a town of Rumania, in the extreme north of Moldavia, on the Shishja, 70 miles NW. of Jassy; pop. 16,000, nearly half Jews.

Dorothea (OF ZELL). See the articles GEORGE I., KÖNIGSMARK.

Dorp, till 1889 a town of Rheinland, now incorporated with Solingen (q.v.).

Dorpat, or DERPT (Esthonian *Tartu*, Russian *Yurieff*), a town of Esthonia, on the Embach, here crossed by a fine granite bridge, 165 miles SW. of Petrograd. It consists of a town proper, with two suburbs. The Domberg Hill, on the right bank of the river, was during the middle ages occupied by the citadel, cathedral, and bishop's palace, on whose site now rise an observatory, the university library, schools of anatomy, &c., with tasteful gardens and promenades; and close by are the other university buildings and the town-house. The university, founded in 1632 by Gustavus Adolphus, was re-established by Alexander I. in 1802. Since May 1887 it had been thoroughly Russianised, the final reorganisation of the law faculty taking effect in 1889; in 1919 it was Esthonised. It has seven faculties, and about 3000 students. There is a notable botanical garden. Dorpat was a Hanse town in the 14th and 15th centuries, and was alternately captured by Swedes, Poles, and Russians until 1704, and remained in Russia's possession till 1918. Thrice was a great part of the town levelled to the ground; on the last occasion, in 1708, it was practically destroyed. But both from these calamities and from the great fires of 1763 and 1775 it recovered, and it is the handsomest and best-built town in the republic. It possesses large printing establishments, breweries, sawmills, manufactories of cigars, tiles, and musical instruments, and has a considerable trade in wood, corn, and flax. Dorpat had long been a centre and hearth of Germanism in the Baltic regions, in spite of official measures of Russification. Pop. 50,000, very largely German.

Dörpfeld, WILHELM, archæologist, born at Barmen in 1855, excavated at Olympia, was secretary and professor in the German Archæological Institute at Athens, and was Schliemann's collaborator and successor at Troy.

D'Orsay, ALFRED GUILLAUME GABRIEL, COUNT, the last of the 'dandies,' was born in Paris, 4th September 1801. The son of General D'Orsay, a distinguished French soldier, he early entered the service of Louis XVIII. as a lieutenant in the Garde du Corps. It was while his regiment was stationed at Valence on the Rhône in 1822 that he made the acquaintance of Lady Blessington (q.v.), who was travelling on the Continent with her husband. An intimacy soon sprang up between the brilliant countess and the still more brilliant Frenchman, and D'Orsay resigned his commission, and attached himself to the Blessingtons, with whom he travelled in Italy and elsewhere, until 1827, when as if to 'regularise' his irregular position in the family, he was married to Lady Harriet Gardiner, Lord Blessington's fifteen-year-old daughter by a former wife—a marriage which, as may be supposed, turned out unhappily. In 1829 Lord Blessington died, and D'Orsay separated formally from his wife, and took up his residence at Lady Blessington's, in Mayfair first, and then at Kensington, where for twenty years they defied the conventions in the midst of a society of authors, artists, and men of fashion. D'Orsay was not only one of the handsomest men of his time, well bred, well dressed, the mirror of fashion and the mould of form; but he was an accomplished painter and sculptor, an author of no mean power, an excellent talker, and a genial companion. An intimate friend and constant supporter of Louis Napoleon, he naturally looked for a position when the exile became prince-president and the host a bankrupt; but the office for which he was so admirably fitted, that of Director of Fine Arts in Paris, was conferred upon him only a few days before his death on 4th August 1852.

Dorse, a small variety of Cod (q.v.).

Dorset, EARL OF. See SACKVILLE.

Dorsetshire, or DORSET, a maritime county in the south of England, on the English Channel, between Hampshire on the E. and Devonshire on the W. Its greatest length is 58 miles; greatest breadth, 40; average, 21; and area, 978 sq. m., or 625,612 acres, of which a third is arable, a ninth waste, and the rest pasture. The coast-line is 75 miles long, with fine cliffs and headlands. St Alban's Head (354 feet high) and Golden Cap (619 feet high) are among the highest coast points between Dover and the Land's End. Off Swanage was fought the first naval battle in British history,

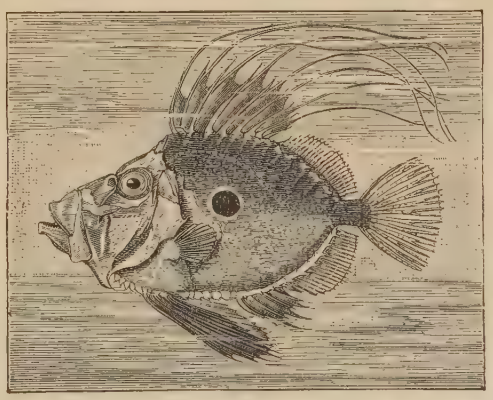
that of Alfred the Great against the Danes in 876, when 120 of the Danish fleet were driven on the rocks and destroyed. About midway in the coast-line is Portland, an island, so called, but connected with the mainland by a remarkable formation known as Chesil Bank (q.v.), which, extending 10 miles towards Abbotsbury, incloses a narrow tidal inlet, called the Fleet, with decoy ponds, and a fine swannery of about 1000 swans at Abbotsbury. There is a dangerous sea called 'The Race,' about a mile to the south of Portland, formed by the meeting of the tides. There are two lighthouses at the end of Portland, also one of more recent erection at Anvil Point, near Swanage. Portland (q.v.) contains a large Borstal institution (long a convict establishment), a fine breakwater, harbour of refuge, a naval hospital, and extensive fortifications. Chalk downs run along the south coast, and through the middle of the county nearly from east to west. The highest point is Pillesden Pen (934 feet). The chief rivers are the Stour and the Frome. Geologically, Dorsetshire consists of strata of plastic clay, chalk, oolite, lias, with some weald and greensand. Remains of colossal reptiles have been found at Lyme Regis and near Swanage. The chief mineral productions are the celebrated Purbeck and Portland building-stones, and white china and pipe clays. At Swanage is found the celebrated Purbeck marble, seen in many English cathedrals. The climate is mild. The chalk hills or downs are covered with short fine pasture, on which countless numbers of Southdown sheep are fed. The soil is chiefly sand, gravel, clay, and chalk. Dorsetshire is mainly a pastoral county, producing sheep, cattle, cheese, and butter; but some wheat, barley, hemp, linseed, hops, &c. are raised. Sainfoin is grown on the chalk hills. There are small manufactures of linen, silk, woollens, flax, hemp, buttons, stockings, and ale and cider. Pop. (1841) 175,054; (1871) 195,537; (1881) 190,979; (1921) 228,258. Since 1885 the county sends four members to Parliament, the towns of Dorchester, Bridport, Poole, Weymouth and Melcombe Regis, Shaftesbury, and Wareham, formerly sending up ten members, ceased to be separate constituencies in that year. Dorchester has prehistoric and Roman remains, as stone circles, barrows, camps, an amphitheatre, and three Roman stations; and a chambered long barrow, known as Gray Mare and Colts, near Gorwell. There are some remains of forty abbacies, priories, hospitals, &c. The ruins of Corfe Castle (q.v.), a seat of the Saxon kings of Wessex, are among the grandest in England. The scenery of Dorsetshire has been rendered familiar to many outside the county by the works of Barnes and Hardy. See Hutchins's *History of Dorset* (1774; 3d ed. 1861–73), Worth's *Dorsetshire* (1882), Moule's *Old Dorset* (1894), *The Victoria History*, and books cited in C. H. Mayo's *Bibliotheca Dorsetiensis* (1885).

Dorstenia. See CONTRAYERVA.

Dort, or DORDRECHT, a town of the Netherlands, in the province of South Holland, is situated on an island formed by the Maas, 10 miles SE. of Rotterdam by rail. An inundation in 1421, in which upwards of 70 villages were destroyed and 100,000 people drowned, separated the site upon which Dort stands from the mainland. It is one of the oldest, as in the middle ages it was the richest of the trading towns of Holland; and its trade is still considerable. Among its chief buildings are a Gothic cathedral (1363) and a handsome town-hall (1339). The town is traversed by canals, and large ships as well as gigantic wood-rafts which come down the Rhine from the Black Forest and Switzerland, are accommodated in its roomy harbour. Close by are a large number of shipyards, corn and saw mills, and manufactories of ironwares, gas-meters, safes, locks, tin-plate, motors, and other machinery. Pop. 54,000. Dort was founded in 1013. Here in 1572, the States of Holland, after the revolt from Spain, held their first assembly; and sat from 13th November 1618 to 19th May 1619, the conclave of Protestant divines known as the Synod of Dort, which condemned the doctrines of Arminius as heretical, and affirmed those of Calvin (see ARMINIUS). The house in which the synod sat has been demolished. Dort is the birthplace of the brothers De Witt, of Cuyp, and Ary Scheffer; to the last a statue was erected in the market-place in 1862.

Dortmund, the most important town of Westphalia, lies in the fertile Hellweg plain, near the Emscher, 74 miles NNE. of Cologne by rail. In 1846 its inhabitants numbered only 8732, and it owes its subsequent increase to the development of the Westphalian coal-mines. It is the headquarters of the mining authorities of Westphalia, and an important railway centre; and it has numerous iron and steel works, bridge-building works, and manufactures of mining material, machines, safes, cement, chocolate, tobacco, cycles, and furniture. In the town there are also numerous breweries, most of the beer being exported. The history of Dortmund goes back into the earliest middle-age traditions, figuring from the 8th century under the names of *Therotmanni*, *Theromanni*, *Trutmanni*, and *Dormpunde*. Subsequently it became a free Hanse town, but was ceded to Prussia in 1815 at the Congress of Vienna. It still possesses several old churches, and the meeting-place of the Vehmgericht (q.v.) is still pointed out; but since the walls were removed in 1863, the general aspect of the town has become quite modern. Pop. (1890) 89,663; (1919) 295,026.

Dory (*Zeus*), a genus of bony fishes in the mackerel family (Scombridæ). The body is high and laterally compressed; the scales are very small or absent; the dorsal fin bears nine or ten spines; and there are bony plates at the root of the dorsal and anal fins, and on the ventral surface. The best known of the six species is the John Dory (*Z. faber*), found in the Mediterranean and off the



John Dory (*Zeus faber*).

Atlantic coasts of Europe. The name is possibly a corruption of *jaune dorée* (yellow-gilt), which well describes the prevalent yellowish colour and metallic sheen. According, however, to Skeat, the 'John' is merely the ordinary English name (cf. '*jack*-snipe'). The colour is sometimes olive-brown, and there are two dark patches on the sides, which are (as in the haddock) fancifully interpreted as the marks of the apostle Peter's

fingers. Others have referred the marks to St Christopher. The John Dory disputes with the Chimæra the title of 'king of the herrings.' It follows rather than leads shoals of herring and other fishes. The body is greatly compressed, and the numerous bony plates bear spines; the head is very large, and the gape wide; the teeth are feeble; the membrane between the long spines of the dorsal fin is prolonged into beautiful waving filaments. The dory is on the whole sluggish, but feeds voraciously on pilchards, breams, and other fishes, &c. It has been known to attain a length of 22 inches, and a weight of 18 lb. It has for long been greatly esteemed for the table. The other species are widely distributed; one is known in Australian seas. On the British coasts, other fishes, such as the Silver Haddock, are erroneously called by the name.

Dôseh, an Arabic word meaning 'treading,' denotes a remarkable ceremony, which, until its suppression in 1884, used to take place in Cairo annually on the feast of the prophet's birth, in the third month of the Mohammedan year. A party of dervishes of the Sa'di order, to the number of a hundred or more, lay down on their faces, side by side, with their arms doubled under their foreheads. A dozen more ran along upon their comrades' prostrate backs, beating drums, and shouting 'Allah!' Then the sheikh of the order, mounted on a good-sized horse, which ambled with a fine action, rode along upon the line of bodies, from whom audible prayers could be heard proceeding. The horse trod upon each man twice, yet, as the sheikh passed on, those behind rose up apparently unhurt. This has however been disputed, and evidence has been produced of considerable injury inflicted by the iron-shod hoofs. It was in consequence of this that the Khedive Tewfik suppressed this singular religious rite. See Lane, *Modern Egyptians*, xxiv.; Butler, *Court Life in Egypt*.

Dositheus was a Jewish heresiarch of the 1st century A.D., who insisted on a painfully rigorous observance of the Sabbath, and died of excessive fasting.—There was also a grammarian of this name in the 4th century, who wrote a Latin grammar for Greek boys.

Dost Mohammed. See AFGHANISTAN.

Dostoieffsky, or DOSTOEVSKI, FEODOR MIKHAILOVITCH (1818–81), a Russian novelist, was born at Moscow, passed through the imperial school of engineers, and after a short trial of the army adopted literature as a profession. His first story, *Poor Folk* (1846; Eng. trans. 1894), which painted with unsparing truth the condition of the peasantry and the more hopeless state of the poor in the cities, at once drew attention to him and to his views of social conditions. At this period he became involved in the Communist plots of Petrocheffsky, and in 1849 was condemned to death, commuted on the scaffold to penal servitude in Siberia, followed by military service in the ranks for life. After four years' imprisonment and six years' exile he was permitted to return to St Petersburg, where in 1860 he published an account of his prison life. His masterpiece, *Crime and Punishment*, which appeared in 1866, is one of the most powerful and affecting works in the whole range of modern fiction, realistic; strong in its grasp of character and its unshrinking analysis of motive; unique in a magnetic sympathy that impels the reader to identify himself with characters often sordid or repulsive. Some critics account *The Brothers Karamazoff* (though unfinished) his greatest work. Another great work is *The Idiot*, whose hero is, like its author, an epileptic. Dostoieffsky in middle life was harassed by the rapacity of relatives and creditors of a brother whose debts he took upon himself. Latterly he developed Slavophil patriotism, partly reactionary.

A translation of the novels by Mrs Constance Garnett began to appear in 1912. Messrs Middleton Murry and Koteliansky translated *Pages from the Journal of an Author* (1916) and *Letters and Reminiscences* (1923); Miss E. C. Mayne, *Letters to his Family and Friends* (1914). See studies by Brandes (1889), Hoffmann (1899), J. A. T. Lloyd (1912), Middleton Murry (1916, 1923), Lavrin (1920); and Lives by Soloviev (1891; trans. 1916), and his daughter Aimée (trans. 1921).

Dotterel (*Eudromias morinellus*), a kind of plover, known in Britain as a bird of passage, though sometimes breeding at high elevations on the hills. It is widely distributed in Europe, in the north in summer, in the south in winter. A nearly related species (*E. asiatica*) has a similar distribution in Asia. The dotterel is about nine inches and a half in its whole length. In summer plumage, the upper parts are of a brownish-gray colour, the feathers edged with deep red; the cheeks, throat, and a band above the eyes, white; the breast bright rust-colour, with a white patch on the upper part of it, bounded above by a blackish

Dotterel (*Eudromias morinellus*).

line; a conspicuous black patch on the middle of the belly; some of the tail-feathers tipped with white. The winter plumage is much less definite. The bird is proverbial for its tame stupidity; but this is due to its unacquaintance with man's evil intent. It becomes shy and watchful after a little experience. It is much esteemed for the table, and well known in the London market. The name Ring Dotterel is applied to a sandplover frequenting the shore (*Ægialites hiaticula*), which seems to serve as sentinel to dunlins and sandpipers. Both Eudromias and Ægialites were formerly included along with the plovers proper (Charadrius). See PLOVER.

Douai (Roman *Duacum*), a town in the French department of Nord, on the river Scarpe, 21 miles S. of Lille. It is one of the chief military towns in the north of France, was strongly fortified, contains an important arsenal, a cannon foundry, and a school of artillery. It was burned in the Great War (1918). The principal buildings are the churches, the hôtel-de-ville, the public library, the museum, hospital, and artillery barracks. The manufactures include linen thread, leather, bottles, iron machinery; and there is an active trade in corn, seed, and linen. Pop. (1921) 34,131. During the middle ages Douai was a constant bone of contention between the Flemish counts and the French rulers. It passed with the rest of Flanders under the dominion of Spain, but was taken by Louis XIV. in 1667. It was captured by the Duke of Marlborough in June 1710, but on the withdrawal of the

allies was re-occupied by the French, who were confirmed in their possession of it at the Peace of Utrecht.

For more than two centuries Douai was the rallying-point of Roman Catholic exiles from Great Britain. There were several educational and religious houses established in the town in connection with the English and Scottish mission. The English College, the parent and model of similar institutions at Rome, Lisbon, and elsewhere on the Continent, was founded in 1568, the tenth year of Elizabeth's reign, by William, afterwards Cardinal Allen (q.v.), as a house of studies for the English clergy abroad, and as a seminary or nursery for ecclesiastics destined for the English mission. The college was affiliated to the Douai University, which had been founded in 1562 by King Philip II., in whose dominion the town then was. Allen's foundation was supported by pensions from the Spanish king and from the pope. The first batch of four missionaries was sent into England in 1574. Political disturbances led to the migration of the college, in 1578, from Douai to Reims, where it was under the protection of the king of France and the Guises. A colony of students from Reims in 1578 formed the nucleus of a second college at Rome, under the government of the Jesuits; and the two establishments together sent into England, before 1586, about 250 priests, of whom no less than 60 suffered death at the hands of the executioner. The most flourishing period of Allen's college was that of its sojourn at Reims (1578–93), though before the return to Douai it had begun notably to decline. On Allen's appointment as cardinal in 1587, and his consequent removal to Rome, the college was torn with internal dissensions, studies were neglected, and scandals ensued. It was at Reims that the English Roman Catholic version of the Bible was begun by Dr Gregory Martin, with the assistance of Allen, Dr Bristow, and others. The New Testament was printed at Reims in 1582. The Old Testament, also translated by Martin, with notes by Dr Worthington, was not completed and published until 1610 at Douai, and hence the version as a whole is commonly known as the Douai Bible (see BIBLE). Notwithstanding its many troubles the college was able to boast that before its dissolution at the French Revolution it had produced more than 30 bishops and 169 writers, while 160 of its alumni had given their lives on the gallows for the papal cause. An interesting list of the English Catholic books printed at Douai will be found at Duthillœul's *Bibliographie Douaisienne*. It is said that valuable documents from the college archives were made into cartridges by the French revolutionary soldiers. Some few of the manuscripts, however, have found their way into the public library of the town, and others are preserved in the archives of the Roman Catholic archbishopric of Westminster. Among the latter is the greater portion of the college Registers or Diaries, the first two parts of which were published in 1878, the third, fourth, and fifth in 1911.

The members were expelled from the college, and the property confiscated by the French government, 12th October 1793. A small portion of the property which remained unsold was restored to Mr Daniel, the last president, by an ordinance of the French king, dated 25th January 1816. But further claims for compensation under the terms of the treaty of peace were resisted by the British commissioners on the ground that the college was established for objects directly opposed to British law, and was to be regarded as a French rather than an English corporation. This decision on appeal was confirmed by a judgment of Lord Gifford in the Privy-council, 25th November 1825. There is no ground for the common story that the sum claimed was expended by the government in paying off the debts incurred by the Prince of Wales in adorning the Brighton Pavilion. The college buildings were converted into artillery barracks known as Les Grands Anglais.

On their return to England, the masters and students of the college, among whom was Lingard, the historian, laid the foundations of a similar college at Crook Hall, in 1808 transferred to Ushaw, near Durham. Another college at Old Hall, Essex, was established by refugees partly from Douai, and partly from St Omer.

There was also established at Douai a Scots College. This seminary, originally founded at Pont-à-Mousson, in Lorraine, by Dr James Cheyney of Aboyne, in 1576, was assisted by a pension from Queen Mary. After her death it was reduced to great straits, and could count only seven members. In 1594 it moved to Douai, thence to Louvain, and finally was once more transferred to Douai in 1608. Clement VIII. placed it under the administration of the Jesuits. Hippolyte Curle, the son of Mary's secretary, made over to the college by deed of gift a large sum of money, providing, however, that in case of his country's return to the Roman religion, the foundation should be transferred to St Andrews University. Curle became the second rector of the college, and died in 1638. The college was closed in 1793 by the French government, and turned into a prison. It eventually became the mother house of a congregation of nuns devoted to education, called Les Dames de la Sainte Union. The register of the Scots College came into the hands of Sir Maxwell Witham of Kirkconnell (see Hist. MSS. Commission, Report V. and App.), and was printed by the New Spalding Club (1906).

The English Franciscan friars established at Douai a house of their own, which produced some men of reputation for learning and piety. The English Benedictines did the same. There was also a college of Irish ecclesiastics in the town. The Benedictines returned after the Revolution to their old buildings, or to a portion of them. They alone retained a footing at Douai till 1903, when they removed to Woolhampton, near Reading, in consequence of the Associations Law.

A curious tract on the history of Allen's foundation was written by the Rev. Hugh Tootle, *alias* Charles Dodd, under the title of *The History of the English College at Douay, by R. C., Chaplain to an English Regiment that marched in upon its surrendering to the Allies* (Lond. 1713). The *First and Second Douay Diaries* of the English College, Douai, with an historical introduction by T. F. Knox (1878), were edited by the Fathers of the London Oratory, the later diaries by Burton and Williams (1911). Full accounts of the later history will be found in Gillow's *Haydock Papers* (1888). Compare the Abbé Dancoisne's *Histoire des Établissements religieux britanniques fondés à Douai avant la Révolution Française*, and *Le Collège Anglais pendant la Révolution*, by the same author.

Douarnenez, a port in the French department of Finistère, on the Bay of Douarnenez, 8 miles NW. of Quimper by rail. It is important for the sardine-fishery, and has a pop. of 12,000.

Double (Ger. *doppelgänger*), a kind of apparition, a person's own likeness appearing and usually admonishing the beholder of approaching death, a wraith; or simply implying *bilocation*, when the same person is supposed to be seen by others in two places at once. See APPARITION and the works there cited; also Lambertini's *De Beatificatione;* and for a kind of double consciousness, see PERSONALITY. Double is playfully applied to either of

two persons so closely resembling as to be mistaken for each other.

Double Bass (Ital. *contrabasso* or *violone*), the largest stringed instrument of the violin species. Originally it had only three strings, tuned to A, D, G of the bass stave; but as much of the music written for it goes down to E and F below this range, a fourth string is now generally added tuned to E below the bass stave. Playing the fundamental base on which the harmony rests, it is an indispensable part of an orchestra, though it was only in the 19th century that special parts were written for it. Formerly its part was simply to double, an octave below, the ordinary base of the harmony, played by some other instrument, or sung by the bass voice. From this probably arose its name of double bass. Though a powerful and essential orchestral instrument, it, on account of its rough tone and difficulty of management, has not, except in very exceptional circumstances, been used as a solo instrument. Domenico Dragonetti (1755–1846) was an unrivalled performer on the double bass: Koussewitski a modern virtuoso.

Double Flowers. See FLOWERS.

Doubling the Cube was one of three famous problems which were discussed by the early Greek geometers, the other two being the trisection of an angle and the squaring of the circle. There are several theories as to how the duplication problem originated; the statements of the ancients on this point being quite unsatisfactory. The legendary origin, told by Eratosthenes in a letter to Ptolemy Euergetes, was that King Minos, when he learned that the dimensions of a tomb for his son Glaucus were to be 100 feet each way, complained of them as too small, and commanded the tomb to be doubled and the cubical form to be retained. Another legend, also mentioned by Eratosthenes, was that certain Delians, in obedience to an oracle, attempted to double one of the altars, and finding a difficulty in doing so, consulted the geometers who were with Plato at the academy. The duplication of the cube hence came to be called the Delian problem.

In whatever manner the problem originated, it was much older than Plato's time, and the first contribution to the solution of it was made by Hippocrates of Chios. He showed that the solution could be obtained if between two straight lines, the greater of which was double the less, there could be inserted two mean proportionals; and in this modified form the problem was ever afterwards attacked. Solutions were discovered by various geometers, Archytas, Menæchmus, Eratosthenes, Nicomedes, and others, and an account of them will be found in the commentary of Eutocius on Archimedes's treatise *Of the Sphere and Cylinder*. This account is translated into English in the *Proceedings of the Edinburgh Mathematical Society*, vol. iv. pp. 2–17. It is often and inaccurately stated, even in mathematical books, that the duplication of the cube cannot be effected by geometry. The truth is that it cannot be effected by elementary plane geometry, where straight lines and circles are the only lines that are employed. By the use of the conic sections or several other geometrical curves, as well as by mechanical contrivances, the solution can be obtained without much difficulty. Nowadays the problem possesses only an historical interest, except for those persons whom De Morgan calls paradoxers.

Doublings, the heraldic term for the linings of robes or mantles, or of the mantlings of achievements.

Doubloon (Span. *doblón*, 'double'), a gold piece, originally double the value of a pistole, formerly coined in Spain and Spanish America. Prior to 1848 it was worth 64s. 8d. The Doblón de Isabel, coined in 1848, was till 1868 equivalent to 20s. 8d.

Doubs, a department of France, on the eastern frontier, adjoining Switzerland, has an area of 2010 sq. m. Pop. (1876) 306,094; (1886) 310,963; (1901) 296,957; (1921) 285,022. It is traversed by the Doubs (270 miles long), a tributary of the Saône, and is separated, on the NW., from the department of Haute Saône by the Ognon (120 miles), also a tributary of the Saône. The surface is hilly, especially in the SE., where the Jura Mountains reach a height of 4600 feet. The climate is moist and more rigorous than in most similar latitudes. The uplands are sparsely inhabited, but the population of the fertile river valleys is very thick. Agriculture has been notably advanced since 1870; swamps have been drained and waste lands reclaimed, and three-fourths of the entire area is now cultivated or under wood. Wheat and oats are the chief cereals, but the vine and fig-tree also thrive well; and the pasturage is excellent, and rears good breeds of horses and goats. In the valleys great quantities of butter and cheese are produced. Mines of iron are worked, and the manufactures include ironwares, clocks, glass, paper, and pottery. Doubs is divided into the four arrondissements of Besançon, Baume-les-Dames, Montbéliard, and Pontarlier. The capital is Besançon.

Douce, FRANCIS, an eccentric and learned antiquary, born in London in 1757, whose easy circumstances allowed him from an early age to give himself entirely to his favourite studies. He was some time keeper of the MSS. in the British Museum, and died 30th March 1834, bequeathing his splendid collection of books, MSS., prints, and coins to the Bodleian; his curiosities to Sir Samuel R. Meyrick; and his letters and commonplace-books to the British Museum, in a chest not to be opened till 1900. When opened they were found of little interest. The most valuable of his works were his *Illustrations of Shakespeare* (2 vols. 1807) and *The Dance of Death* (1833). He contributed to the *Archæologia* and *Gentleman's Magazine*, edited two books for the Roxburghe Club (1822 and 1824), and assisted in Scott's *Sir Tristram*, J. T. Smith's *Vagabondiniana* (1817), and the edition of Warton's *History of English Poetry* issued in 1824.

Doughty, CHARLES MONTAGU, traveller, prose-writer, and poet, was born at Theberton Hall in Suffolk in 1843, and studied at Gonville and Caius, Cambridge. In 1875 began his two years' journeying in north-western and central Arabia, from Damascus to Hayil, Aneysa, and Jidda—two years of endurance and courage, of perils and the closest of observation, out of which slowly grew his great book. *Travels in Arabia Deserta* (1888) was for long little known; but the few who had access to it—for it was a rare book, not reprinted till 1921—knew it to be more than a classic of travel: it is a classic of prose literature. Artificial it may be in style, and laborious, it is yet austere. In his later works, poetic dramas and epics—*Dawn in Britain* (1906), *Adam Cast Forth* (1908), *The Cliffs* (1909), *The Clouds* (1912), *The Titans* (1916), *Mansoul* (1920; revised 1923)—the artificiality and archaism are more marked. Disciple though he is of Spenser, his verse is hard and compact as rock, strange, uncouth, and gigantic as Stonehenge.

Douglas, the modern capital and principal seaport of the Isle of Man, lies on the margin of a highly picturesque bay, on the east side of the island, 75 miles NW. of Liverpool, 46 W. of Barrow, and 94 NE. of Dublin. From the excellence of the sea-bathing, and its central position, it has

become highly popular as a watering-place. The old town, standing on the south-western edge of the bay, consists of narrow tortuous streets, and presents a vivid contrast to the handsome modern terraces and villas which occupy the rising ground beyond, and the ground facing the north of the bay. The street and charming promenade following the line of the bay is one of its most agreeable features. Conspicuous in the centre of the crescent of the bay stands Castle Mona. The picturesque Tower of Refuge, on a dangerous rock in the southern area of the bay, called Conister, was erected in 1833 for shipwrecked mariners, by Sir William Hillary, who, during his residence at Douglas, founded the Royal National Lifeboat Institution. Pop. (1851) 9880; (1881) 15,719; (1911) 22,192; (1921) 20,192.

Douglas, a small town of Lanarkshire, on Douglas Water, 11 miles SSW. of Lanark. It has decayed from its former importance, though coal, lime, and sandstone are worked in the valley. Of the old kirk of St Bride, the burial-place of the Douglases till 1761, only the choir and a spire remain. Modern Douglas Castle, a seat of the Earl of Home, is nearly a mile from the town. It is a poor successor to Scott's 'Castle Dangerous,' now represented by little more than a tower.—The scene of the 'Douglas tragedy' is Blackhouse Tower, on the Douglas Burn in Yarrow parish, Selkirkshire.

Douglas, The Family of. A legend of the 16th century told how, in the year 770, a Scottish king, whose ranks had been broken by the fierce onset of a Lord of the Isles, saw the tide of battle suddenly turned by an unknown chief; how, when the victory was won, the monarch asked where was his deliverer; how the answer ran in Erse, *Sholto Du-glas* ('Behold that dark-gray man'); and how the warrior was rewarded with that Clydesdale valley which, taking from him its name of Douglas, gave surname to his descendants. This fable has long ceased to be believed. Equal discredit has fallen on the theory which the laborious Chalmers advanced in the *Caledonia*, that the Douglases sprang from a Fleming of the name of Theobald, who, between the years 1147 and 1164, had a grant of lands on the Douglas Water from the Abbot of Kelso. What was boasted of the Douglases by their historian in 1644 still holds true: 'We do not know them in the fountain, but in the stream; not in the root, but in the stem; for we know not who was the first mean man that did by his virtue raise himself above the vulgar.' It was thought likely, in the beginning of the 15th century, that the Douglases and the Murrays had come of the same stock, and in this old and not improbable conjecture all that is known on the subject must still be summed up.

William of Douglas, the first of the family who appears in record, was so called, doubtless, from the wild pastoral dale which he possessed. He is found witnessing charters by the king and the Bishop of Glasgow between 1175 and 1213. He was either the brother or the brother-in-law of Sir Freskin of Murray, and had six sons, of whom Archibald, or Erkenbald, was his heir, and Brice rose to be Bishop of Moray. Sir Archibald is a witness to charters between 1190 and 1232, and attained the rank of knighthood. Sir William of Douglas, apparently the son of Sir Archibald, figures in record from 1240 to 1273. His second son, distinguished in the family traditions as William the Hardy, spoiled the monks of Melrose, and deforced the king's officers in the execution of a judgment in favour of his mother. He was the first man of mark who joined Wallace in the rising against the English in 1297. It appears that he possessed lands in one English, and in seven Scottish counties—Northumberland, Berwick, Edinburgh, Fife, Lanark, Ayr, Dumfries, and Wigtown.

The history of his son, the Good Sir James of Douglas, is familiar to every one, as Bruce's greatest captain in the long War of Independence (see Bruce). The hero of seventy fights, he is said to have won them all but thirteen, leaving the name of 'the Black Douglas'—so he was called from his swarthy complexion—as a word of fear by which English mothers stilled their children. He was slain in Andalusia, in 1330, on his way to the Holy Land with the heart of his royal master. The 'bloody heart' in the Douglas arms commemorates Bruce's dying bequest to him. His son William fell at Halidon Hill; and the next Lord of Douglas, Hugh, brother of Lord James, and a canon of Glasgow, made over the now great domains of the family in 1342 to his nephew Sir William.

Earls of Douglas.—The Douglases had since the time of William the Hardy held the title of Lords of Douglas; but in 1358, Sir William of Douglas, who had fought at Poitiers, was made Earl of Douglas, and by marriage became Earl of Mar. In 1371 he disputed the succession to the Scottish crown with Robert II., claiming as a descendant of the Baliols and Comyns. He died in 1384. His son James, second Earl of Douglas and Mar, the conqueror of Hotspur, fell at Otterburn in 1388; and as he left no legitimate issue, the direct male line of William the Hardy and the Good Sir James now came to an end. His aunt had married for her second husband one of her brother's esquires, James of Sandilands, and through her Lord Torphichen, whose barony was a creation of Queen Mary in 1564, is now the heir general and representative at common law of the House of Douglas.

The earldom of Douglas, meanwhile, was bestowed on an illegitimate son of the Good Sir James—Archibald, Lord of Galloway, surnamed the Grim. By his marriage with the heiress of Bothwell, he added that fair barony to the Douglas domains; and having married his only daughter to the heir-apparent of the Scottish crown, and his eldest son to the eldest daughter of the Scottish king, he died in 1401. His son and successor, Archibald, fourth Earl of Douglas, was, from his many misfortunes in battle, surnamed 'The Tineman,'—i.e. the loser. At Homildon, in 1402, he was wounded in five places, lost an eye, and was taken prisoner by Hotspur. Next year, at Shrewsbury, he felled the English king to the earth, but was again wounded and taken prisoner. Repairing to France, he was there made Duke of Touraine, and fell at Verneuil in 1424. He was succeeded by his son Archibald, who distinguished himself in the French wars, and dying in 1439, was buried in the church of Douglas, where his tomb yet remains, inscribed with his high titles of 'Duke of Touraine, Earl of Douglas and of Longueville, Lord of Galloway, Wigtown, and Annandale, Lieutenant of the King of Scots.' His son and successor, William, a boy of sixteen, is said to have kept a thousand horsemen in his train, to have created knights, and to have affected the pomp of parliaments in his baronial courts. His power and possessions made him an object of fear to the Scottish crown; and, having been decoyed into the castle of Edinburgh by the crafty and unscrupulous Crichton, he was, after a hasty trial, beheaded, along with his brother, within the walls of that castle, in 1440. It was before him that the black bull's head was presented at table, in 'token of death.' His Scottish earldom was bestowed on his grand-uncle (the second son of Archibald the Grim), James, surnamed the Gross, who in 1437 had been made Earl of Avondale. His son William was, for a time, all-powerful with King James II., who made him lieutenant-general of the realm; but afterwards losing the royal favour, he seems to

have entered into a confederacy against the king, by whom he was killed in Stirling Castle in 1452. Leaving no child, he was succeeded by his brother James, who in 1454 made open war against King James II., as the murderer of his brother and kinsman (the sixth and eighth Earls of Douglas). The issue seemed doubtful for a time, but the Hamiltons and others being gained over to the king's side, Douglas fled to England. The struggle was still maintained by his brothers. They were defeated at Arkinholm (where Langholm now stands), in May 1455; and the earldom of Douglas came to an end by forfeiture, after an existence of ninety-eight years, during which it had been held by no fewer than nine lords. The last earl lived many years in England, leagued himself in 1484 with the exiled Duke of Albany, was defeated and taken prisoner at Lochmaben, and died in the abbey of Lindores in April or June 1488. So ended the elder illegitimate line of the Douglases.

Earls of Angus.—Meanwhile a younger and illegitimate branch had been rising to great power. William, first Earl of Douglas, while securing the earldom of Mar, also secured the affections of the young widow of his wife's brother, Margaret Stewart, Countess of Angus and Mar. The issue of this amour was a son, George, who in 1389 had a grant of his mother's earldom of Angus. George, fourth Earl of Angus, took part with the king against the Douglases in 1454; his loyalty was rewarded by a grant of their old inheritance of Douglas-dale and other lands; and so, in the phrase of the time, 'the Red Douglas put down the Black.' The 'Great Earl of Douglas' died in 1462, being succeeded by his son Archibald, surnamed Bell-the-Cat (see James III.), who filled the highest offices in the state, and added largely to the family possessions. He was succeeded by his grandson, Archibald, who in 1514 married the queen-dowager of Scotland, Margaret, sister of Henry VIII. of England, and widow of James IV. of Scotland. The fruit of this marriage was a daughter, Margaret, who, marrying the Earl of Lennox, became the mother of Henry, Lord Darnley, the husband of Queen Mary, and father of James VI. The Earl of Angus had for a time supreme power in Scotland, but in 1528, the young king, James V., escaped from his hands, and sentence of forfeiture was passed against Angus and his kinsmen. On James's death in 1542, Angus was restored to his estates and honours. He was succeeded by his nephew, David, whose son, Archibald, the 'Good Earl,' died without male issue, and the earldom passed to a collateral branch. William Douglas of Glenbervie became ninth Earl of Angus.

Marquises and Duke of Douglas, and Lords Douglas.—William, eleventh Earl of Angus, his grandson, was created Marquis of Douglas in 1633. The third Marquis was created Duke of Douglas in 1703, and died childless in 1761, when his dukedom became extinct, and his marquisate devolved on the Duke of Hamilton, as descended in the male line from William, Earl of Selkirk, third son of the first Marquis of Douglas. His grace's sister, Lady Jane Douglas, born in 1698, and married in 1746 to Sir John Stewart of Grandtully, was said to have given birth at Paris to twin sons in 1748. One of them died in 1753; the other in 1761 was served heir of entail and provision general to the Duke of Douglas. An attempt was made to reduce his service, on the ground that he was not the child of Lady Jane Douglas; but the House of Lords, in 1771, settled the famous *Douglas Cause* by giving final judgment in his favour. He was made a British peer in 1790, by the title of Baron Douglas of Douglas Castle, which became extinct on the death of his son James, fourth Lord Douglas, in 1857, when the estates devolved on the first Lord Douglas's grand-daughter, the Countess of Home.

Earls of Morton.—Sir Andrew of Douglas, who appears in record in 1248, was apparently a younger son of Sir Archibald, or Erkenbald, of Douglas, the second chief of the house. His great-grandson (?), Sir William of Douglas of Liddesdale, the Knight of Liddesdale—as he was called by his contemporaries, who regarded him as 'the flower of chivalry'—was assassinated in 1353 by his kinsman, William, first Earl of Douglas. The grandson of his nephew, the scholarly and princely Sir James of Douglas of Dalkeith, married a daughter of King James I., and in 1458 was created Earl of Morton. His grandson, the third earl, dying without male issue in 1553, the earldom devolved on his youngest daughter's husband, the Regent Morton—James Douglas, great-grandson of Archibald Bell-the-Cat (see Morton). Aberdour and some other old domains of the family still remain with his successor, the Earl of Morton, who, there is every reason to believe, descends legitimately in the male line from William of Douglas, the great progenitor of the race in the 12th century.

James, second Earl of Douglas and Mar—the hero of Otterburn—had an illegitimate son, Sir William Douglas of Drumlanrig, whose descendants were created Viscounts of Drumlanrig in 1628, Earls of Queensberry in 1633, Marquises of Queensberry in 1681, Dukes of Queensberry in 1683, Earls of March in 1697, and Earls of Solway in 1706. On the death of the fourth Duke of Queensberry in 1810, that title went to the Duke of Buccleuch; the title of Marquis of Queensberry went to the heir male of the family, Sir Charles Douglas of Kelhead; and the title of Earl of March went to the Earl of Wemyss.

In 1646 the third son of the first Marquis of Douglas was created Earl of Selkirk. In 1651 the eldest son of the same marquis was created Earl of Ormond, and in 1661 Earl of Forfar. In 1675 the fourth son of the same marquis was created Earl of Dumbarton. In 1641 the second son of the tenth Earl of Angus was created Lord Mordington. In 1633 Sir Robert Douglas of Spott, a descendant of the Morton family, was created Viscount of Belhaven. Of all these titles, that of the Earl of Selkirk belonging since 1885 to the Duke of Hamilton, and that of Earl of Belhaven, survive; the others are dormant or extinct.

See the *History of the Houses of Douglas and Angus*, by David Hume of Godscroft (1644, 1 vol. fol.; reprinted in 1748; extended from his *Origin and Descent of the Family of Douglas*, c. 1633); the *Douglas Book*, by Sir W. Fraser (from family muniments, 4 vols. 1885); and Sir H. Maxwell, *History of the House of Douglas* (2 vols. 1902).

Douglas, David (1798–1834), botanist and traveller, born at Scone, became a gardener, collected in North America, discovered and introduced many plants, including the Douglas fir (*Tsuga*, or *Pseudotsuga*, *Douglasii*), and was killed by a wild bull in a pitfall in Hawaii. See his *Journal* (1915).

Douglas, Gawain or Gavin, the poet-bishop, the third son of Archibald 'Bell-the-Cat,' fifth Earl of Angus, was born at Tantallon Castle about 1474. He was educated at St Andrews for the priesthood, and in 1496 was first presented to Monymusk, Aberdeenshire, but ere long was appointed to Prestonkirk, near Dunbar, then called Hauch or Prestonhaugh. In 1501 he was made dean or provost of St Giles, Edinburgh, and while holding these preferments he wrote all his poems. From the marriage of his nephew, the sixth Earl of Angus, to the widowed queen of James IV., Douglas expected rapid preferment; but the jealousy of the nobility and the Regent Albany was such that he was disappointed of the abbacy

of Aberbrothock and the archbishopric of St Andrews, and when, through the influence of the queen, he had obtained the bishopric of Dunkeld directly from the pope (January 1515), he was imprisoned on an old statute for receiving bulls from the pope, and not allowed to be consecrated until more than a year after. On the fall of the party of Angus, after the queen, stung by his ill-treatment, had flung herself into the arms of Albany and determined on a divorce, the bishop fled to England to obtain the aid of Henry VIII., but was suddenly cut off at London by the plague in 1522, and buried in the hospital church of the Savoy. The extant poems attributed to Douglas are *The Palice of Honour*, most likely written in 1501, an allegory of the life of the virtuous man; a translation of the *Æneid*, with prologues; and *King Hart*, an allegory of the human heart in its struggle with the temptations of the flesh, of disputed authorship, not printed apparently till it appeared in Pinkerton's *Ancient Scottish Poems* (1786). There is also a short poem entitled *Conscience*, whose beauties are sadly marred by excessive conceits. Throughout his verse Douglas shows his deep indebtedness to Chaucer, but his youthful exuberance of ornament, his sense for colour and splendour, and the vigour of his 'braid and plane' Scots dialect, are his own. His *Æneid*, which he finished most likely about 1513, was the first version of a Latin classic published in English; it remains to Gawain Douglas no small achievement in the history of English literature, that 'in a barbarous age he gave rude Scotland Virgil's page.' His collected works were edited by Dr John Small (4 vols. Edin. 1874). See also histories of literature by J. M. Ross (1884), T. F. Henderson (1898), J. H. Millar (1903), and others, and G. Gregory Smith, *The Transition Period* (1900).

Douglas, Sir Howard, Bart., G.C.B., son of Admiral Sir C. Douglas, was born at Gosport in 1776, and served in Canada (1795) and in two Peninsular campaigns, being present at Corunna. He was successively governor of New Brunswick (1823–29), where he founded the university of Fredericton, of which he was the first chancellor, Lord High Commissioner of the Ionian Islands (1835–40), and M.P. for Liverpool (1842–46). He wrote several treatises accepted as authoritative at the time, among which are *An Essay on Military Bridges* (1816), which is said to have given Telford the idea of the suspension principle; a treatise on *Naval Gunnery* (1819; 5th ed. 1860, reproduced in America, France, and Spain); *Observations on Carnot's Fortification;* a work on the value of the British North American provinces (1831); and *Naval Evolutions* (1832). He died 9th November 1861. See Life by S. W. Fullom (1862).

Douglas, John, Bishop of Salisbury, the son of a shopkeeper of Pittenweem, Fifeshire, was born 14th July 1721. He was educated at Dunbar and Oxford, ordained deacon in 1744, and as an army chaplain was at the battle of Fontenoy (1745). His after-life is little more than a chronicle of his very numerous preferments, which ended in his translation to the see of Salisbury in 1791. He died 18th May 1807. Douglas only occasionally resided on his livings. He generally spent the winter months in London, and the summer months at the fashionable watering-places, in the society of the Earl of Bath, who was his great patron. He wrote much, mainly controversial: defending Milton from Lauder's charge of plagiarism (1750), writing on miracles (1754) against Hume, attacks on the Hutchinsonians, and political pamphlets. See his *Miscellaneous Works* (with Life, 1820).

Douglas, Norman, a distinguished prose-writer, scholarly, vivacious, wayward, and delicately brutal, has written baffling novels: *South Wind* (1917), *They Went* (1920); unconventional travel books: *Siren Land* (1911), *Fountains in the Sand* (1912), *Old Calabria* (1919), *Alone* (1921), *Together* (1923; giving reminiscences of boyhood in Tyrol); and *Experiments: A Miscellany* (1925).

Douglas, Sir Robert (1694–1770), a Scottish baronet, author of a *Peerage of Scotland* (1764); completed by Wood (2 vols. 1813). A new edition—substantially a new work on a larger scale and on a more critical method—was edited by Sir James Balfour Paul, Lyon King, in 1904–14.

Douglas, Stephen Arnold, born at Brandon, Vermont, in 1813, practised law in Illinois, and was successively attorney-general of this state, member of the legislature, secretary of state (1840), and judge of the supreme court (1841). He was returned to congress in 1843–44–46, and to the United States senate in 1847–52–58. In the lower house he advocated the annexation of Texas, and of Oregon up to 54° 40′ N. lat., and favoured the war with Mexico, and in the senate he opposed the ratification of the Clayton-Bulwer Treaty, and declared himself in favour of the acquisition of Cuba, his desire being to 'make the United States an ocean-bound republic.' On the question of slavery he maintained that the people of each territory should decide whether it should be a free state or a slave state; this was known as the doctrine of 'popular' or 'squatter sovereignty.' In 1860 he received the regular Democratic nomination for the presidency, the seceding delegates nominating John C. Breckinridge. Douglas obtained 12 electoral and 1,375,157 popular votes, as against 180 electoral and 1,866,352 popular votes cast for Lincoln, to whom, in the early days of the rebellion, he gave an unfaltering support. He died 3d June 1861, at Chicago, where an imposing monument, surmounted by a statue, has been erected. See books by Sheehan (New York, 1860), Flint (Phila. 1860), Allen Johnson (1908), Willis (1910), and *Political Debates* (1913).

Douglas, Sir William Fettes, P.R.S.A., was born at Edinburgh, 29th March 1822. He studied in the university there, and was for several years engaged in business. As a painter he was mainly self taught, though he attended the Trustees' Academy for a short time. At first he practised chiefly as a landscape painter, but he soon turned to figure-subjects, producing works distinguished by excellent colouring, and by especially firm, careful, and refined handling. His later years were entirely devoted to landscape water-colours. He was elected A.R.S.A. in 1851, R.S.A. in 1854, and P.R.S.A. in 1882. He died 20th July 1891.

Douglass, Frederick, an American orator, was born at Tuckahoe, near Easton, Maryland, in 1817, his father being a white man, his mother a negro slave. Permitted to work in a shipyard in Baltimore, he in 1838 escaped to New York, and thence to New Bedford, Massachusetts, where his negro employer, who had just read Scott's *Lady of the Lake*, induced him to substitute Douglass for the name of Bailey, conferred on him by his mother. In 1841 he attended an Anti-slavery Convention at Nantucket, and spoke so eloquently on the subject of slavery that he was employed as agent of the Massachusetts Anti-slavery Society, and lectured for four years with great success. In 1845 he commenced a lecturing tour in Great Britain, where a contribution of £150 was made to buy his freedom. Returning to America, he established in 1847 *Frederick Douglass's Paper*, a weekly abolition newspaper at Rochester, New York. Successively

assistant-secretary to the Santo Domingo Commission (1871), marshal and recorder for D.C., and minister to Hayti (1889–90), he died in 1895. See his autobiography (1882), and Lives by Holland (1891), Chesnutt (1899), and Booker Washington (1907).

Doukhobors. See DUKHOBORTZI.

Doulton, SIR HENRY, the head of the famous firm of Lambeth potters, was born at Lambeth, 24th July 1820, and on attaining his fifteenth year entered his father's establishment there. He devoted himself to the most technical branch of the industry, and worked for many years at the potter's wheel. In 1846 he began the manufacture of stoneware pipes for sewage and drainage, for which a special factory was erected near Lambeth Palace, and thus initiated the substitution of impervious pipes for the old flat-bottomed brick drains, with their gaping joints; in 1848 drain-pipe works, which became the largest in the world, were started at Rowley Regis, near Dudley. Sir Henry Doulton, however, is chiefly noteworthy as having been mainly instrumental in bringing about the revival in art pottery which has since spread into every civilised country; and his firm's works in art stoneware, silicon, impasto, terra-cotta, faience, and Doulton wares, have since 1870 excited the admiration of critics. Created a Chevalier of the Legion of Honour (1878), and knighted (1887), he died 17th November 1897. See POTTERY.

Doumic, RENÉ, French man of letters, critic, and journalist, born in Paris in 1860, was educated at the École Normale, and taught rhetoric at the Collège Stanislas. A contributor to the *Moniteur*, the *Journal des Débats*, and the *Revue Bleue*, he is most notable as a member of the staff of the *Revue des Deux Mondes*, of which he became editor. He is author of a number of works in literary history, biography, and criticism. He was admitted to the Academy in 1909.

Doum Palm. See DUM PALM.

Doune, a village of Perthshire, on the Teith, 9 miles NW. of Stirling by rail. Pop. 900. Doune Castle, built by Murdoch, Duke of Albany, in the early part of the 15th century, is now a magnificent and well-preserved ruin. It is described in Scott's *Waverley*, and was reduced to ruins by Hawley's dragoons in 1746. A mile to the west is Deanston, with its cotton-mills, long managed by James Smith (1789–1850), notable as an inventor, as the promoter of 'deep draining and thorough ploughing,' and as a philanthropist.

Douro (Span. *Duero*), one of the largest rivers of Spain and Portugal, rises in the Pico de Urbión (7369 feet), in Old Castile, about 30 miles NW. of Soria (3445 feet above sea-level). From its source it flows south-east to Soria, then winds towards the west, and pursues a general westward direction till it reaches the Portuguese border, when it flows south-west for about 60 miles, forming the boundary between Spain and Portugal, and then flows west through Portugal, entering the Atlantic below Oporto. Its Portuguese tributaries are comparatively small. Of its 490 miles, 90 are navigable.

Douw. See DOW.

Dove, a river rising 4 miles SW. of Buxton, and flowing south and south-east along the borders of Derbyshire and Staffordshire to the Trent, which it enters at Newton Solney, after a course of 45 miles. It was the favourite fishing stream of Izaak Walton, who lived here with his friend, Charles Cotton; and it is still beloved of anglers. —DOVEDALE is a romantic glen, forming the course of the 'princess of rivers' for 3 miles, between Thorpe Mill and Mill Dale, below Alstonfield. It is hemmed in by fantastic walls of limestone rock, and presents a series of fairy-like combinations of rock and wood and water.

Dove. See PIGEON, TURTLE-DOVE.

Dove. In Christian art, as early as the 6th century, the dove was employed as an emblem of the Holy Ghost, of course from the words of Luke, iii. 22, which do not, however, state that the Spirit descended on our Lord at his baptism in the bodily form of a dove, but simply 'in a bodily form, as a dove'—i.e. with the fluttering motion of a dove. From the dove being also used to symbolise purity, it is generally represented white, with its beak and claws red, as they occur in nature. In the older pictures, a golden nimbus surrounds its head; the nimbus being frequently divided by a cross, either red or black. In stained glass windows we see the dove with seven rays proceeding from it, terminating in seven stars, significative of the seven gifts of the Holy Spirit. Holding an olive branch, the dove is an emblem of peace. When seen issuing from the lips of dying saints and martyrs, it represents the human soul purified by suffering. A dove with six wings is a type of the Church of Christ; and when so employed it has the breast and belly of silver, and the back of gold, two wings being attached to the head, two to the shoulders, and two to the feet. The pyx containing the host was sometimes made in the form of a dove, and suspended over the altar; and the dove is often placed on the covers of fonts. In this position it may still be seen in some parish churches in England.

Do've, HEINRICH WILHELM, physicist and meteorologist, was born in 1803, at Liegnitz, in Silesia, studied at Breslau and Berlin, and in 1845 became professor of Natural Philosophy at Berlin, where he died, 4th April 1879. He laboured successfully in many fields of science, especially optics and electricity; but his greatest services were rendered to meteorology, which he did much to establish on a scientific basis. He was from 1848 director of the Royal Meteorological Institute, with over eighty stations. To him is due, amongst a great variety of optical discoveries, the application of the stereoscope to the detection of forged banknotes. Dove was a voluminous writer; his treatise on the *Distribution of Heat on the Surface of the Globe* was published in 1853 by the British Association, and his notable *Das Gesetz der Stürme* (4th ed. 1874) has also been translated.

Dovecot. The right of erecting and keeping dovecots was in England formerly a privilege of manors, and was rigorously protected by law; but such exceptional privileges have long been abolished. It is enacted by the Scottish statute 1617, chap. 19, still in observance, that no person shall build a dovecot or pigeon-house, either in town or country, unless he be possessed of lands or teinds of the yearly value of ten chalders of victual, lying within at least two miles of it. No person having such qualification shall build more than one dovecot within the 'bounds foresaid.' Dovecot breakers are guilty of theft; and under a rigorous Act of 1579, a third offence of dovecot breaking was capitally punishable. See Rankine *On Landownership*, p. 146 (4th ed. 1909).

Dovekie. See ROTCHE.

Dover, a Cinque Port and municipal (till 1918 parliamentary) borough in the east of Kent, 66 miles ESE. of London, is not only a charmingly situated watering-place, but, being the nearest point of the English coast to France, is a seaport of growing importance, with mail service to Calais and Ostend. In 1891 parliament sanctioned great harbour works—the Admiralty pier (dating partly from 1844) being extended, and a new east pier built so as to enclose a commercial harbour of 36 acres. To the east of this a National Harbour of

610 acres was made in 1897–1909. The fortifications comprise Dover Castle, which occupies a commanding position on the chalk cliffs, 375 feet above the level of the sea, and still includes some of the old Saxon and Norman work; Fort Burgoyne on the north side of the town, Archcliffe Fort to the west, and the batteries on the Western Heights. There are also the remains of a Roman pharos or lighthouse, and of a Romano-British church (restored). Dover has a town-hall, a museum, a hospital, great barracks, and a large number of churches. The Duke of York's Royal Military School was removed from London to Dover in 1907. The town is chiefly dependent on its shipping trade and its attractions as a watering-place, but shipbuilding and sail and rope making are carried on, and there are also flour and paper mills. Coal is mined near Shakespeare Cliff. Formerly it returned two members to parliament, in 1885–1918 but one. Pop. (1881) 28,486; (1921) 39,985. Dover is well sheltered by the cliffs, and ends landward in a charming valley leading to what is known as 'The Garden of Kent.' By the Romans it was known as *Portus Duris;* the Normans called it Dovere; the French, Douvres; whilst in legal documents of this day the town is Dovar, all four terms being variations of the Celtic word 'Dour,' the name of the small river which runs through the town. Fortified and walled by William the Conqueror, during whose reign it was nearly burned down, noted as the place of King John's submission to the pope, besieged by the French, held during the Civil War by the parliamentarians, threatened by the first Napoleon, and celebrated as the headquarters of the Lord Wardens of the Cinque Ports (see CINQUE PORTS), and the base for the defence of the Straits in the Great War, Dover holds a distinguished place in English history. Submarine cables connect it with the Continent, and here is the entrance to the proposed Channel Tunnel (q.v.).

Dover, (1) the capital of Delaware, U.S.A., on Jones's Creek, 48 miles S. of Wilmington. It has a state-house, and several canning and other factories. Pop. 4000.—(2) The oldest city of New Hampshire, founded in 1623, is situated on the Cocheco River, 68 miles N. by E. of Boston by rail, and has large cotton-mills, besides manufactures of boots and shoes, woollens, and iron. Pop. 13,000.

Dover, ROBERT (1575–1641), a Warwickshire attorney, founded and for near forty years directed the 'Cotswold games' (see ATHLETIC SPORTS).

Dover, STRAIT OF (Fr. *Pas de Calais*), the channel between England and France, connecting the English Channel and the North Sea, whose tides meet here. It is 18 to 25 miles broad, and 6 to 29 fathoms deep. On 24th August 1875, Captain Webb swam from Dover to Calais in 21¾ hours. Blériot, on 25th July 1909, was the first to fly across. See CHANNEL (ENGLISH).

Dovercourt. See HARWICH.

Doveron. See DEVERON.

Dover's Powder was first prescribed by Thomas Dover, M.D. (1660–1742), who in 1709, whilst captain of a privateer, took Alexander Selkirk off from Juan Fernández. The powder was prepared by mixing powdered ipecacuanha root, 1 part; powdered opium, 1 part; and sulphate of potash, 8 parts. The whole was thoroughly mixed, and the ordinary dose was from 5 to 10 grains. Occasionally, saltpetre was added. It is a most valuable medicine, and acts as a sudorific, increasing the proportion of sweat. In feverish conditions, where there is dry furred tongue, and dry skin, and the brain out of order, Dover's powder is reckoned injurious; but where the tongue is moist and soft, the skin moist and soft, and the brain comparatively unaffected, it is of great service. In heartburn 3 to 4 grains will often give relief.

Dovrefjeld, part of the mountainous plateau of Norway, connecting the Kiölen Mountains with the Jotun Fjelde, lies between 63° and 62° 40′ N. lat. The average elevation ranges from 2650 to 3600 feet; the highest point is Snehætten, 7566 feet. The main railway from Christiania to Trondhjem by Gudbrandsdal (opened 1921) crosses the Dovrefjeld (at Hjerkin) by a pass 3334 feet above sea-level.

Dow, or DOU, GERARD, Dutch *genre*-painter, was born at Leyden on 7th April 1613. He studied under Bartolomeus Dolendo, an engraver, and Pieter Kouwenhoven, a glass-painter, and at the age of fifteen entered the school of Rembrandt. The influence of the last-named master is very visible in his Arundell picture of a scene from the life of Tobit. At first he mainly occupied himself with portraiture, but he soon turned to *genre*, treating, with extreme care, familiar subjects, small in scale, with few figures, and with little dramatic action. The most insignificant incidents of daily life were precious to Dow, and were delineated with the utmost delicacy, neatness, and care. The richness, transparency, vigour, and harmony of his colouring are beyond all praise, but his touch is minute, his way of work a little trivial, and wanting in the largeness and breadth which distinguish the productions of the greater *genre*-painters of Holland. His works, of which about 200 have been catalogued, are in all the great European collections. His own portrait, that of his wife, and 'The Poulterer's Shop,' are in the National Gallery, London; his celebrated 'Dropsical Woman' (1663) is in the Louvre, along with ten other examples of his art; the Amsterdam Museum contains five of his works, and the Dresden Gallery no fewer than sixteen. Dow died at Leyden in 1675. See a book by Martin (trans. 1908).

Dowager (Old Fr. *douagere*, from *douage*, 'dowry'), a widow with a dower; but commonly the title is applied only to the widows of persons of high rank. For queen-dowager, see QUEEN.

Dowden, EDWARD (1843–1913), was born in Cork, and was educated at Trinity College, Dublin, where his course was remarkably distinguished. In 1867 he became professor of Oratory and of English Literature at Dublin University. Dowden contributed many able articles to the leading magazines, and proved himself a profound Shakespearian, and a critic of uncommon insight and capacity, by his *Shakspere: A Study of his Mind and Art* (1875), the invaluable Shakespeare primer (1877), *Studies in Literature: 1789–1877* (1878), *Southey* (1879), and *Transcripts and Studies* (1888). In 1876 he published poems, in 1881 an edition of Shakespeare's *Sonnets* and *The Correspondence of Southey and Caroline Bowles,* in 1886 his authoritative *Life of Shelley,* and in 1904 his *Browning;* besides several volumes of *Studies, A History of French Literature,* and editions of Shelley, Wordsworth, Southey, &c. He contributed important articles to *Chambers's Encyclopædia. A Woman's Reliquary* (poems, 1913) and *Fragments from Old Letters* (1914) were posthumous.

Dower. See HUSBAND AND WIFE, JOINTURE.

Dowie, JOHN ALEXANDER (1847–1907), born at Edinburgh, was a Congregational minister in Sydney, but becoming a faith healer and calling himself 'Elijah the Restorer,' founded in Illinois a prosperous industrial and banking community called 'Zion City.' Charged with advocating polygamy, he was in 1906 deposed from the leadership of the Zionist Church.

Dowlais. See MERTHYR-TYDVIL.

Dowland, JOHN (*c.* 1563–*c.* 1626), composer, was lutanist at the Danish (1598) and English (1612) courts, travelled much, and wrote songs and lute music. See his three *Books of Airs* (ed. E. W. Fellowes, 1921 *et seq.*).

Dowlas, a coarse, strong, unbleached linen, used for joiners' aprons, and in some districts for sheets and pillow-cases, and even for workpeople's shirts; but it is falling out of use.

Dowlatabad. See DAULATABAD.

Down, the Kentish home of Darwin (q.v.).

Down, a maritime county of Ireland, in the south-east of the province of Ulster, 50 miles long (NE. to SW.) and 35 broad (NW. and SE.). Area, 609,239 acres; pop. (1841) 368,143; (1881) 272,107; (1911) 304,589. It has a coast-line of 67 miles, or 139, counting inlets and islets. It has four spacious inlets: Belfast Lough, Strangford Lough, Dundrum and Carlingford Bays. The Mourne Mountains cover 90 sq. m. in the south, and rise in Slieve Donard to 2796 feet. The other parts of County Down are mostly undulating and hilly, with plains and fine meadows along the rivers. The chief rivers are the Upper Bann and the Lagan. The Newry Canal admits vessels of 50 tons, and with the Ulster Canal opens communication through almost all Ulster. Nearly one-half of the entire area is under crop, mostly oats, potatoes, turnips, wheat, flax, and barley. Many pigs, horses, and cattle are reared for export. The chief manufacture is linen, especially the finer fabrics, as muslin, woven in the houses of the small farmers, but hosiery, leather, salt, thread, and woollens are also made; and these, with corn, butter, pork, and hides, are the chief exports. Down is among the best cultivated of the Irish counties, and has more resident gentry (almost all Protestants, of English and Scottish descent) than any other Ulster county. Of its population, some 39 per cent. are Presbyterians, and about 31 per cent. Roman Catholics, while about 22 per cent. are Episcopalians. It sends two members to Westminster and eight to Belfast. Newry was a parliamentary borough till 1918. The chief towns are Downpatrick, Newry, Newtownards, Banbridge, Lisburn, Holywood, Donaghadee (with part of Belfast till 1898). County Down contains many ancient remains, as raths, round towers, castles, and abbeys. On the top of Slieve Croob (1755 feet) are twenty-three stone cairns, one being 54 feet high. See Alex. Knox, *History of County Down* (Dublin, 1875).

Downham Market, an urban district of Norfolk, on the right bank of the Ouse, in a flat fen country, 10 miles S. by W. of Lynn; pop. 3500.

Downing Street, a short street in Whitehall (named after Sir George Downing, secretary to the Treasury in 1667), where are the Colonial and Foreign Offices, with the official residence since 1735 of the First Lord of the Treasury. Here cabinet councils are held, hence the term is sometimes employed for the government in office.

Downpatrick, or simply DOWN, the capital of County Down, situated near the influx of the Quoyle into the south-west end of Lough Strangford, 27 miles SE. of Belfast, and 140 NNE. of Dublin by rail. Downpatrick takes its name from St Patrick, and is the seat of the diocese of Down, which was united with that of Dromore in 1842. It returned a member to parliament till 1885. Vessels of 100 tons reach the quay a mile from Downpatrick. Its chief manufacture is sewed muslin. Pop. 3200.

Downs (from the root *dun*, 'a hill,' borrowed by Teutonic languages from Celtic, seen also in Fr. *dune*), a term applied, like *denes* in Norfolk, to hillocks of sand thrown up by the sea or the wind along the sea-coast (see DUNES, DRIFT). It is also a general name for any undulating tract of upland too light for cultivation, and covered with short grass. It is specially applied to two broad ridges of undulating hills south of the Thames, beginning in the middle of Hampshire, and running eastward, the one (the North Downs) through the middle of Surrey and Kent to Dover (about 120 miles), and the other (the South Downs) through the south-east of Hampshire and near the Sussex coast to Beachy Head (about 80 miles). Between the two ranges lies the valley of the Weald, from which the chalk strata have been removed by denudation. Towards the Weald, the descent from both Downs is rapid, and presents cliffs as of a sea-margin; while the opposite slopes are gradual. The highest point of the North Downs is Inkpen Hill (1011 feet); and of the South Downs, Butser Hill (889 feet). These uplands are covered with fine short pasture, which, from its aromatic quality, forms excellent feeding-ground for the famous Southdown sheep.

Downs, THE, a roadstead for shipping off the east coast of Kent, opposite Ramsgate and Deal, between North and South Foreland, and protected externally by the Goodwin Sands—a natural breakwater with 1 to 4 fathoms water, and often partly dry at low tide. This large natural harbour of refuge is 8 miles by 6, with an anchorage of 4 to 12 fathoms. It is unsafe only in south winds. The Small Downs, an appendage of the Downs proper, lies inside the Brake Sand, has from 2½ to 5 fathoms water, and is about 2 miles wide. The obstinate but indecisive battle of the Downs was fought in June 1666, between the English under Monk, and the Dutch under De Ruyter, De Witt, and Van Tromp. See also BLAKE (ROBERT).

Downton, a town of Wiltshire, on the right bank of the Avon, here split into three branches, 6 miles SSE. of Salisbury. It has an Early English market-cross, a cruciform church, and a singular earthwork (the Moot); whilst 2 miles north is Trafalgar House, presented in 1814 by the nation to Lord Nelson's brother and successor. For the agricultural college (1880), see AGRICULTURE.

Dowsing. See DIVINING ROD.

Dowson, ERNEST (1867–1900), poet, studied at Oxford, lived much in France, frequented low haunts, drank, and died before his time. He wrote a couple of novels and some short stories, but will live by his delicately finished poems (collected, with memoir by Arthur Symons, 1900).

Doxology (Gr., 'a praising'), an exclamation or prayer in honour of the majesty of God, such as Paul uses at the close of his epistles, and sometimes even in the middle of an argument (Rom. ix. 5). The hymn of the angels (Luke, ii. 14) is also called a doxology by the Christian church; so likewise are the close of the 'Lord's Prayer' and the 'Trisagion' ('Holy, holy, holy'). The so-called 'Greater Doxology,' which is simply an expansion of the angelic hymn, in the Roman liturgy is placed immediately after the beginning of the Mass, and in the English Prayer-book at the close of the communion office. It commences with the words, *Gloria in excelsis Deo* ('Glory to God in the highest'). The Lesser Doxology, 'Glory be to the Father, and to the Son, and to the Holy Ghost, as it was,' &c., is repeated at the end of each psalm in the service of the Roman and Anglican churches. The Greater Doxology is of Eastern origin, and is first met with, though not in its final form, in the seventh book of the Apostolic Constitutions (q.v.), where it is described as the 'morning prayer;' but it is probable that this, as well as the Lesser Doxology and the 'Trisagion,' came into use at a much earlier date, as the Scriptures began to circulate among the churches, the 'Trisagion' (cf.

Isa. vi. 3) being presumably the earliest. The origin of the Lesser Doxology (perhaps traceable to Matt. xxviii. 19) is the most obscure, and it is only certain that its present form is the result of the Arian controversy, the second clause having been unknown in Christendom for several centuries.

Doyle, Sir Francis Hastings, poet, was born at Nunappleton, near Tadcaster, August 22, 1810. He was educated at Eton, and Christ Church, Oxford, and took a first-class in classics in 1831. He was called to the bar, but his devotion to poetry and his innate love of horses and horse-racing were hardly consistent with success as a barrister. He succeeded his father as second baronet in 1839, held lucrative offices in the Customs, and filled for ten years (1867–77) the chair of Poetry at Oxford, together with an All Souls' fellowship. In 1886 he published his *Reminiscences and Opinions, 1813–1885*, which revealed its author's genial humour, broad sympathies, and liberal culture. Doyle died June 8, 1888. His two series of Oxford lectures he published in 1869 and in 1877; his volumes of verse were *Miscellaneous Verses* (1841), *Two Destinies* (1844), and the *Return of the Guards, and other Poems* (1866). By his 'Birkenhead,' 'The Private of the Buffs,' 'The Red Thread of Honour,' 'The Saving of the Colours,' and 'Gordon,' he made himself in an especial sense the laureate of English heroism.

Doyle, Richard, caricaturist, was born in London in 1824, second son of John Doyle (1797–1868), who was himself a celebrated caricaturist, under the signature H. B. He received instruction in art from his father, and became a contributor to *Punch*, the current design on the cover being from his pencil, and furnished its pages with the well-known sketches of 'Ye Manners and Customs of ye Englyshe.' In 1850 his connection with *Punch* ceased, owing to its criticisms of the Roman Catholic Church, of which he was a member, and he afterwards employed himself in the illustration of books. Among his works of this nature may be mentioned the *Adventures of Brown, Jones, and Robinson*, and the illustrations to the *Newcomes*, the *Scouring of the White Horse*, to Leigh Hunt's *Jar of Honey*, and Ruskin's *King of the Golden River*. He contributed 'Sketches of Modern Society' to the *Cornhill Magazine*, and published a Christmas book for 1869, called *In Fairy Land*. Doyle drew with care, accuracy, and skill thousands of animated little figures, and his caricatures are all distinguished by the most genial humour, and the most graceful drawing. He was also a clever painter in water-colours, and his work in this medium was frequently exhibited at the Grosvenor Gallery. He died December 11, 1883.

His nephew, Sir A. Conan Doyle, was born at Edinburgh in 1859, and educated at Stonyhurst and in Germany. He studied medicine at Edinburgh in 1876–80, and practised as a doctor at Southsea in 1882–90, subsequently devoting himself wholly to literature. His *début* was an article in *Chambers's Journal* in 1879; and *The Captain of the Polestar* (1887), *A Study in Scarlet* (1888), *The Mystery of Cloomber* (1888), *Micah Clarke* (1889), and *The White Company* (1891) were early stories. But it was by the preternatural acumen of the hero of his detective stories, *The Adventures of Sherlock Holmes* and *The Memoirs of Sherlock Holmes* (originally in the *Strand Magazine;* as books, 1892 and 1893), that Conan Doyle became known to a very wide circle of readers. Later works are *The Refugees*, *The Red Lamp*, *The Stark-Munro Letters* (1895), and *Rodney Stone* (1896); a play, *A Story of Waterloo; The Great Boer War* (1900), incorporating his experiences as a surgeon in the field; books on the Great War and on spiritualism. He contested Central Edinburgh (1900) and Hawick burghs (1905) as a Unionist.

Dozy, Reinhart, a learned Orientalist, was born 21st February 1820, at Leyden, and studied there. In 1844 he obtained a post in the library, and in 1850 he was appointed extraordinary, and in 1857 ordinary, professor of History at Leyden. He died 29th April 1883. His *Histoire des Musulmans d'Espagne* (1861; Eng. trans. 1913) is a model of what a history should be. His earlier *Recherches* on Spain in the middle ages (1849; 3d ed. 1881) exposed the wilful corruptions of the monkish chroniclers, and destroyed many popular illusions based upon the Poem and Chronicle of the Cid. Other publications are the *Historia Abbadidarum* (1852), and editions of Al-Marrakushi, Ibn-Badrun, Ibn-Adhari, Al-Makkari, and with De Goeje, of Edrisi (q.v.); a supplement to Arab dictionaries (2 vols. 1877–81); *Het Islamisme* (1863; French trans. 1879); *De Israëliten te Mekka* (1864); and a work (1884) on the religion of the Harranians.

Dracæna. See Dragon-tree.

Drachenfels ('Dragon's Rock'), a peak of the range called the Siebengebirge, on the right bank of the Rhine, 8 miles SE. of Bonn, and has an elevation of 1056 feet. Its top, which commands a glorious prospect, may be gained by a mountain railway (1883).

Drachma, Drachm, Dram. The drachma was a silver coin, the unit of the money-system in ancient Greece. It varied in value in different parts of Greece and at different times, but always remained the 6000th part of the talent, and the 100th part of the mina, and was divided into six obols. The Attic drachma is estimated as equivalent to 9¾d. of our money—very nearly a French franc. The drachma (originally 'a handful') was also the name of a weight, and 100 drachmas made a mina (nearly 1 lb.) in weight, as in money. The unit in the monetary system of modern Greece, since 1833, is also called a drachma, which is divided into 100 lepta. In 1868 Greece entered the Latin Monetary Union, and the drachma became equal to the franc. The modern Greek weight called drachma was equal to ⅓ oz. avoirdupois. In the British system of weights there were, till recently, two drachms or drams: the avoirdupois, equal to $\frac{1}{7\cdot0}$ oz., and the apothecaries' (not now used), equal to ⅛ oz. See Dirhem.

Drachmann, Holger Henrik Herbolt (1846–1908), Danish poet, dramatist, and novelist, was born at Copenhagen, son of a physician of German family. He studied art, became a marine painter of some merit, travelled much, and acquired a knowledge of the lives of seamen. For a time a radical of the school of Brandes, he became afterwards a nationalist conservative.

Draco (Gr. *Drakōn*), an Athenian lawgiver and archon, who, in the year 621 B.C., was appointed to draw up new laws for the disordered state. These, however, effected little change in the form of the state; but by being committed to writing, put an end to the arbitrary administration of justice on the part of the archons, and resulted in the establishment of a court of appeal—that of the Ephetæ. Draco's legislation had a beneficial and permanent effect upon the political development of Athens. The extraordinary severity of these laws, however, which punished the slightest theft, or even laziness, with death, no less than sacrilege, murder, and treason, caused them to be often neglected, and made them so hated, that Solon was appointed to draw out a new code of laws (594). These were termed *nomoi*, as opposed to the *thesmoi* of Draco. Solon, though he softened their severity in most instances, retained that law which punished a murderer with death. Draco at a later

period went to Ægina, where, after having introduced his laws, he is said to have been stifled in the theatre by the garments thrown upon him as a mark of respect by the people. The severity of his laws gave rise to a pun by Herodicus, who declared that Draco's laws were those of a dragon (Gr. *drakōn*) and not of a man. Hence also originated the metaphorical remark of Demades, 'that they were written not in ink but in blood.' Extremely severe and sanguinary laws are still called *Draconic*.

Draco, a constellation in the northern hemisphere. The star γ Draconis, a bright star nearly in the solstitial colure, was used in determining the coefficient of aberration of the fixed stars.

Dracontium, a genus of Araceæ, of which one West Indian species, *D. polyphyllum*, has a medicinal history and repute similar to that of Green Dragon (see DRAGON, GREEN). The poisonous tubers yield starch on washing.

Dracontius, BLOSSIUS ÆMILIUS, Latin Christian poet of the 5th century, an advocate at Carthage, was imprisoned by a king of the Vandals. His *De Laudibus Dei* tells the story of Creation. He probably wrote a tragedy, *Orestes*.

Draft, a written order for the payment of money. It is properly distinguished from a bill by being addressed by the drawer, not to his debtor, but to his agent, servant, or correspondent. This distinction is, however, little attended to.

Drag, a mechanism for slackening the speed of carriages, by operating on one or more of the wheels. The form of drag best known to old travellers by coach was that of the 'shoe,' a hollow piece of iron attached by a chain to the carriage, which being put below one of the hind wheels partially reduced the vehicle to the nature of a sledge. As the shoe-drag required to be applied and removed with some inconvenient detention of the vehicle, a step was made in advance when a method of retarding a wheel without detention was discovered. The mechanism is operated by the driver without moving from his seat. A handle affects a series of rods and levers by which a block is pressed against each of the two hind wheels, so as to slacken their motion. It is of French origin. In the case of vehicles used for heavy loads, the levers are worked by a handwheel and screw instead of a handle. See BRAKES.

Drag'oman (from Arab. *tarjumân*, 'interpreter;' cf. TARGUM), the general name given in Eastern countries to an interpreter, or to a guide to foreigners. The dragoman is, however, much more than the Italian *cicerone*, or the French *commissionaire* or *valet de place*. In Syria, for example, he is a contractor for the management of expeditions, and undertakes to solve all the difficulties that arise between the traveller and the natives. The dragomans attached to embassies have special privileges. 'Student-dragomans' is a term sometimes given to 'student-interpreters' preparing for the consular service in the East. See CONSUL.

Dragon, (1) a name surviving from mythology and imaginative beast-lore, as the scientific title of a genus of arboreal lizards, of which the most familiar is *Draco volans*. The genus is especially remarkable for the extension of the skin of the sides on the prolonged posterior ribs. A parachute is thus formed which enables these 'dragons' to take rapid swoops from branch to branch. The tail is very long; the skin of the throat forms a loose wattle; the colours are particularly brilliant. There are several species inhabitants of the East Indies, not including Ceylon.—(2) The term dragon has also been applied in modern times to a large lizard (*Thorictis dracæna*) found in Brazil and Guiana. It attains a length of 3 feet, most of which goes to the tail. Tejus and Ameiva are allied genera.—(3) The ancient myths might to

Fringed Dragon (*Draco fimbriatus*).

some extent be rehabilitated in the application of the term 'dragon' to some of the extinct saurians. See LIZARD, REPTILE.

Dragon, in Mythology. In the mythical history and legendary poetry of most nations, the dragon holds a prominent place as the embodiment of the antagonistic and hostile principle as it has opposed itself to man from the earliest period in the world's history. In other words, the dragon is the emblem of all that is obstructive, loathsome, and horrible in nature, the ideal of the spirit of evil which is in opposition to the order, harmony, and progress of the human race. On the other hand, in both China and Japan, the 'Bob-tailed dragon' is an exception, where he is regarded with veneration. 'His fidelity as a friend,' says Mr Conway in his *Demonology and Devil Lore* (i. 105), 'led to the ill return of an attack by which his tail was amputated, and ever since his soured temper has shown itself in raising storms. When a violent tempest arises, the Cantonese say "the bob-tailed dragon is passing," in the same proverbial way as the Aryan peasantries attribute the same phenomenon to their storm gods.' But this favourable aspect of the dragon is the exception. Again, whilst the serpent seeks the attainment of its object by cunning and deceitful artifices—crawling on its belly, and always assuming ostensibly characteristics the very opposite of its own—the dragon proceeds openly to work, running on its feet, with expanded wings, and head and tail erect, violently and ruthlessly making onslaught on its victim, spouting fire and fury from both mouth and tail, and wasting and devastating the whole land. Hence, as the universally recognised enemy of mankind, the overthrow of the dragon was made to figure as one of the greatest exploits of gods and heroes. As the highest ideal of human strength and courage, the task properly fell to Herakles; but it was not confined to him, for we find both Apollo and Perseus represented as dragon-slayers. In the Vedic mythology the dragon Vritra, the god of evil and darkness, is in antagonism to Indra, the god of light and good. From legendary poetry the dragon passed into art, and was depicted on the shield or carved for the crest of a conqueror's helmet. The dragon does not seem to have been a native emblem with the Romans, and when they ultimately adopted it as a sort of subordinate symbol, the eagle still holding the first place, it seems to have been in consequence

of their intercourse with Pelasgic or with Teutonic nations. Amongst all the new peoples that overran Europe at the termination of the classical period, the dragon seems to have occupied nearly the same place that it held in the earlier stages of Greek life; in modern Greek folk-tales, the dragon is specially prominent. For the story of Cadmus and the dragon's teeth, see CADMUS. In the *Nibelungen Lied*, we find Siegfried killing a dragon at Worms; and the dragon killed by Beowulf (q.v.) in the epic that bears his name, is, as often in such stories, the enraged guardian of a rifled hoard of gold. Even Thor himself was a slayer of dragons (Grimm, *Deutsche Mythologie*, ii. 653). Among the Teutonic tribes which settled in England, it was from the first depicted on their shields and banners, and most of the dragon myths of Great Britain were no doubt importations brought over by early colonists —the celebrated Lambton worm being a survival of an ancient superstition. The Old English *wyrm*, meant equally dragon, serpent, and worm; and in such names as Ormsby, Ormskirk, we have reminiscences of the 'laidly [loathly] worm' of the old ballads. As a device, the dragon appears to have been the standard of the West Saxons, and of the English previous to the Norman Conquest. It formed one of the supporters of the royal arms borne by all Tudor monarchs, with the exception of Queen Mary, who substituted an eagle. Several of the Plantagenet kings and princes inscribed the figure of a dragon on their banner and shields. Peter Langtoffe says, at the battle of Lewes, fought in 1264, 'the king schewed forth his schild, his dragon full austere.' Amongst the Celts, it was the emblem of sovereignty, and as such borne as the sovereign's crest. Lord Tennyson's *Idylls* have made every one familiar with 'the dragon of the Great Pendragonship,' blazing on Arthur's helmet, as he rode forth to his last battle, and 'making all the night a stream of fire.'

The fiery dragon, or fire-drake, and the flying dragon in the air, were meteoric phenomena, of which we have frequent accounts in old books, and, indeed, as Brand remarks, 'the dragon is one of those shapes which fear has created to itself,' and which appears in circumstances, and clothes itself in forms, as various as our fears.

Of the two Hebrew words translated dragon in the authorised version of the Old Testament, one obviously means a serpent; while the dragon in Bel and the Dragon is a monster. The dragon of the Apocalypse is identified with the old serpent, the devil. In Christian art, the dragon is the emblem of sin, the usual form that is given to it being that of a winged crocodile. It is often represented as crushed under the feet of saints and martyrs, and other holy personages. Sometimes its prostrate attitude signifies the triumph of Christianity over paganism, as in pictures of St George (see GEORGE, ST), St Michael, and St Sylvester; or over heresy and schism, as when it was adopted as the emblem of the Knights of the order of the Dragon in Hungary, which was instituted for the purpose of contending against the adherents of John Huss and Jerome of Prague.

The dragon is often employed in heraldry, and figures of the heraldic dragon vary considerably according to the fancy of the draughtsman. The chief characteristics are the head of a wolf, the body of a serpent, four eagles' feet, bat-like wings, and barbed tongue and tail. An animal so represented is said to be *dragonné*. See GRIFFIN. A dragon without wings is called a lindworm, or lintworm, which Grimm (*Deutsche Mythol.* ii. 652) explains to mean a beautiful or shining worm. It should be noted that in some of the older treatises on natural history full descriptions of the dragon occur, the belief in its actual existence having been a widespread belief. Two of the ablest scientific writers of the 16th century, Conrad Gesner, professor of Natural History at Zurich, and Aldrovandi, the Pisan professor, have given elaborate descriptions of the dragon. In ancient mythology the task of drawing the chariot of the night was assigned to dragons, on account of their supposed watchfulness; and the loathsome ingredients for the witches' mess in *Macbeth* (IV. i.) include 'the scale of dragon.' See Elliot Smith, *The Evolution of the Dragon* (1919)

Dragon, GREEN (*Arum* (*Dracunculus*) *vulgaris*), an Araceous plant, with spotted petioles and handsome lobed leaves, and dark-coloured fetid flowers, is common in Greece and other countries of southern Europe, and is occasionally to be seen in gardens. The root-stock is acrid, emetic, and was formerly of medicinal repute in the treatment of piles; also (apparently for no better reason than the doctrine of signatures could draw from the spotted stems) in the treatment of snake-bites.

Dragonet (*Callionymus*), a genus of spiny-rayed bony fishes near the Gobies (q.v.), remarkable for having the gill-openings reduced to a small hole on each side of the nape, and the ventral fins placed under the throat, separate, and larger than the pectorals. The species are numerous, widely distributed in the temperate seas of the Old World, and generally finely coloured. The Gemmeous Dragonet (*C. lyra*) of the British coasts—called *Gowdie* (*gowd*, 'gold') in Scotland—is a fish about 10 or 12 inches long, of a prevailing yellow colour

Gemmeous Dragonet (*Callionymus lyra*).

varied with spots of brown. At the reproductive season the male becomes very gorgeously adorned with blue and violet spots and stripes. This fish is also called Skulpin or Sculpin—a name given in America to a marine bull-head or *Cottus*.

Dragon-fish. See DRAGONET.

Dragon-fly, a name applied to the members of a large family (Libellulidæ) of amphibious neuropterous insects. They are very frequently referred to under the title Odonata. They are well-known insects, conspicuous in their large size, brilliant iridescent colouring, and rapid, restless flight. The slender grace of some forms, especially when half-concealed by the drapery of the wings, has suggested their French title of *demoiselles*, while the Germans hint at a similar comparison in calling them *wasserjungfern*. None the less do they deserve our English name, for they are indeed the dragons and tyrants of the insect world.

Structure.—The body is long and lank; the two pairs of wings are large and almost equal; the head is freely movable upon the thorax; the eyes are usually very large, and are associated with eye-spots; the mouth organs, overlapped by a large upper lip, are very strong, and remarkably adapted for the capture and mastication of other insects.

Habit.—The dragon-flies live near water, in

which they spend their early life. During the day they are ceaselessly active, poising in the air with very rapid vibrations of their wings, or darting over the pools indeed like 'living flashes of light.' They rest upon bushes and the like during the night. Both as larvæ and as adults they are exceedingly voracious, feeding chiefly upon other insects. The two sexes are often seen flying

Dragon-fly and Nymph (*Libellula depressa*).

together in amatory dance, the male clasping his partner's neck with his tail. The colours of the sexes are often different, and the characteristic radiance of the male is in some cases assumed only at reproductive maturity. The males are sometimes larger, never smaller, than the females. The eggs are laid under water, sometimes within aquatic plants. The larvæ live in the water until they are ready for their metamorphosis. Their voracity is very great, and is satisfied by the deft exercise of the peculiarly modified second pair of maxillæ (labium), which can be extended in front of the head like a pair of nippers mounted on a flexible

Metamorphoses of Dragon-fly (*Aeschna grandis*):
a, larva; *b*, pupa; *c*, perfect insect issuing from pupa case; *d*, perfect insect, with wings fully developed.

stalk. This peculiar development is often called the 'mask.' In some young dragon-flies (smaller species of Agrion) there are leaf-like respiratory plates (tracheal gills) at the end of the body; in most the respiration is effected by a rhythmic water-current in and out of the rectum, on the walls of which there are numerous plates abundantly riddled by tracheæ. The expulsion of the water is strong enough to drive the larva slowly onwards. Before the final moult, the larva creeps up the stem of some water-plant, and rests for a while. Then 'an inner impulse rends the veil of his old husk, from head to tail come out bright plates of sapphire mail.' The wings are first small, soon 'grow like gauze,' and are perfected in the using. Tennyson's well-known description of the metamorphosis is vividly accurate.

Forms.—The family is widely distributed, but most abundant in tropical countries. Yet the exotic forms do not surpass the splendour of some British species. There are three sub-families: (1) Agrioninæ (e.g. Agrion, Calopteryx); (2) Aeschninæ (e.g. Aeschna, Gomphus); (3) Libellulinæ (e.g. Libellula). There are numerous British species—e.g. *Aeschna grandis*, the great dragon-fly, about 4 inches long, and the smaller *Libellula depressa*. The restless activity, the splendid colouring, the voracious carnivorous diet, are probably associated facts.

Dragonnades, the name applied to the persecution of French Protestants, begun by Louis XIV. in 1681, by quartering dragoons in Protestant villages and houses, and giving up the inhabitants to the outrage and plunder of the soldiery, until they should abjure their faith. Armed expeditions marched through the provinces, and by their prompt measures many heretics were restored to the bosom of the church; and in consequence, on the 22d October 1685, Louis revoked the Edict of Nantes (q.v.), that the good work might be fully accomplished. See CAMISARDS, and HUGUENOTS.

Dragon-root (*Arisæma atrorubens*), an Araceous plant, whose acrid tuber is variously used in domestic medicine, especially in North America.

Dragon's Blood is a name which has come down to us from ancient pharmacy in somewhat vague application to a number of resinous substances broadly agreeing in their deep-red or reddish-brown colour and astringent properties, but of very various origin. *Dracæna draco*, the Dragon-tree (q.v.) of the Canary Islands, yields on incision or even exudation from the stem or leaves, a variety which was formerly of commercial importance, and which is found in the prehistoric Guanche graves, apparently as an accessory of the embalming process. A more important variety is that obtained from the fruits of *Calamus draco*, an East Indian palm. The Red Sandalwood (*Pterocarpus santalinus*, a papilionaceous tree) is another East Indian source, while its West Indian congener, *P. draco*, is of considerable importance. The allied *Dalbergia monetaria* of Guiana, and the Mexican *Croton draco*, must also be mentioned. In Australia the resin of *Eucalyptus resinifera* has also acquired the same name. On account of its colour and astringent properties, dragon's blood has long been used in the preparation of dentifrices; also in alcoholic solution for staining marble, leather, wood, &c.; in oils and turpentines in the preparation of varnishes; and in the Illustration of Books (q.v.).

Dragon's Head (*Dracocephalum*), a genus of Labiatæ, common in gardens, so called from the form of its corolla.

Dragon-tree, a genus (Dracæna) of Liliaceæ (sub-order Smilaceæ), remarkable not only for its resin (see DRAGON'S BLOOD), but also for the indefinite thickening of its stem by means of secondary meristem, and the consequent resemblance in permanence and general habit to a dicotyledonous tree. The examination of a microscopic section of a young stem, however, shows that the thickening arises not as in dicotyledons or conifers through the activity of a surviving tract of embryonic tissue between the wood and bast of the fibro-vascular bundles—but in an essentially distinct and

simpler manner. The stem is at first normally monocotyledonous in structure—i.e. with closed scattered bundles of the ordinary type. The secondary meristem, formed from the cortex, lies wholly outside these, and grows steadily outwards,

Dragon-tree (*Dracæna Draco*).

depositing new bundles on the inner side alone (see MONOCOTYLEDONS, STEM). The growth is slow. The great dragon-tree (*D. Draco*). of Orotava, Teneriffe, famous through the description of Humboldt and other travellers, was about 75 feet high, 50 feet in girth, with an internal cavity about 10 feet in diameter. Not simply was it of almost as vast size when the islands were discovered in 1492, but calculations, based on the observed rate of growth of younger trees, carried it back to a probable age of from five to six thousand years. Unfortunately it was blown down by a storm in 1868. Species and varieties of Dracæna are in great and increasing esteem as foliage plants. *D. marginata*, *stricta*, &c. may be mentioned as old favourites, but a due conception of their

Branch of *Cordyline* (Dracæna) *australis*.

importance may be best obtained by reference to florists' catalogues. Species of the allied genus Cordyline, especially those from New Zealand, are sufficiently hardy to be planted out of doors in summer. *C. terminalis* is used for hedges in the East, and boundary marks in the West Indies, on account of its conspicuous red foliage.

Dragoon, a cavalry soldier who is armed with an infantry firearm, and trained to fight on foot as well as on horseback. The name was derived from the short musket carried by Marshal Brissac's horsemen in the 16th century, which suggested a fire-spouting dragon. Dragoons were originally intended to act as mounted infantry, and in order to make them more efficient in that capacity, the Russians in 1875–80 armed theirs with the long rifle. In the British army all Cavalry (q.v.) now carry rifles (instead of carbines), but the name dragoon is given somewhat arbitrarily to certain regiments. After the Crimean war, the so-called *light* dragoons were changed into hussars, leaving three regiments of dragoons, seven of dragoon guards, and the three cuirassed regiments of household troops. Six of these are classified as *medium*, and the remainder as *heavy* cavalry, but the men and horses are all big, as compared with those of hussar and lancer regiments. The weights carried by the horses on the march are 19 stone 4 lb. for dragoons, 18 stone 10 lb. for lancers, and 18 stone for hussars. The oldest dragoon regiment is the Scots Greys, established 1683.

Draguignan, the capital of the French department of Var, on a tributary of the Argens, and at the base of the wooded Malmont (2151 feet), 51 miles by rail NE. of Toulon. It has a college, and manufactures of leather, silk, soap, &c. Pop. 10,000.

Drainage is the art of carrying off water from the soil and subsoil of land by means of open or closed drains or trenches; the term, however, is generally understood to apply to closed drains. By its means the fertility of wet land has been greatly increased, and the climate of districts which were before wet and swampy very much improved. When the drains are put in every six or ten yards, it is called *furrow* or *frequent* draining.

The vast amount of capital which has been expended in drainage since the development of the improved methods of draining attests its utility and necessity. Before the introduction of furrow-draining, stiff and tenacious clays were of comparatively little value. They were cultivated at much expenditure of labour, and the crops which grew upon them were influenced to an exceptional extent by the variations of the seasons.

Drainage by open ditches was no doubt the first mode of freeing land from superfluous water. The Roman agricultural writers mention the good results arising from covered drains, formed of wood and other substances, which served so far to render the land dry. In the 18th century, a large extent of clay-land was drained at narrow intervals in Norfolk and Essex, by putting in brushwood and even straw in the bottom of the drains. The progress of draining, which is now regarded in many soils as essential to economic culture, was slow and partial, until James Smith of Deanston, in 1823, reduced the practice to a system, and showed the principles upon which its efficiency depended. Through the exertions of this advocate, furrow-draining soon became a *sine quâ non* in the culture of clay-soils or indeed most soils, in moist climates.

On ordinarily level fields, the line of greatest fall is usually chosen as the best for cutting drains. On steep slopes, where the excessive water is generally due to springs, the best results are obtained by oblique drains, which intercept the line of flow of the water. The minimum fall is about one in five or six hundred, though twice this amount, or, say, three inches per chain (22 yards) is allowed wherever possible. The smaller drains are usually conducted into larger or *main* drains, instead of each discharging its quota of water into the open ditch. This is rendered necessary, as the mouths of the smaller drains would be more liable to be choked up by the growth of weeds;

while the collecting of water into main drains secures a fuller flow to sweep out any matters which might accumulate where the discharge was small. Moreover, the less of the action of the air in the drains the more efficient they are.

The most efficient, and at the same time most cheaply cut drain, is one represented at fig. 1. It is made so that a pipe of a cylindrical form may be laid along the bottom, which need be of no greater width than what is necessary to allow of the pipes being properly laid. Drains of this form are cut with a set of spades which are of different widths—the broadest being used for taking out the top, and the narrowest for the bottom. The work of forming pipe-drains is now accomplished in some cases by mechanical *tractor-ditchers*, which cut the drain and lay the pipes in one operation. These machines are in common use in the United States, and have been tried successfully in this country.

Fig. 1.

Before the general use of pipes, stones were the common materials with which drains were formed. Smith of Deanston recommended that they should be broken so small, that they might pass through a ring two inches and a half in diameter. From nine inches to a foot in depth was the quantity which was commonly put in. Where stones can be easily got they are still preferred to tiles, as cheaper, and if well put in, more efficient and durable; where any considerable amount of carting is involved, however, the additional labour charge will be greater than the cost of tiles. In constructing stone drains a good plan is to set a pretty large block at each side of the bottom of the drain, and then use a third as a sort of wedge. A coating of smaller stones is surmounted by turf.

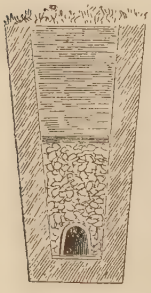


Fig. 2.

When tiles and pipes were first used, it was even thought necessary to have some gravel, or small stones, placed above them in the drains, for the purpose of enabling the water to find its way into them, as seen at fig. 2. It was soon found, however, that tile drains were quite as efficient without any stones or gravel; and that they were less liable to be choked up, as the clay or earth acted as a filter in preventing the intrusion of any kind of solid matter.

Many kinds of tiles and pipes have been tried, but the cylindrical form is most used. At one time, a bore in the pipe of an inch in diameter was thought sufficient, but 2½ or 3 inch pipes are now preferred. Theoretically a 1½ or 2 inch tile is sufficient to carry off the water from such an area as a drain is ordinarily required to serve; but larger pipes are much less affected by slight displacement or by the accumulation of silt, and hence remain efficient for a much longer period. Drain pipes are usually made about 15 inches in length. In some cases a *collar* is used to insure the complete continuity of the drain. The *collar* is a short length of circular tube which loosely embraces the two pipes and thus covers the joint. This *collar* was at one time thought quite essential for the durability of the drain, but it has been found in practice that well-laid pipes will work efficiently and endure satisfactorily without them. And, therefore, as they increase the cost considerably they are not now so largely used. In soft mossy or clayey subsoils, semi cylindrical tiles called muggs have been laid on lath, with the bend up.

Smith at first advocated the making of drains from 2½ to 3 feet deep, at intervals of from 10 to 40 feet. Experience has shown that depth and width must vary with the nature of the soil. On stiff clays the best depth is probably about 30 inches, with about 18 feet between drains. The lighter the soil the deeper may the drains be and the wider apart, but even on sands 3 feet 6 inches and 30 to 36 feet are regarded as about the maximum depth and distance apart respectively.

The principal advantages of drainage are, the deepening of the staple soil, and rendering it more friable, so that a superfluity of water, which would cause the formation of those chemical compounds that are found in stagnant water, is prevented. The greater depth of mould, and more perfect culture, render the soil more absorbent of moisture in dry weather. As crops can usually be sown sooner on drained lands, they also ripen earlier, and produce more abundantly. In short, while drained land obtains a greater capacity for moisture and manure, it imparts to plants greater capabilities for economically working up the materials which they find in the soil and atmosphere, seeing they are maintained in the most healthy conditions of growth.

Drainage in its various forms has, as is well known, not only improved the fertility and value of land in Britain, but materially changed the aspect and climate of large districts which before suffered from the wet, swampy character of the surface soil. Mosses and wet rushy lands have been transformed into dry and productive fields, while by the removal of all superfluous pools, the air is freed from those hovering vapours which are injurious to general amenity and salubrity. To the farmer, the more immediate advantage of drainage consists in that rapid running off of the water which falls as rain, so as to admit of working lands without any undue delay, while natural springs and dampness, from whatever source arising, are also run away with wonderful success. Drainage according to the principles first established by Smith of Deanston is now practised in most parts of the world. Recent advances in technique are mostly due to the United States, where within the past few decades very large areas have been brought under cultivation by draining.

See WASTE LANDS, BEDFORD LEVEL, BŒOTIA, BOG, FUCINO (LAKE OF), HAARLEM LAKE, HOLLAND, MAREOTIS, MEXICO (CITY), POLDER, ZUIDER ZEE, &c.; also IRRIGATION. The drainage of houses and cities will be considered at SEWAGE.

Drais VON SAUERBRONN, BARON KARL (1785–1851), inventor of the draisine or draisnene, a form of dandy-horse (see CYCLING), was director of waters and forests for Baden, and wrote on forestry.

Drake, SIR FRANCIS, the greatest of the Elizabethan seamen, was born near Tavistock, most likely in 1540. His father was apparently in humble life, is said to have had twelve sons, and to have been obliged for conscience' sake to take shelter in Kent. The boy was apprenticed at an early age to the master of a small vessel, who bequeathed it to him, after which he followed the coasting trade some years. 'But the narrow seas were a prison for so large a spirit, born for greater undertakings,' and by 1565 he was voyaging to Guinea and the Spanish Main. In 1567 he commanded the *Judith* of 50 tons in his kinsman John Hawkins's ill-fated expedition; next made in 1570 and in 1571 voyages to the West Indies with a view to find intelligence how to make good the losses he had suffered from the Spaniards at that time. Next in May 1572 he equipped two small ships, the *Pasha* and *Swan*, with but seventy-three men, landed at Nombre de Dios, 29th July, and beat off the Spaniards after a short struggle, in which he was severely wounded. His own fainting from loss of blood alone prevented the 'Treasure of the World'

from being carried off. In this audacious expedition Drake further burned Porto Bello, captured and destroyed many Spanish ships, crossed the isthmus to the highest point of the dividing ridge, where, climbing a tree from whose tops the guides told him both seas could be seen, he gazed upon the vast waters of the South Seas, and with that touch of romantic enthusiasm that redeemed all his piracies, 'besought Almighty God of His goodness to give him life and leave to sail once in an English ship in that sea.' Drake arrived in Plymouth on Sunday, 9th August 1573, during sermon-time, when the news of his return 'did so speedily pass over all the church, and surpass their minds with desire and delight to see him, that very few or none remained with the preacher, all hastening to see the evidence of God's love and blessing towards our gracious queen and country.'

In 1577 he fitted out another small squadron of five vessels, the destination of which was kept secret, consisting of his own ship the *Pelican* of 100 tons, the *Elizabeth* of 80 tons, and three smaller vessels, and with these sailed from Plymouth on the 13th December. One Thomas Doughty was tried and executed at Port St Julian for an attempt to stir up a mutiny, and on the 20th August, the squadron, now reduced to three ships by the burning of two, entered the Strait of Magellan, and here Drake changed his own ship's name from the *Pelican* to the *Golden Hind*. In sixteen days they made the passage, then followed violent tempests for fifty-two days, during which the *Marigold* foundered with all hands and the *Elizabeth* parted with the admiral and resolved to return home. She reached England, 2d June 1579. Drake was driven far to the southward, but at length was able to alter his course and steer northwards again. At Valparaiso he provisioned his ship from the Spanish storehouses, reached Callao on 15th February 1579, found a rich prize off Cape Francisco (March 1) and another on 4th April. Drake now determined to return home by crossing the Pacific. He touched land at a creek on the northern side of the Golden Gate, then for sixty-eight days together had no sight of land until he made the Pelew Islands. After refreshing three weeks at Ternate, and a thorough refit on the south-west coast of Java, he held for the Cape of Good Hope, and arrived in England, 26th September 1580. The queen, in the face of Spanish protests, was at first uncertain how to receive Drake, but at length (April 4, 1581) paid a visit to his ship at Deptford, and knighted him on its deck.

In the autumn of 1585 Drake sailed with a fleet of twenty-five ships against the Spanish Indies, harrying Hispaniola, Cartagena, and the coast of Florida, and after great sufferings from sickness, brought home the 190 dispirited Virginian colonists, with tobacco and potatoes (28th July 1586). Early in 1587 he set sail with a strong squadron to cripple the king of Spain in his own seas, and retard his preparations for invasion—a sport which he called 'singeing the king of Spain's beard.' Sailing right into the harbour of Cadiz, he sank or burned as many as thirty-three ships, and made his way out unscathed. The seeming recklessness of his tactics was no devil-may-care bravado, but due to consummate seamanship no less than promptitude and courage. Drake next sailed to the Azores, capturing a rich homeward-bound Portuguese carack worth £100,000. In the face of the impending struggle for which Philip II. had long been preparing, his persistent plan was to follow up the policy of harassing the enemy on his own coasts—'to seek God's enemies and her majesty's where they may be found.' In a letter to the reluctant and parsimonious queen not three months before the actual sailing of the Armada, he reiterates his advice 'to encounter them somewhat far off, and more near their own coast, which will be the better cheap for your majesty and people, and much the dearer for the enemy.' There is no doubt that Drake's plan was the best, and had not the elements themselves fought for England, the issue might have been vastly different.

Drake's division in the three-fold arrangement of the English fleet was at first stationed off Ushant, until all the ships were blown together to Plymouth by the same storm that carried the Spaniards across the Bay of Biscay. Here, on the Hoe, the admirals and captains were playing the famous game of bowls, when the news was brought that the enemy was off the Lizard. Howard was eager to put to sea at once, but Drake would first finish the game, saying 'there 's plenty of time to win this game, and to thrash the Spaniards too.' The story, whether true or no, is in perfect keeping with the character of the man. Early next morning the battle began, and raged along the Channel throughout the week. Drake's consummate seamanship and audacious courage covered him with fresh glory, and inspired new terror in the Spaniards. He captured the *Rosario* off Portland, whose captain, Don Pedro de Valdes, ransomed himself with £3000 three years later. On the 29th July occurred the final action so disastrous to the Spaniards, after which they came to their fatal determination to return to Spain round the Orkneys. Two days later Drake wrote to Walsingham: 'There was never anything pleased me better than the seeing the enemy flying with a southerly wind to the northward. God grant you have a good eye to the Duke of Parma, for with the grace of God, if we live, I doubt it not, but ere it be long so to handle the matter with the Duke of Sidonia, as he shall wish himself at Saint Mary Port among his orange trees.' It was not long before want of ammunition compelled Drake and Howard to fall back from the chase, but the storms of the northern seas took up their work and swept the Spaniards to destruction. Drake s fears that the Armada might refit in Denmark were happily frustrated, and the liberties of England were saved. Next spring a great expedition under him and Sir John Norreys sailed for the coasts of Spain and Portugal, but had little success beyond the damage inflicted upon the Spanish shipping, while sickness and actual hunger carried off thousands on board the crowded and ill-victualled ships. Drake spent his next few years in peaceful labours on shore, bringing a new water-supply to Plymouth, and representing the town in parliament. In August 1595 he sailed from Plymouth on his last expedition to the West Indies. Ill-fortune followed the fleet from the beginning; Hawkins, the second in command, died off Porto Rico in November, and Drake himself fell ill from dysentery and died off Porto Bello, 28th January 1596. His body was put into a leaden coffin and next day committed to the deep; as an anonymous poet quoted in Prince's *Worthies of Devon* said:

The waves became his winding-sheet; the waters were his tomb;
But for his fame, the ocean sea was not sufficient room.

See the Life by Barrow (1843); Froude's *English Seamen of the 16th Century* (1895); Corbett's short Life (1890); his elaborate *Drake and the Rise of the Tudor Navy* (2 vols. 1898); *New Light on Drake* (trans. Mrs Nuttall, 1914).

Drake, FRIEDRICH, a celebrated German sculptor, born at Pyrmont, 23d June 1805, and trained under Rauch of Berlin. Among his principal works are 'The Eight Provinces of Prussia' (colossal allegorical figures), and a 'Warrior crowned by Victory,' which is reckoned one of the masterpieces of German sculpture. But Drake owes his celebrity chiefly to statues, busts, and medallions,

and there are few of his great countrymen of whom he has not preserved a marble memorial. His statues of Schinkel, the two Humboldts, Rauch, Oken, his colossal statues of Frederick-William III., and William I. at Cologne, deserve especial mention; as also the busts of Bismarck and Moltke. Drake, long professor of Sculpture in the Academy at Berlin, died 6th April 1882.

Drake, NATHAN, Shakespearian scholar, was born at York in 1766, graduated M.D. at Edinburgh in 1789, practised his profession for forty years at Hadleigh, in Suffolk, and died in 1836. He published several collections of more than average essays, but his name now lives only in his learned and valuable *Shakespeare and his Times* (2 vols. 1817). A supplementary work was entitled *Memorials of Shakespeare, or Sketches of his Character and Genius by Various Writers* (1828).

Drake, SAMUEL GARDNER, American antiquary, was born in Pittsfield, New Hampshire, in 1798, and in 1828 established in Boston what is said to have been the first antiquarian book-shop in the United States. He published a number of reprints and of valuable works relating chiefly to the early history of New England. He died 14th June 1875.

Drakenberge, or DRAKENSBERG ('Dragon Mountains'), the general name given by the Dutch colonists to the range of mountains in the east of South Africa bordering the plateau. From about 29° S. lat. the three chains which form the southern portion unite and extend north-eastward in one mass, whose highest points are Cathkin Peak (12,000 feet), Mont aux Sources and Giant's Castle (11,000). The range is crossed by Van Reenen (5415) and De Beers (5635) passes.

Dram. See DRACHMA.

Drama, a Greek term literally signifying action, and applied to that form of literature which serves as text for what in the same sense is called acting, that is to say, the performance before spectators of an 'acted' and spoken imitation of scenes of life. The following article discusses merely the drama as limited to a class of literary productions, the art of acting and the history of theatrical performances being reserved for the article THEATRE. Nor will any attempt be made here to give a detailed account of the work of distinguished dramatists, which will be found from Æschylus downwards under the proper heads. We shall here confine ourselves to the survey of the general characteristics of the successive schools of literary drama in Greece, Rome, the middle ages, and modern Europe. In some oriental languages the drama holds a not unimportant place, but the written examples are not supposed to be of very great antiquity, and in any case they are, as drama, much inferior in interest to the European examples.

No specimens of the earliest age of Greek drama, that is to say, of the compositions, either purely dithyrambic or consisting of choric songs interspersed only with monologue, which are supposed to have prevailed in the infancy of the art, now survive, nor can much (if anything) be said to be known about them. Our earliest examples, the dramas of Æschylus, whose chief predecessors were Phrynichus, Chœrilus, and Pratinas, exhibit the drama in a very advanced condition, so far as the particular style goes. The dialogue, though in the earliest examples not more than two actors were permitted to be present as speakers on the stage at the same time, is managed so as to unfold a varied and completely dramatic story; while the chorus, either as a whole or subdivided into sections, performs its lyrical odes, and, when necessary, takes part by its leader, and rarely by other members, in the actual dialogue. The almost immediate addition of the tritagonist or third speaking actor, which, whether due to Æschylus himself or not, appears in his later plays, is practically the only change of importance subsequently made; and this was not as a rule further extended in Greek tragedy, that is to say, in the works of the three great writers, Æschylus, Sophocles, and Euripides, of whose works we possess, though unfortunately but a very small proportion, yet a part considerable when considered by itself. Very rarely the *quarta persona* or something like him appears, but this is a mere exception, and unimportant. We have thus the very remarkable phenomenon of an extremely artificial and complicated art, which seems almost within a single generation to have attained its furthest possible development. The actors—who sometimes make a tolerably numerous list, though not more than three may, as a rule, figure on the stage at once, except as mute persons—conduct the dramatic performance strictly so called by dialogue, gesture, and a certain amount (though less than on the modern stage) of action. The chorus, in its odes, explains incidents which assist if they are not necessary to the comprehension of the action, moralises on this same action, and occasionally takes part in it, giving in its specially choric utterances a certain heed to the keeping up of the sacred character which (see THEATRE) seems to have been associated with the origin of dramatic performances, if not of dramatic writing, in almost all countries.

The plays written for this disposition of company were for the most part, if not always, arranged in trilogies or sets of three, followed or not by a fourth play of a quite distinct and comic or satiric character. Whether there was any original reason for this arrangement, except that of convenience, is not known; but the reasons of convenience, when the limitations of the drama are considered, are obvious. For with each new play the restrictions of the Unities were relaxed, or rather disappeared altogether, and a fresh time, a fresh place, and an only distantly connected scheme of action could be entered upon. These famous Unities, which at various times in the history of literature have been the subject of the fiercest discussion, appear to be less *a priori* rules which the authors had before them and obeyed, than generalisations from these authors' practice, which later critics and students deduced and formulated. Some slight and some serious deviations from them, as in the case of the change of scene and the lapse of time in the *Eumenides*, have been detected. But generally speaking, the Unity of Time rules that not more than twenty-four hours are to be supposed to pass; the Unity of Place, that the scene shall not be changed; and the Unity of Action, that nothing like an independent underplot shall be permitted, every incident, and practically every speech, being subordinated to the main argument. On the whole, these strict conditions are very strictly observed. When they were taken with the exact and (in the case of the choruses) intricate metrical structure of the verse, they set Greek tragedy at the head of all literary performances as an example of exquisite symmetry of form, of severe but not overdone proportion. It is, however, almost as remarkable that, at least in Æschylus and Sophocles (for the 'Third Poet' is in this respect far inferior), no deficiency of dramatic interest attends this severity of form. Even in the earliest examples the metrical arrangements—iambic trimeter and trochaic tetrameter for the dialogue, anapæstic dimeter for part of the chorus work, and a vast variety of apparently lawless but in reality most correctly regulated rhythms for the rest—are consummate. The magnificent poetical quality of Æschylus, the sense of overmastering fate with which he

manages to charge all his drama, and the perfect humanity of Sophocles, relieve their work entirely from the charge of sterility which has been brought against more modern imitations of their form. No other general remark is required as to Greek tragedy, except that its subjects, as we have them, were limited to poetical and heroic tradition, with a certain admixture of what in modern literature we should call the chronicle-play, or drama of contemporary event. The only extant example (for we know that there were others) is the *Persæ* of Æschylus; an exceedingly interesting play, because it shows the ease with which the Greeks could achieve what has baffled almost all moderns.

We are even more scantily furnished with examples of Greek comedy. Indeed, we have no complete specimens, except (very fortunately) the work of the acknowledged chief of the style, Aristophanes. Yet we know that not only the two poets whose names are indissolubly coupled with his—Eupolis and Cratinus—but many others, illustrated what is called the Old Comedy, in which persons and political events of the day were satirised with a fearlessness never exceeded, rarely equalled, and likely to provoke (as we know it did provoke) violent reprisals. In addition to this we have in the *Cyclops* of Euripides an example, though probably not a very typical example, of the satyric play which finished the tragic trilogy, making with it a tetralogy. Of the so-called Middle and New Comedies which succeeded the Old, and which successively attenuated its bold personal attack into a weak comedy of manners, we have no specimens at all, though we can judge to some extent of their nature by the Latin imitations which have survived. But the great name of Menander, although illustrated at the present day only by the merest fragments, survives with a reputation in the New Comedy only inferior to that of Aristophanes in the Old. Of the two later kinds, the best that can be said is that the Greek genius, with its almost unfailing peculiarity of pushing such kinds as it attempted at all to their utmost capabilities, elaborated pretty completely the stock comedy, or comedy of certain general types of character; and that great as have been the changes of manners, no one, with the single exception of Molière, has made much original addition thereto since. Of the Old Comedy much more might be said, though we must for the present chiefly refer the reader to the article ARISTOPHANES. It must suffice here to say that to an abundance of wit in dialogue, not excelled even by Molière and Congreve, Aristophanes joined poetical faculties to which neither of these great writers can make the faintest pretence, a bold and thorough grasp of politics, which he exhibits especially in the parabases or direct addresses to the audience, and a quality of humour in the English sense, which no other ancient has approached. If it were not for the limitations of the female characters which Greek manners necessitated, Aristophanes would probably have been the equal of Shakespeare in the comedy of which *As You Like It*, *A Midsummer Night's Dream*, and *Much Ado About Nothing* are examples that never can be excelled, and that have never been equalled in their own way. As it is, the *Knights*, the *Clouds*, and the *Frogs* deserve exactly the same description.

It was thus the fortune of this extraordinary people, in the literary practice of a very brief period of years, to leave examples ranking to this day in the first class of the literature of the world, and serving as the basis of a set of critical rules which, followed not always with knowledge, governed literature until but the other day. Their immediate disciples and successors, the Latin poets, added but little if anything to the general system of drama, and their work has been transmitted to us in a most fragmentary condition. Latin tragedy of the regular kind may be said to have perished *en masse*, with a singular and very important exception. By very great good luck the comic work of Plautus and Terence, which we possess in good measure, not only represents for us the two great divisions of the Greek comic drama which, as we have said, are in Greek utterly lost, save in the most insignificant fragments, but exhibits in its own characteristics a very important difference of feature. The work of Terence is distinctly literary work, probably coming as near as the author could manage to its Greek originals. The work of Plautus, though hardly less indebted in many cases to those originals for plot and incident, displays a very strong infusion of vernacular character—the character, as we may judge, of the lost Atellan farces, and the character generally of Roman humour. The fault of Terence is, that he is thin; the fault of Plautus is, that he is coarse; and as far as we can judge from evidence but little more abundant than the fragmentary bones of extinct animals, these two defects may or must have been characteristic of the Roman drama generally. Of the tragedy, as we have said, at least of the early tragedy of Pacuvius, Accius, and others, it is very hard to judge at all; but there seems good ground for regarding it as a feeble copy of Greek, probably with attempts to make up for feebleness by rant of diction. The very remarkable group of works which are attributed to Seneca, whether to L. Annæus Seneca, the philosopher, or another of the same name, but which at least date with certainty from the imperial period of Rome, stand by themselves. They represent various styles, the heroic and so to speak romantic kind, the kind of already somewhat distant history, and the kind of contemporary interest. They are pretty obviously what we call 'closet drama,' that is to say, whether they were ever acted or not they were clearly written as writing, and not merely as playwright's work. They have, with much literary ability, a certain absence of *vis vivida*, though this absence has often been exaggerated. But where they are so very important is in this—that they, far more than the great early plays of Greece, determined the tragic revival of the Renaissance. It is Seneca, not Æschylus, not Sophocles, not even Euripides, that the experimenting dramatists of Italy, of England, of France most of all, follow when they attempt the regular tragedy in the 16th and 17th centuries. Seneca (not any of 'The Three') is directly responsible for Corneille; and if England had not set her face against it, it was Seneca who would have been reproduced in England by Sackville and Norton, by Edwards, by Daniel, by the Countess of Pembroke, and others; as he was in France by Garnier and Montchrestien; as he had been in Italy by Trissino.

It is, however, evident that the drama, as distinguished from pantomimic shows, beast-fights, and the like, was not a favourite kind of literature either with the Romans or with the inhabitants of the Roman empire; and this partly accounts for the ferocity of the early fathers of the church against the theatre, a theatre which was for the most part occupied by things very different from the *Antigone* or the *Eumenides*, by things compared to which even the *Lysistrata* would appear innocent. It also accounts for the small attraction which dramatic writing seems to have had for the authors of the empire. Lucian, for instance, ought to have written admirable plays; but he has left us not one. And by degrees, from the combination of all the causes hinted at and others, drama seems to have become practically extinct. The early dark

ages produce nothing worth speaking of, while the Terentian comedies of the nun Hrotswitha stand by themselves, and are little more than literary *pastiches*. When the drama reappears, the reappearance marks a genuine new birth. As before, this birth was connected with the offices of religion, though the precise extent to which this connection reached is a matter of great, and (if one who has given some attention to it may say so) of never-to-be-settled debate among the learned. It is sufficient to say that about the 11th century in France appear the beginnings of the famous miracle or mystery play, which has sacred subjects only, is in its earliest forms very short, and consists for the most part in the representation 'by personages,' as the vernacular phrase went, either of scenes from the Bible or of legends of the saints. There is no chorus in the proper classical sense, though rarely there are approaches to it. The metre is usually rhymed octosyllabic couplets, with a few more complicated schemes thrown in, and the dramatic action, though genuine and complete as far as it goes, is very simple. This kind, which is still represented in sophisticated forms by the famous Ammergau passion-play, was extremely popular; and though later in other countries than in France, has tolerably early representatives in most of them, especially in Germany and England. France, however, was its special home, and the liking of the people for these at first sacred dramatic performances seems to have branched out there into a variety of secular kinds, which, so early at any rate, are not paralleled anywhere else. As early as the 13th century a single French author, Adam de la Halle, originated, so far as is known, two important styles, the comic opera (in *Robin et Marion*) and the modern comedy, in the half autobiographic composition called the *Jus* [*Jeu*, 'game'] *Adam* or *Jus de la Feuillie* ['of the booth']. Of these compositions the former has hardly a trace of roughness, while the latter contains no hint of classical inspiration. By the 14th century probably, by the 15th certainly, France had added to the miracle or mystery, which branched out into the 'profane mystery' or chronicle-play dealing with current events or ancient history, not merely the *farce* — the dramatisation of the earlier verse *fabliau* or comic story, and the 'Morality'—an allegorical play of virtues, vices, and the life of man generally, to which the general medieval passion for allegory gave great vogue; but also the *sotie* or political farce, something like though not in the least imitated from the Athenian comedy of the old type, as well as not a few minor varieties. The passion for dramatic entertainments was very great; societies or guilds existed for their performance, and it was not unusual for days, or even weeks, to be occupied in a single display. We still have mysteries extending to fifty thousand lines, and altogether it may be said that this passion for scenic representation, as it has been always more widespread, developed itself earlier in France than in any other European country. It is not a little striking also, that in the south-west corner of France the morality still substantially survives in the Basque *pastorales*.

In no other country than France, however, did the tastes of the middle age receive a more complete check and change at the Renaissance; and as this change was partly connected with the importation of Spanish and Italian fashions, it may be desirable very briefly to sketch the great and interesting dramas of the two peninsulas before recounting the later history of dramatic literature in France.

Great as are the performances of Italy in European literature, her achievements in drama, even to these late days, are of little moment, when compared with the towering fame of Dante and Petrarch, of Ariosto and Tasso. Her chief influence was to direct France into following the Senecan tragedy, and, through a writer who took the French name Larivey, but who was really a Giunto, the Terentian comedy somewhat relaxed. No Italian medieval work for the stage is in the least remarkable; but as soon as the Renaissance dawned, divers writers, Trissino especially, adopted the stiff form of tragedy already referred to, and persons no less notable than Macchiavelli, Cardinal Bibbiena, and the great Ariosto, attempted comedy. Before very long, however, the lyrical drama, which under the name of opera, was from Italy to conquer Europe, pushed drama proper much out of favour. It was a little restored by a group of learned writers in the late 17th century, the chief of whom was the Marquis Maffei, a soldier, an antiquary, and a playwright, whose *Merope* (1714) Voltaire deigned to follow very closely. Goldoni and Gozzi started a school of comedy which was to a great extent a reflection of national manners, and has real distinction. Whether as much can be said of the formal lyric dramas of Metastasio in the middle, or of the much vaunted tragedies of Alfieri at the end of the 18th century, is perhaps a matter of taste. There are some who hold that in no poet is the worse side of the so-called classical drama more apparent than in the second of these writers. But neither Alfieri nor any other writer of Italy has succeeded in drama, since the school of Venetian comedy above mentioned, in striking what may be called an original note, though during the 19th century Manzoni and others have attempted the style. In general literary history the dramatic achievement of modern Italy is the determination of France into the classical model.

Very different is the record of Spain. It is an infinitely more germinal history than that of Italy, though unluckily it is even shorter. The strong, though apparently not sustained originality of Spain, showed itself nowhere more than in her drama. No medieval performances of much merit are cited by historians; but instead of being diverted by the Renaissance into a mere following of classical models like France and Italy, the Spaniards showed independence almost equal to, and an immediate command of form far greater than, that of the English theatre itself. In part they continued the religious tradition by their *autos;* in part they diverged into romantic drama of the freest kind; and they almost invented for themselves the comedy of fashionable life and intrigue which was imitated freely by all the great playwrights of the 17th century in other countries, and which is famous for its prodigal waste of ingenuity, if also for its rather penurious thrift of probability. They furnished in the Don Juan (q.v.) story one of the two or three most fertile dramatic motives of Europe, and in Lope de Vega and Calderon they produced dramatists not equalled in fertility anywhere, and surpassed in genius only by the greatest names of the world. Half at least of the most famous plays of the French classical period are more or less directly borrowed from Spain, and England also pillaged in her turn. But the period of Spanish dramatic productiveness was unfortunately as short as it was brilliant; and it has had no revival. What the Spaniards did for Europe in dramatic matters was to develop a fertile and powerful drama in complete defiance of classical traditions, to show the dramatic possibilities of the supernatural, and to push almost to the farthest extent the comedy of ingenious surprises, and 'wheels within wheels.' The merits of this drama are the more remarkable that its most usual metrical vehicle, the trochaic

dimeter, does not seem beforehand very well suited for the purpose.

The first influence which impelled men to the creation of the new drama in France came, as has been said, from, or rather through Italy; but it was necessary before dramatic work of the first class could be produced, that the Spanish influence should also be felt. It is at first sight surprising that so vigorous and racy a kind as the indigenous comic drama of France had already shown itself to be, should be pushed out by a merely learned and literary importation. Nor in fact was it so, except in Paris and one or two other centres of culture, while even there it was not completely banished until the genius of Molière, which long exercised itself in something very like the ancient farce, effected a combination between the vernacular, the Terentian, and the Spanish comedy. In tragedy, however, the school commonly called the Pléiade—i.e. the poet Ronsard and his set—effected a complete revolution or innovation, following the Senecan model. The two plays of Jodelle, a member of the Pléiade itself, *Cléopatre* and *Didon*, set the example of a tragedy exactly resembling those attributed to Seneca, with choruses and all apparatus complete. This style of tragedy was continued for many years, and was cultivated by at least two poets of the greatest talent, Robert Garnier and Antoine de Montchrestien; but the choruses were by degrees dropped as unsuitable to modern audiences. Still the substance of the tragedy remained much the same, even when, in the hands of a later school, of whom Alexandre Hardy was the chief, a great infusion of Spanish romanticism took place. Nor was the scheme much altered, whatever might be the case with the treatment, when Rotrou and Corneille at last formed the French classical tragedy proper. For the details of this reformation, and of the similar, though less strict reformation which comedy, in the hands of Scarron, Corneille, and Molière chiefly, also underwent, reference must be made to the separate articles on Corneille, Molière, and Racine. As produced by these three great men, and by imitators in the second half of the 17th century, both tragedy and comedy assumed shapes which France long retained unaltered, and which for a time gave law and pattern to all Europe except England, and even to some extent there. The tragedy was of the Greek or rather the Senecan kind, without choruses, and with a slight relaxation of some of the minor stringencies, but with the unities for the most part maintained, and with, as a rule, the fortunes of a love affair substituted for the classic themes of fate and inherited doom. The metrical structure was unvarying, alexandrines or iambic trimeters arranged in couplets tipped with *rimes difficiles*, or rhymes as elaborate as possible. Much less restriction trammelled comedy, which accordingly ranks higher. It might be written either in prose or in verse; the unities of place, and even to some extent of action, were neglected or construed loosely. A very great variety of interest and subject matter was admitted, and the elaboration of really witty dialogue supplied endless opportunities of ornament. At the same time, in the hands of Molière nearly always, though less often in those of his followers, the moral or satirical purpose was carefully observed. The reign of these two kinds continued with little interruption, though with great variety, and on the whole constant diminution of merit, till the end of the first quarter of the 19th century. In tragedy, Crébillon the elder succeeded in raising the style to something not far below Corneille's level, while Voltaire, applying his own singularly various and versatile talent to it, and enlarging the range of subject and situation, produced work which ranks as drama, though not as poetry, almost with the work of Corneille and Racine itself. In comedy, the level continued higher, very excellent work of the Molièresque kind, slightly altered in various ways, being done by Destouches, Marivaux, Piron, and others; while towards the middle of the 18th century, a sort of third or bastard kind, variously called as it approached one extremity or the other, *comédie larmoyante*, or *tragédie bourgeoise*, was introduced by La Chaussée, Sedaine, Diderot, and others. Unlike most bastard kinds this proved fertile, and under the generic name of *drame* may be said to have important representatives at the present day. It tended naturally to emancipate itself from the restrictions of tragedy, and so no doubt helped the great revolt of what is called the Romantic Movement, which about 1830 practically destroyed the old French tragedy, and seriously interfered with the Molièresque tradition of comedy. Here, too, reference must be made to special names —e.g. Dumas, Hugo, and De Musset. It must be sufficient here to say that the alteration has revived the always keen interest of Frenchmen in the drama, and introduced a vast quantity of literary work of much higher value than had been produced in drama since the latter half of the 17th century. France has once more become the central seat of drama in Europe, and foreign nations have been much busier in adapting her productions than in producing original work of their own. At the same time it must be confessed that tragedy proper has continually dwindled, and that even comedy of the higher kind has been somewhat injuriously affected. The chief new growth of value at once literary and dramatic has been in the production of dramatic sketches of various sorts, slight in substance and brief in duration, but admirable of their kind. During the Second Empire an immense popularity was also achieved by comic opera or rather *opéra bouffe* of a not very exalted class, the sprightly music of Offenbach contributing much to this result.

Of the great literary European nations, Germany has on the whole contributed least to the European drama, though one dramatic motive, the Faust story, worthy to rank with that of Don Juan, is due to her, and though at two distinct periods, the middle of the sixteenth and the junction of the eighteenth and nineteenth centuries, the supernatural drama, of which this Faust legend has given the chief example, exercised, mainly on German impulse, great influence abroad. Otherwise the Germans have been, save for one brief period, more remarkable for assiduous cultivation of the art of acting, and the theory of the stage, than for the production of great dramatic work. There is no German drama of European reputation that dates either from the middle ages or from the Renaissance, or from the 17th century; and it was not till the middle of the 18th that Lessing, not so much by his actual dramas as by his critical discussions of the drama and dramaturgy generally, earned for himself a really great place in dramatic history. At the end of that century what has been called the *Sturm und Drang* school flooded Europe for a time with extravagant or sentimental productions of the class of which Schiller's *Robbers* and Kotzebue's *Menschenhass und Reue* ('The Stranger') are the most famous examples in two different kinds; while the first mentioned is perhaps the best, and the second one of the worst in literary merit. Kotzebue, indeed, was a very popular dramatist everywhere for a time. The two great writers, Schiller and Goethe, stand on a different level altogether. The former, calming down from the state of mind out of which grew his *Robbers*, produced a series of plays which to the English taste suffer from a too close approxima-

tion to the French style, while, according to classical standards, they err by dramatic license, but which nevertheless contain much noble poetry and some striking drama. But in this same style Goethe's *Egmont* far surpasses anything of Schiller's, except the splendid chronicle-play of *Wallenstein*, while his *Iphigenia in Tauris* is (except Milton's *Samson*) the only modern classical drama which is really classical, and his *Faust* is not only one of the capital works of European literature, but includes rather than constitutes some of the finest dramatic work to be found out of Shakespeare. The chief vehicle of German dramatic poetry is the same as that of English, the unrhymed iambic decasyllable.

There are more reasons than one for taking the drama of England last, the two most pertinent being that it was, except the German, the last to crystallise itself into a determined form, and that while that form has on the whole maintained itself, each of the influences which have been already discussed in their several countries of origin has successively exercised more or less force there. In England, as elsewhere, the miracle-play existed, and divers collections of it, known as the York, Digby, Townley, Chester, and other collections, have been preserved and published. But these are both later and ruder than the French examples. Nor does the drama seem to have taken in England, until quite the beginning of the 16th century, anything like the various extensions which it received in France. Out of the miracles and Mysteries (q.v.) arose the moralities; between them and the regular drama come the interludes of Henry Medwall and John Heywood (q.v.), and the doggerel of Bale. The great and original school, commonly known as that of the Elizabethan dramatists, did not, however, arise till the last quarter of the century. Among the somewhat amorphous dramatic products which preceded it, without as far as can be seen giving this great group of playwrights much help of pattern or precept, it is usual and proper to distinguish three pieces—*Ralph Roister Doister*, by Nicholas Udall; *Gammer Gurton's Needle*, assigned to Bishop Still; and the tragedy of *Gorboduc*, or *Ferrex and Porrex*, by Sackville the poet and Thomas Norton. The first and second are comedies, or rather farces, the second of ruder type than the first, but both exhibiting a considerable advance from the mere interlude towards comedy proper. The third, composed under the same influence as the drama of the Pléiade, is after the style of Seneca—a style which happily, though more than once attempted in the years immediately following, was obstinately resisted by the English genius, and took no root here whatever. It is not possible to assign any foreign origin to that school of English drama, which, suddenly appearing in the work of the so-called 'university' group, of Marlowe, Greene, Peele, and in a rather different vein Lyly, passed into the far more capable hands of Shakespeare, Ben Jonson, Chapman, Dekker, Beaumont and Fletcher, Webster, Middleton, Thomas Heywood, Massinger, Ford, and Shirley. To indicate even briefly the main characteristics of this drama would overpass the whole limits of this article. Suffice it to say, that allowing for its admitted defects in order, measure, and elaborate finish, as well as in dramatic arrangement and in academically perfect literary style, no drama in the world excels or equals it in the vigorous variety of dramatic character and situation, or in the application of the highest poetry to the purposes of drama. Its desinence is usually fixed at the death of Shirley (1666), but, as a matter of fact, the best plays of the class had ceased to be written even before the closing of the theatres twenty years earlier, as a result of the Puritan hatred for stage plays. By this time the two great ethical defects of the whole school, the unnecessary horror of its tragedy, and the unnecessary foulness of its comedy, had reached their highest point, while both the dramatic and the poetic quality of its practitioners had sadly fallen off. In particular, the secret of blank verse which had afforded so admirable a vehicle was all but lost before ever the Civil War broke out. Accordingly, when after the Restoration tragedy revived (the staple matter of comedy and its usual manner are so much the same in all circumstances that fewer changes appear therein in every case), it assumed a very different complexion. Partly influenced by the admiration of things French, but more by the fact that Davenant had been enabled by Oliver Cromwell's love of music to introduce even during the Commonwealth a sort of musical drama, there came in what are called 'heroic' plays, the chief formal characteristic of which is that they are written, not in blank verse, but in rhymed couplets. These held the stage for some twenty years or so, their chief practitioner being Dryden, with Crowne, Otway, Lee, and others to back him in tragedy, and Shadwell, Crowne, Otway, Etheredge, Wycherley, and others in comedy. At last Dryden himself, either following or guiding the public taste, returned to blank verse, and produced in it the last really fine examples of English tragedy, properly so called, for the work of Rowe and Congreve in this kind is not noteworthy. The 18th century produced nothing of value, and all the attempts that have been made since at pure tragedy on the English stage have been either merely literary work, or a kind of *drame*, or else performances of scarcely any literary merit but some stage adaptability.

No such fate for a long time befell comedy. It has frequently been held that the Restoration dramatists in the proper sense (for the term is often very loosely used) introduced an entirely new style. It might perhaps be maintained without much difficulty that Etheredge and Wycherley, the two chief writers of the new school, rather adjusted the old humour comedy of Jonson, and the bustling lively comic work of Fletcher, to the change of manners, the greater demand for literary style, and the example of Molière. Following them, in the reign of William of Orange and that of Anne, Congreve, Vanbrugh, and Farquhar carried this altered style to almost its highest possible perfection. All their work, as well in the earlier as in the later examples of it, was, however, marred by a singular brutality of thought, even where (which was rarely the case) this brutality of thought was not coupled with an equal coarseness of language. For a long time the public demanded, enjoyed, or tolerated this; but at length taste changed, and the famous paper war, which had begun with Jeremy Collier's attack on the stage, undoubtedly did much to purify English comedy. But it did not strengthen it, and nothing in the way of comic dialogue has since been produced which equals the best scenes of Vanbrugh and Congreve. It is, however, justly complained that this liveliness of dialogue is frequently studied at the expense of the verisimilitude and progress of the action. No similar complaint had to be made, though much comic work of merit was produced, until the time of Goldsmith. His two masterpieces were followed at no very great interval by the famous work of Sheridan, in which the methods of what may still be called Restoration comedy are adapted to altered tastes in literature and morals with surpassing skill. Sheridan is the last great name in the English drama, and though, especially of late years, the taste for theatrical performances has spread enormously, and the opportunities of gratifying it have increased in proportion, drama of the first or even a high second-rate quality has perpetually

refused to be written. With rare intervals the works of Shakespeare have kept the stage; but all the other old tragic dramatists have become obsolete, and, except Goldsmith and Sheridan, the old comic writers have shared the same fate. Successive schools of dramatic writing have had their day of favour, sometimes owing to the predilections of certain popular actors. Thus a school imitated from the Germans of the *Sturm und Drang* class was followed by a period of jejune, though decent dramas such as Talfourd's *Ion*, Milman's *Fazio*, and the works of Joanna Baillie and Sheridan Knowles. Then succeeded (though exact succession is rarely to be predicated of such things) a period of light low comedy and farce, such as that identified in one way or other with the names of Mathews, Planché, and Maddison Morton. And this again has been followed by a rage for burlesque, for a new kind of comic opera of not inconsiderable merit, &c. But Shakespeare has always continued to be acted, and has trained actors without producing dramatists. The most considerable, probably, of strictly 19th-century English playwrights was the late Lord Lytton. Yet the *Lady of Lyons*, *Money*, *Richelieu*, &c., though usually effective on the stage, can scarcely be said to be so to the reader, while some later dramas by poets of excellence, though respectable or admirable to the reader, have either not succeeded in being acted at all, or have not been acted successfully.

It has seemed preferable for the plan of such an article as the present to adopt the historical method rather than to divide the drama into its kinds and examine the characteristics of each, such as tragedy, comedy, farce, melodrama, pantomime, and others, with their subdivisions, philosophical and historical. A survey of the great body of dramatic literature in our possession will, however, lead to the not uninteresting conclusion that not merely the forms which literary work for dramatic representation can take, but even the situations and incidents which are suitable to such representation, are by no means very numerous, and tend to reproduce themselves in the practice of different times and different nations with considerable regularity. So also in necessary consequence do the faults incident to the looser and severer systems of drama respectively recur. We also see, as might again be foreseen, that considerably less variety is obtainable in tragedy than in comedy, and that the former is infinitely the more difficult, and, in any excellence, the less abundant variety. Such questions as the baleful effect alleged, and probably with justice, to have been exercised on the drama by the popularity during the 19th century of the prose novel, and the extension of periodical literature generally, can also only be hinted at. But it may be briefly said that the ages and circumstances in which drama has flourished most, have been those in which, by this or that accident, it occupied for a time and sometimes almost monopolised the position of public instructor and informer on questions of thought and news, as well as that of public amuser. And another point worth noting is that the periods of best acting have by no means always coincided with the periods of best drama-writing.

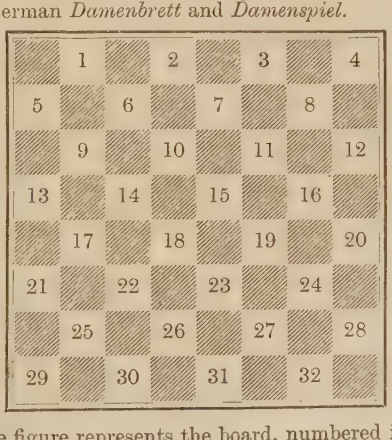
Drama, an inland town of Greek Macedonia, 26 miles NW. of Kavala, is a tobacco-growing centre, with sesame-oil factories, tanneries, and sawmills; pop. 15,000. The department of Drama has an area of 2200 sq. m., and a pop. of 182,600.

Drammen, a seaport of Norway, on the Dramselv, which here discharges its waters through the Dramsfiord into the Gulf of Christiania, 33 miles SW. of Christiania by rail. The Dramselv, the second largest river in Norway, draining 6500 sq. m., is crossed here by three bridges, one of them 345 yards long. Of the town's three quarters Bragernäs is north, Strömsö and Tangen south of the river. It manufactures wooden goods and paper pulp, and exports these and timber. Pop. 26,000.

Draper, JOHN WILLIAM, was born at St Helens, near Liverpool, 5th May 1811. He received a course of chemical training in London, and in 1833 emigrated to Virginia. In 1836 he graduated with honours as a doctor of medicine at the university of Pennsylvania; and after holding for some time a professorship in Hampden-Sidney College, Virginia, he was called in 1839 to the chair of Chemistry in the university of New York. He did much to strengthen the medical department of that institution, of which he was for a long time the president. He wrote a large number of papers on scientific subjects, such as the chemical action of light, radiant energy, phosphorescence, spectrum analysis, photography, and the chemistry and physics of living organisms. Among his works are *On the Forces that Produce the Organisation of Plants* (1844), *Scientific Memoirs* (1878), a work on Physiology (1856), *History of the Intellectual Development of Europe* (1862), *History of the American Civil War* (3 vols. 1867–70), and a *History of the Conflict between Science and Religion* (1874). The last-named work had a wide success, and was translated into several languages. He died January 4, 1882.—His son, HENRY (1837–82), attained distinction as an original observer in astronomy and chemistry, working with great enthusiasm and success in both sciences. —Another son, JOHN CHRISTOPHER (1835–85), was a successful teacher of chemistry and physiology, and the author of various text-books and scientific memoirs.

Draught, in maritime affairs, is a technical name for the depth to which a ship sinks in the water when afloat. The draught is marked on the stem or stern-post, or both, from the keel upwards. See SHIPBUILDING.

Draughts, a game played with 'men' on a checkered board, like a chess-board, of sixty-four black and white squares, is of unknown origin. Though Strutt (*Sports and Pastimes*) calls it a modern invention, other authorities consider it very old. It was certainly played in Europe in the 16th century, and in 1668 a treatise on the game was published in Paris by Mallet. The Greeks and Romans had a similar game, and the Egyptians are represented on monuments as engaged in some such amusement. In France it is called *Jeu des Dames*, a name which appears in *Dambrod*, the old Scots name for the draught-board, as also in the German *Damenbrett* and *Damenspiel*.



The figure represents the board, numbered in the usual method for registering games. Two players, each having a set of twelve men—one set white

the other black (or round and square, or distinguished in any other way), sit opposite each other, having their men arranged on squares 1 to 12 and 21 to 32 respectively. The men can be placed either on the black or white squares, but the whole must be placed on one colour only. Whichever colour is used, however, the single corners 4 and 29 must be at the players' *left* hand.

The object of the game is to clear off the opponent's men altogether from the board, or to so shut them up that they cannot be moved. Generally the black men play first, and as the men are changed each game, the first move becomes alternate. The movements of the men are very simple. Each player alternately moves one man at a time diagonally forward, always keeping on the same-coloured squares. When an enemy's man stands in the way, no move can be made unless there be a vacant square immediately beyond, into which the man can be lifted, in which case the man leaped over is 'taken,' and removed from the board; and so on, till the game is lost and won, or drawn. When a man on either side has succeeded in making his way to the opposite side of the board, he becomes *crowned*, which is done by putting another man on the top of him; and he can then move in any diagonal direction, but always only one square at a time.

When the men are reduced to a few on each side, a somewhat mysterious element called *the move* comes into play. This may be explained by the following case: Suppose only one man left on each side, one on square 2, the other on square 10; should it be the turn of the man on 2 to move, he must obviously be taken and lose the game. The one on 10 is said to have the advantage of *the move*. The only chance for a man with the move against him is to get into a double corner, when the game is drawn. When there are several men left on either side, then it becomes a matter of nice calculation and great importance to find which side has the move, on account of the advantage arising therefrom. Many treatises have been written on the theory of *the move* and the method of calculating it.

James Wyllie ('the herd-laddie') was champion of the world as well as of Scotland till 1894. Other Scottish world champions are Ferrie of Greenock, Jordan of Edinburgh, and Stewart of Blairadam. Famous English players have been Smith, Richmond, Beattie, Gardner, Jewett, Christie, and Birkenshaw; in America (where the game is called *checkers*), Freeman, Barker, and Reed.

A standard book is that by Joshua Sturges (1800), revised by J. A. Kear (1896); another, Andrew Anderson's, especially as re-edited by R. M'Culloch (1888). Other writers are 'Berkeley,' Gould, Spayth, Barker, Robertson, Bowen, Hill, and Lees.

Drava, or DRAVE (Ger. *Drau*), a river of Europe, rising in Tyrol, at an altitude of 5477 feet, and flowing 447 miles with a general east-south-easterly course, through or along the borders of Carinthia, Slovenia, Croatia, Hungary, and Slavonia, till, 10 miles below Essek, it falls into the Danube. At first it is a mountain-torrent, rushing furiously through Tyrol; but joined by numerous streams, its volume increases, and from Villach downwards (379 miles) it is navigable.

Dravidians is a name given to a large group of the non-Aryan peoples of Southern India, including those speaking Tamil, Telugu, Kanarese, Malayalim, Toda, Gond, and some other tongues of minor importance—in all some 57,500,000 people. These languages are all distinguished by having a rational and an irrational gender in nouns, which in the verbs also are indicated by pronominal suffixes. The grammatical relations are generally expressed by pronominal suffixes. Rask did much to establish the Dravidian group. See INDIA; Bishop Caldwell's great *Comparative Grammar of the Dravidian Languages* (1856; 2d ed. 1875); Konow in *Linguistic Survey of India* (vol. iv. 1906); Slater, *Dravidian Element in Indian Culture* (1923); and for what ethnologists have called the 'pre-Dravidian' race, see AUSTRALIA (*Aborigines*), ETHNOLOGY, VEDDAS.

Drawback, a term in commerce, employed in connection with the remitting or paying back by government of excise duties on certain classes of articles exported. Excise duties, as a matter of course, enhance by so much the natural price of the commodity on which they are imposed. Were these duties not remitted, the commodity so taxed would not be ordered by those foreign countries where articles of the same kind could be purchased free of such duties. To afford facility for the exportation of these articles, the state resorts to the expedient of returning to the exporter a sum equal in amount to what he or the manufacturer had paid to the excise. Such is drawback. Among other matters of fiscal policy, Adam Smith, in his *Wealth of Nations*, discusses the propriety of giving drawbacks, and sees in them nothing that is adverse to a sound political economy. 'To allow,' he says, 'the merchant to draw back upon exportation, either the whole or a part of whatever excise or inland duty is imposed upon domestic industry, can never occasion the exportation of a greater quantity of goods than what would have been exported had no duty been imposed. Such encouragements do not tend to turn towards any particular employment a greater share of the capital of the country than what would go to that employment of its own accord, but only to hinder the duty from driving away any part of that share to other employments. They tend not to overturn that balance which naturally establishes itself among all the various employments of the society, but to hinder it being overturned by the duty: they tend not to destroy, but to preserve, what it is in most cases advantageous to preserve, the natural division and distribution of labour in the society.' It will, however, be admitted that the system of drawbacks is liable to abuse. The bounties paid by several European states to sugar, for example, were based on the payment of drawbacks, the sum returned being actually larger than the sum paid as duty. See BOUNTY.

Drawbridge. See BRIDGE.

Drawing is the expression of form in graphic art. The term is more particularly applied to expression of form by line. In the preliminary study of drawing, a lead-pencil or other pointed instrument is employed, and the pupil is directed to copy geometrical or other well-defined forms bounded by distinct lines. But in nature no such boundary lines exist; her objects relieve themselves to the eye as spaces that are lighter or darker in tone, or of varying colour. All expression by line of natural things is consequently a conventional rendering, and the true skill of the artist lies in the imagination and insight with which he chooses such lines as are typical and vital, as most simply and forcibly reveal the character of the thing drawn. Such selection is, in particular, the chief excellence of an etched plate, etching being, of all artistic processes, that in which the line is most sensitive and susceptible to the slightest impulse of the artist, and a process in which the line tells by itself, and does not instinctively tend to become merged in a series of accurately gradated tints, as is the case in engraving with the burin. The slighter etchings of Rembrandt are unsurpassable examples of expressive selection of line; while the woodcuts of

Holbein's 'Dance of Death' show how accurately the character of even a minute face may be rendered by a very few blunt lines and touches, set each in its absolutely right place. The more academic method of drawing, of which the classical outlines after Flaxman are examples, has in it less of spirit and insight. It trusts greatly to an unbroken and formally correct outline, and founds its charm less on seizure of individualities of character than on dignity of abstract design, and the grace inherent in flowing curves. In painting, art has rid herself of the conventionalism of line, and, like nature, expresses form by spaces. In speaking of the drawing of a picture, we indicate not only, or chiefly, the contours of its figures, but also their interior modelling, the subtle delicacies of colouring, of tone, and of light and shade, so far as these express the form of objects and reveal their individuality. Architectural drawing has its own rules; and mechanical or engineering drawing differs widely from other kinds in being done wholly by aid of instruments. See ART, PERSPECTIVE.

Drawing and Quartering. The punishment for Treason (q.v.), in force till 1870, was that the offender be *drawn* to the place of execution on a hurdle; that he be hanged by the neck and disembowelled; that his head be severed from his body, and that body be divided into four parts, or *quartered*. Despard (q.v.) and his six confederates were in 1803 drawn, hanged, and beheaded. See *Notes and Queries* for 1880–82.

Drawing-room. See COURT.

Drayton, MICHAEL, poet, was born at Hartshill, near Atherstone, Warwickshire, in 1563. It is not known whether he was a member of either university; nor is there any foundation for the statement that he served in early manhood as a soldier. In his epistle to Henry Reynolds he refers to the time when he was 'a proper goodly page,' probably in the family of Sir Henry Goodere, his patron. His earliest production was *The Harmony of the Church*, a metrical rendering of scriptural passages. For some reason it gave offence to the authorities, and was condemned to be destroyed. In 1593 he published a volume of eclogues, under the title of *Idea, the Shepherd's Garland*, which afterwards underwent considerable revision. The first of his more important poems was *Mortimeriados* (1596), which he republished (with many alterations) in 1603, under the title of *The Barons' Wars*. As a whole this historical poem is somewhat deficient in interest, but it abounds in fine passages. *England's Heroical Epistles*, first published in 1597, and frequently republished, written on the model of Ovid's *Heroides*, has more polish and less inequality than we find in many of Drayton's works; the versification is fluent and the diction choice. In *Poems, Lyric and Heroic* (*c.* 1606), appeared the *Ballad of Agincourt*, the most spirited of English martial lyrics. The first eighteen 'songs' or books of Drayton's greatest work, *Polyolbion*, were published in 1613, with annotations by John Selden; twelve more songs were written later, and the complete poem appeared in 1622. This gigantic undertaking was the labour of many years. Drayton aimed at giving 'a chorographical description of all the tracts, rivers, mountains, forests, and other parts of Great Britain;' and expended on his monumental work a vast amount of learning, industry, and skill. From the nature of the subject the poem could not fail to be to some extent monotonous; but the monotony is amply relieved by the beauty of the pastoral descriptions. In 1619 Drayton collected in a single volume all the poems (with the exception of *Polyolbion*) which he wished to preserve. Eight years afterwards he published a new volume of miscellaneous poems, among which was the whimsical and delightful *Nymphidia, the Court of Fairy*, a triumph of ingenious fancy. His last work, *The Muses' Elysium*, appeared in 1630; it contains some pastoral poems of finished elegance. He died in 1631. There is a monument to him in Westminster Abbey, and the inscription was probably by Ben Jonson. Drayton wrote many sonnets; one of them ('Since there's no help, come let us kiss and part') was pronounced by Rossetti to be 'almost the best in the language, if not quite.' He had a hand in not a few plays, including *Sir John Oldcastle* and perhaps *Henry VI.* Selections have been edited by A. H. Bullen (1883) and Dean Beeching (1899). The 1622 *Polyolbion* and other works have been reprinted by the Spenser Society (1885-92), *Nimphidia*, by Mr Brett-Smith (1921). See Oliver Elton, *Michael Drayton* (1905).

Drayton-in-Hales. See MARKET-DRAYTON.

Dreams have from all times aroused universal interest; they have often decided the destinies of individuals and of nations. The wise man among the ancients was pre-eminently the interpreter of dreams, and the ability to interpret successfully or plausibly was the quickest way to royal favour, as Joseph and Daniel found it to be. Many ideas have been advanced to explain them. The belief was common among the ancients that they were due to the soul's activities, the term soul sometimes being employed in a religious sense, and sometimes as synonymous with mind. Dreams have, in fact, done much to determine human beliefs concerning the nature of the soul and of its continued existence after death. Some thought that the dream was what the soul sees during sleep. The ancients, who deified everything, had a goddess of dreams, Brizo, who was worshipped at Delos. The Greeks and Romans were accustomed to lie down on skins in special places after religious rites and expected definite oracular pronouncements to be conveyed to them in this manner. On the other hand, the *Odyssey* refers to dreams as demons having their home on the road to Hades. Some were said to be shades of departed heroes which had been turned into benevolent or malignant beings. The ancient Hebrews knew that dreams originated inside the head; that hunger and thirst produced dreams in which these desires were satisfied, and that they followed a multitude of cares. Like the heathen they believed that some dreams were divine inspirations, and applied to diviners for their interpretation. Paracelsus (1493–1551) attributed dreams to physical causes, mental causes, astral influences, and spiritual agencies. It was not until the early part of the 19th century that views more in accord with modern teachings appeared. Gray, in his *Theory of Dreams*, in 1808 calls the dream 'the work of the mind, sketches of the fancy, deriving its materials from experience.'

To-day the nature of dreams is beginning to be properly understood. The problem during recent years has been studied with much enthusiasm by Freud and Jung and the psycho-analytical school of thought. These writers have done much to lay bare the psychological mechanism by which the dream is produced, and have placed the study of the dream on a scientific basis. According to Freud, dreams are not meaningless thoughts, but follow definite psychic laws and are replete with information of great psychological importance. He considers that no conscious experience is entirely lost; what seems to have vanished from the current consciousness has really passed into a sub-consciousness, where it lives on in an organised form as real as if it were still part of the conscious personality.

Dreams are the awakening of these dormant complexes, and thus they are transfigured experiences; they are, in fact, a manifestation of ordered mental experience. External stimuli may enter into the complex machinery of dream-formation, but only so far as to stir up some repressed element buried in the dreamer's unconscious mind. The dream as remembered, i.e. its *manifest* content, is merely a condensation of a number of hidden thoughts which represent its *latent* content. The latent content can only be discovered by an exhaustive analysis of the dream as remembered. Such an analysis shows that to effect such a transition from latent to manifest content, a great amount of work must have been performed by the dream; this is termed the *dream-work*.

The dream-work denotes the transference of the dream-thought to the dream-content, and thus it is not creative, it judges nothing, it decides nothing, and it develops no new fancies of its own. It merely prepares the matter for condensation, and, as the result of the other influences, it undergoes displacement and becomes refashioned for dramatisation and explanatory elaboration; thus a speech in a dream is never a new composition, it is merely pieced together out of speeches already made or heard. The words are copied, but the occasion of their utterance is overlooked and their meaning may be violently changed. The dream-work is only the first recognition of a group of psychical processes, to which must be referred the origin of hysterical symptoms, morbid dreads, and obsessions. The more important of the various processes made use of by the dream-work are as follows:

Dramatisation.—The dream has a dramatic character, in which its events unroll themselves before the sleeper, and preserve this character even if the dreamer himself is one of the actors. This dramatic quality is a property of the dream itself, and is due to the necessity in large measure for expression by means of sensory images. Often these images are more vivid than those of waking life. It is just as if a political speech or legal address had to be transformed into pantomime. By far the greater part of the dream consists of definite images of sight and hearing.

Symbolisation.—The relation between the underlying motive of the dream and the form in which this motive is expressed requires a process of symbolisation, the relation being of such a kind that the image of the manifest dream is a concrete symbol of the thought, emotion, or sentiment which forms its latent motive, e.g. motives connected with the dreamer's safety may be represented by a weapon of defence.

Condensation.—This process is one by means of which events which may range from those of the previous day back to the infancy of the dreamer, and thoughts and emotions connected with these events, find expression in the dream by some simple image or group of images. A vast body of experience may thus find expression in perhaps only a single incident of a dream. By this means composite or mixed persons may be built up consisting of one feature of one person and another of another. This character is intimately connected with the question of interpretation. Only when the life-history of the dreamer has been thoroughly investigated from every point of view which can possibly concern the dream is it likely that the correct interpretation is being approached. Any immediate and obvious interpretation of a dream is almost certain to be false or at least incomplete.

Displacement.—Condensation necessarily involves some degree of displacement of interest. If several different thoughts find their expression in a single image, certain interests arising out of one part of the latent content may be represented by an image with which they seem to have no natural connection. If the dream contains a number of images symbolising different dream-thoughts, the interests attached to one may be transferred to another. Freud attaches special importance to a form of displacement in which an emotional state which forms the most prominent motive of a dream finds expression, not in the form which would seem to be its natural symbol, but in some apparently insignificant image, e.g. a wish of the dreamer himself may find expression in the word or act of some other person. On the other hand, incidents which are really trivial may stand out prominently; the object of these is to hide something which is unpleasant to the dreamer.

Secondary Elaboration.—This term is used to express that part of the dream-work by means of which the manifest dream attains such sense and intelligibility as it may possess, whereby it makes use of interpolations, alterations, distortions, and maskings of unacceptable ideas. A certain amount of elaboration takes place unconsciously (primary elaboration), but secondary elaboration is wholly a matter of early waking thought, and is simply an effort of the dreamer to alter the dream to suit himself. Wishes and phantasies are not infrequently employed in this process, and we may thus be shown directly the true core of the dream, although distorted through admixture with other matter. Dreams differ greatly in their degree of coherence and apparent rationality, due to differences in the extent to which this process of sensory elaboration has been in action.

Disguise and Censorship.—In view of the fact that experiences repressed into the unconscious are mostly of a painful nature, their return to consciousness will again cause pain. The influence of consciousness is thus exerted to prevent their return, and when they attempt to return in the dream, due to the relaxation of conscious inhibition, a psychic conflict takes place, resulting in a compromise; by that they are allowed to enter, but only disguised by symbolisms and other distortions. This mechanism is termed the 'censor.' It is supposed to scrutinise all that comes up from the unconscious, and only allows that to pass which is so distorted that its real nature will not be recognised readily by the dreamer. The function of the censor is protection; it protects the sleeper from being awakened by thoughts which would have this effect if they came up from the unconscious in their real guise. According to this view, the nightmare is due to failure of the censor before the overpowering strength of some emotional stress calling for expression.

Wish-fulfilment.—We pass now from the processes of the dream-work to the nature of the dream-thoughts which thus find expression. Freud considers that every dream expresses the fulfilment of a wish. Many dreams are undoubtedly so. Others express other emotional states, such as anxiety, fear, or shame.

The Rôle of Sex.—Freud believes that the wishes which provide the motives for the dream, and find their ideal fulfilment in it, arise in the vast majority of cases out of the needs of the sexual life. Emotions and sentiments based on the instinct of self-preservation may also supply motives for the dream.

Dreams may thus be regarded as concealed realisations of repressed desires. They thus do foretell the future, but not the future which will occur, only that which we would like to occur. Dreams may be divided into three classes according to their relation towards the realisation of desire. First, those which exhibit a *non-repressed, non-concealed desire;* these are best seen in children, where the sleeping experience differs very little from the

waking experience, and the dream takes the form of the ungratified desires of the day. Second, dreams which express in *veiled* form some *repressed desire;* these constitute by far the larger number of our dreams, and they require analysis for their understanding. Third, dreams where repression exists, but *without* or with but slight concealment. These dreams are invariably accompanied by a feeling of dread, which brings the dream to an end. This feeling of dread replaces dream-displacement, which in dreams of the second class is prevented by the dream-work. Painful experience depresses the vitality, and thus tends to be repressed, i.e. to disappear from conscious memory. Similarly, distressing dreams, being immediately repressed in the waking state, are not remembered.

In contrast to those who assume that sleep is disturbed by dreams, the function of the dream is to act as the *guardian of sleep.* This is clearly seen in the dreams of children. The bad child who wishes the moon to play with wakes up at night crying for it; the good child remains asleep and dreams he has the moon and is playing with it. The dream which realises his desire is believed during sleep; it thus removes his desire and makes sleep possible. The adult's dream is not so simple, because he has learnt the futility of desire, and thus it is rare for him to have his wishes realised during sleep in the short psychical way. The dream may also prolong sleep by preventing the dreamer being disturbed by external stimuli, e.g. a noise intended to waken the dreamer may be interpreted into the dream in some pleasant form, such as applause, a dinner-bell, or some similar pleasing event, which is fitted naturally into the dream and allows sleep to continue. The dream also may have a protective function, and suspend sleep at the proper time. It acts like a conscientious night-watchman, who first quells the disturbance so as not to awake the citizen, but equally does his duty in awakening the street if he finds the trouble too serious to cope with alone. That the senses aroused during sleep influence the dream is well known, but the stimulus is not properly recognised in the dream, and is intermingled with a number of indefinite interpretations. Thus it is told of Dr Gregory that he dreamt of ascending the crater of Mount Etna after having gone to sleep with a bottle of hot water at his feet. A French observer, Maury, had a series of experiments conducted on himself. When his lips and nose were tickled with a feather he dreamt that the skin of his face was being torn off with a pitch-plaster; pinching the back of his neck made him dream of a doctor who had blistered him there in his infancy.

A striking confirmation of the truth of Freud's interpretation of dreams is found in their resemblance to another aspect of human thought and action, namely, the primitive culture of savage peoples. These two manifestations of the human mind have this much in common, that the mechanism by which dream-thoughts find expression has the same general characters as those which have produced the rites and customs of savage man. Both arise in the unconscious, and the phenomena compared both belong to the realm of mind, the one individual and the other collective. The dream is the expression of the infantile mentality of the individual; savage rites and customs are the expression of the primitive or infantile mentality of the race. The determination of social behaviour by the unconscious is not confined to rude culture, but is only somewhat more obvious in it than among more highly civilised peoples. It may be noted, however, that much the same might be said of the dream as compared with the waking thoughts of the day. We have every reason to believe that our waking thoughts are largely determined by the unconscious. It is chiefly the greater obviousness of its determination by the unconscious which is characteristic of the dream.

Among barbarous peoples the place occupied by the history and science of the civilised is taken by the myth. The myth is a means of recording knowledge of the unconscious past, and reveals the unconscious history of the race just as the dream does of the individual. They come into being through the action of laws very similar to those which produce the dream.

Certain drugs give a specific character to dreams, e.g. opium, cocaine, cannabis indica, and alcohol, depending on whether the drug is an excitant or a depressant, and on the mentality of the individual. The magnificent visions of the opium-eater have been made familiar by the classical account of De Quincey.

LITERATURE.—Freud, *The Interpretation of Dreams* (1913), *On Dreams* (1914); Bergson, *Dreams* (1914); Rivers, *Dreams and Primitive Culture* (1917); Jung, *Analytical Psychology* (1917); Walsh, *The Psychology of Dreams* (1920).

Dredge, a machine used for bringing up from the bottom of lakes, or of the sea, specimens of the organisms and plants which exist there. A rude species of hand dredge appears to have been in use from the earliest times, and is still employed among the peoples of the Pacific islands, an improved form being common in all civilised countries possessing a seaboard. As a means of scientific investigation the dredge was first used by Müller, who, before 1779, had made systematic investigations into the deep-sea fauna and flora off the coasts of Norway and Denmark. Other naturalists were not slow to recognise the value of the results thus obtained, and the dredge was extensively employed by the principal scientific men of the period, among whom Forbes especially deserves mention, although it was some time before its full value was known.

For ordinary purposes, and for use where the water does not exceed 100 fathoms in depth, Dr Robert Ball's dredge (1838) is generally recognised as most useful. With slight modifications, it continues to be employed in preference to other forms. The frame is 1½ feet long, with scrapers not more than 3 inches wide, and so placed that the distance across the scraping surfaces is between 7 and 8 inches; these scrapers are connected by the frame-ends, made of bar iron five-eighths of an inch in diameter. Two curved iron arms (*a*, *a* in fig.) are fixed to the extremities of the cross-bar by means of 'eyes,' which allow the arms to fall down over the mouth of the dredge. The bag is secured to the thick inner end of the scrapers by means of an iron rod and stout iron rings (*b*, *b* in fig.). This bag may be of any depth, but 2 feet will be found very convenient; it ought to be hand-netted from stout twine, and the lower end lined with coarse canvas, to prevent the escape of the more minute animals and plants. All the materials used in the construction of a dredge, the iron especially, ought to be of the very best quality. Captain Calver, of the *Porcupine* (1869–70), invented the use of hemp tangles (half-a-dozen fastened to an iron rod attached to the bottom of the dredge, or behind

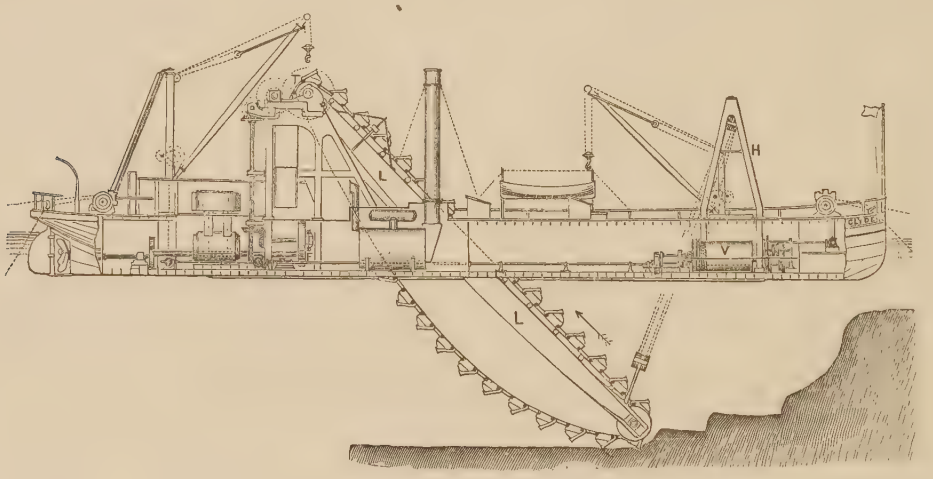
Dr Ball's Dredge.

it), and found them very successful in sweeping the bottom of objects which did not find their way into the dredge.

In the cruises of the *Blake* (1877–80), a case of stout canvas was used to cover the dredge, with the result that the most delicate organisms were brought up entirely uninjured, even after the machine had been dragged along rough ground for some time; the cover was also found to preserve the net from injury by contact with sharp rocks. In dredging, before the net is let down, the depth of the water should always be ascertained by casts of the lead, when not already approximately known, and, whenever practicable, a deep-sea thermometer ought to be used in conjunction with the lead, and the temperature of the water, which has a more important bearing on the distribution of life than is generally supposed, carefully observed and recorded. The rope attaching the dredge to the vessel ought to be tested before use, as any failure in it may lead to the loss of the dredge and its contents, and must be kept sufficiently slack to prevent its snapping from any sudden jerk. The length let out should be, as a rule, double the depth of water, to avoid danger of breakage from ordinary causes. If, however, the water be under 30 fathoms, the length of rope ought to be three times the depth. The boat from which dredging operations are carried on should always be kept moving, but very slowly. Wire-rope is used for deep-sea work with large vessels.

Dredger, a machine for clearing out or deepening harbours, canals, river channels, &c. Sometimes a channel can be deepened by natural scour assisted perhaps by training-walls, but when a large quantity of hard material has to be removed, dredging has often to be adopted. The material is pumped up or raised by buckets or grabs, discharged into barges, and removed to the place of deposit. The cost of dredging is very variable, and prior to 1914 might work out at from 1½d. to 1s. 6d. per ton; the larger sum might occur in the case of small quantities and with hired plant and when the place of deposit was some distance away. Repairs and maintenance expenses form a heavy item in the cost of dredging operations.

There are many types of dredger suitable for different circumstances—bucket-ladder dredgers,



Dredger.

grab, suction, rock-breaking, and eroding dredgers, of which the first-named is the most common. As shown in the diagram, the upper tumbler, T, is made to rotate by powerful gearing worked by the engines, and this gives motion to the chain to which the buckets are attached. The bucket-ladder, L, is raised and lowered by the topping-lift, H, and the lower end can project before the bow, and so cut a passage for the vessel through a dry bank.

A bucket-dredger at work must be securely moored by bow and stern chains or steel wire-ropes run out from each bow and quarter. The system of cross-dredging is generally adopted. The vessel is moored at one side of the bank to be dredged, the ladder is lowered so as to take a cut, and the one set of side-chains are hove in and the opposite set paid out. When the bank has been crossed, the bow-chain is hove in perhaps 12 feet, and a new cut is carried across, and so on till the required depth is reached. By means of shoots the dredgings are discharged into barges lying alongside. When these are filled they steam to the place of deposit—usually in deep water or out at sea—and the stuff is discharged by opening the hopper-doors in the bottom of the vessels. The barge-loading dredger works expeditiously, as it dredges and fills barges continuously; in the case of the hopper-dredger, which dispenses with barges, the dredging is entirely suspended while steaming away to the place of deposit, and time is also lost in dropping and picking up moorings, particularly in stormy weather. But each system has its advantage according to circumstances.

A bucket-ladder dredger, built in 1914 for deepening the Clyde below Port Glasgow, was 157 feet long, 34 feet beam, and 11 feet deep. In ordinary dredging material it could lift 500 tons per hour from a depth not exceeding 42 feet. Two sets of buckets were supplied, the one for hard boulder clay with buckets of 7 cubic feet capacity each, and the other for softer clay and sand with buckets of 18 cubic feet capacity. The vessel was self-propelling, and cost £21,000, but bucket-dredgers are made of much larger size and power than this vessel. Two hopper-barges, costing £15,000 each, were required to carry the dredged material some 12 miles away. These barges conveyed 1200 tons of material, and steamed, when loaded, at about 10 knots.

Grab-dredgers are used chiefly in soft material, and consist of a bucket suspended from the end of an arm. The bucket, by its weight, is forced into the material, and is opened and closed by a special arrangement of chains. The system of suction-dredging is also largely adopted in dredging soft material. A long pipe, fitted with a nozzle, is inserted into the sand, which is pumped up and

discharged either into barges or on to the shore through long pipes. Rock-dredging operations are the most expensive. When soft rock has to be removed, this may be done by claws attached to the buckets of a powerful dredger. If the rock is too hard for this method, it may be broken up either by blasting or by heavy rams—in principle huge chisel-pointed hammers weighing several tons each—and afterwards removed by grab or by buckets. The eroding-dredger is the simplest form of dredging-machine. By its means the material is loosened and left to be transported elsewhere by the current. Dredgers, combining several types, are frequently constructed.

Dred Scott Case, brought before the supreme court of the United States in 1856, was the case of a negro called Dred Scott, who with his wife and two children had been held as slaves by a Dr Emerson in Missouri. On returning thither, Scott and his family claimed to be free, as having resided with their owner in Illinois and Minnesota. The decision was hostile to their claim, and they were held to be still slaves. See SLAVERY.

Dreissena, a genus of bivalves, in the mussel family (Mytilidæ), peculiar in having the mantle halves almost completely united. One species (*D. polymorpha*) deserves notice, since, from its home in the Black Sea and Caspian, it has travelled westward on ships or logs, and has now established itself in many European (including British) estuaries and canals.

Drelincourt, CHARLES, a French Protestant divine, was born at Sedan in 1595, and was from 1620 a pastor near Paris, where he died in 1669. He wrote, among other works, a book that was translated and frequently reprinted in English, under the title *Consolations against the Fear of Death.* See DEFOE.

Dren'the, a frontier province of the Netherlands, bordering on Hanover; area, 1030 sq. m.; population, 210,000. It is the least populous province in the kingdom. The soil is in general poor, only about one-half of the surface being capable of cultivation, the remaining portion covered chiefly with heath and morass. The inhabitants are chiefly employed in agriculture, pasturage, and in digging and exporting peat.

Drepanum. See TRAPANI.

Dresden, the capital of the republic of Saxony, is situated in a charming valley on the Elbe, 116 miles SE. of Berlin, and 62 ESE. of Leipzig. The Altstadt and Friedrichstadt on the left bank of the Elbe, and the Neustadt and Antonstadt on the right or northern bank, are united by several bridges, including the Augustus Bridge, rebuilt 1906; the Albert Bridge, erected in 1875–77, a masterpiece of architecture; and the Marienbrücke, which is at once a railway and a carriage bridge. Dresden is a pleasant and attractive, though not exactly a beautiful town. It contains several open squares, and is embellished with statues and public gardens; and the Brühl Terrace, on the south bank of the Elbe, originally laid out by Count Brühl in 1738, is a charming promenade, on which in 1889 extensive improvements were made. Its architecture and splendid art collections, and its artistic and educational reputation, render Dresden one of the pleasantest and gayest of the smaller residential continental towns.

Dresden occupies an important position in the history of art, especially as the cradle of rococo art, which culminated here about the middle of the 18th century. Herder called it the German Florence. The Academy of Art, opened in 1764, and specially famous for drawing and architecture, the choir in connection with the Roman Catholic church, and the Conservatory of Music, are all of no small importance to the progress of art at the present day. Scientific, educational, æsthetic, and benevolent institutions also abound in the town. The museum, one of the finest specimens of modern architecture, built by Semper in 1847–54, contains collections of engravings (400,000 examples) and drawings, besides the famous picture-gallery. The last, which owes its origin chiefly to Augustus III. of Saxony, who purchased the Modena gallery in 1745, is one of the finest collections out of Italy, and contains about 2400 paintings, mainly by Italian and Flemish masters. The gem of the collection is the 'Sistine Madonna,' by Raphael (see PIACENZA); other masterpieces being Titian's 'Tribute Money,' and Correggio's 'Magdalene' and 'La Notte.' The so-called 'Holbein Madonna,' often ranked second among the treasures of the gallery, is now admitted to be a replica, the original being at Darmstadt. Adjoining the museum is the Zwinger, a remarkable rococo building of 1711–22, designed as the vestibule of an elaborate palace, of which, however, no more was ever built. It now contains valuable collections of casts, zoology, mineralogy, and mathematical and philosophical instruments. The Johanneum, erected as royal stables at the end of the 16th century, now accommodates the historical museum, founded in 1833, the gallery of arms, and the priceless collection of porcelain, which embraces 15,000 specimens. The Augusteum, or collection of antiquities, chiefly Roman objects of the Imperial times, and the Public Library, are deposited in the Japanese Palace, built in 1715 in the Neustadt. The library contains over 400,000 volumes, 20,000 maps, and 4000 MSS., and is particularly complete in the departments of literary history and classical antiquity, as well as in histories of France and Germany. The 'Green Vault' in the royal palace contains a valuable collection of precious stones, pearls, and curios, and articles in gold, silver, ivory, &c. The cabinet of coins is also preserved in the palace. The list of art treasures in Dresden may be closed with the collection of antiques (chiefly ecclesiastical), and the gallery of casts of the works of the sculptor Rietschel, both in the 'Lustschloss,' erected in 1680, in the Grosse Garten, a handsome public park, 350 acres in extent. Among the important buildings not yet mentioned are the royal palace, a large edifice, begun by Duke George in 1534, completed in 1890–1902; the prince's palace, erected by Augustus II. in 1718; the Brühl Palace, now the Ständehaus; and the magnificent new theatre (1871–78), designed by Semper. Of the churches, the finest are the Frauenkirche (1726–34), with a lofty dome and lantern 320 feet in height; the Roman Catholic church (1737–56), in an elaborate baroque style, adorned on the exterior with sixty-four statues; the Sophienkirche (1351–57), restored and provided with towers in 1865–69; and the Kreuzkirche, the largest church in Dresden, rebuilt 1764–85, and again after being burnt down in 1897. The Synagogue (1838–40), by Semper, is worthy of mention. There is a technical high school.

The most important industries are the manufactures of gold and silver articles, artificial flowers, machinery, chemicals, paper-hangings, painters' canvas and colours, chocolate, glass, pianofortes, photographic apparatus, cigarettes, straw-plaiting, brewing, and market-gardening. The so-called 'Dresden china' is manufactured not at Dresden but at Meissen (see POTTERY). A considerable trade is carried on by means of the Elbe, which is also enlivened by numerous small passenger-steamers. Pop. (1871) 177,087; (1885) 246,086; (1890) 289,844; (1910) 548,308; (1919) 587,748.

The oldest part of the town (originally Slavonic) was on the right bank of the river, but having been

rebuilt after a fire in 1685, it has since been known as the Neustadt. Henry the Illustrious made Dresden his capital in 1270, and after the division of the Saxon lands in 1485 it became the seat of the Albertine line, and its prosperity increased. Several sovereigns contributed to its embellishment, as Augustus I. and Augustus II. It suffered severely, however, during the Seven Years' War, and again in August 1813, when the armies of the allies gathered from all sides towards Dresden. The assault was made on the 26th, but was beaten back by Napoleon; and the allies retreated. Napoleon did not quit the city till the 7th Oct., leaving nearly 30,000 men behind. As all access was cut off by the Russians, the city suffered from famine, and capitulated on 11th Nov. The revolution of 1849 also did great damage to the town. Dresden was occupied by the Prussians in 1866. Since that period great and numerous improvements have been effected, and the city has been extended, especially in the south-eastern suburbs, known as the English and American quarters.

Dress. See FASHION.

Dreux, a town of France, in the dep. of Eure-et-Loir, on the Blaise, 27 miles NNW. of Chartres by rail. It lies at the foot of a hill crowned with the ruins of the castle of the Counts of Dreux. From among the ruins rises a beautiful chapel, erected by the mother of Louis-Philippe in 1816, to which were removed in 1876 the remains of the king and others of the Orleans line who had died in exile. The town-hall and the parish church are both good specimens of Gothic. Pop. 11,000. Dreux is the ancient *Durocassis*. In 1562 the Constable Montmorency defeated the Huguenots here.

Drew, SAMUEL (1765–1835), the 'Cornish metaphysician,' was born at St Austell, and had been a smuggler and shoemaker when in 1788 he became a Wesleyan preacher. He died at Helston.

Dreyfus, ALFRED, born in 1854 at Mülhausen in Alsace, the son of a rich Jewish manufacturer, migrated in 1874 to Paris. He was an artillery captain, attached to the General Army Staff, when in 1893–94, charged with delivering to a foreign government documents connected with the national defence, he was court-martialled, degraded, and transported to the Cayenne Île du Diable. The efforts of his wife and friends to prove him an innocent victim of malice, injustice, and forgery plunged France into a chaos of militarism and anti-Semitism. He was brought back to France in 1899, retried at Rennes, reconvicted 9th September, sentenced to ten years' imprisonment, but immediately pardoned. The proceedings against him were finally quashed in July 1906, and he was reinstated in the army as major. He was given the Legion of Honour in 1919. See the article ZOLA.

Dreyse, JOHANN NIKOLAUS VON (1787–1867), born near Erfurt, worked as a locksmith in Germany, and in a musket-factory in Paris 1809–14. He then founded an ironware factory in Sömmerda, and commenced the manufacture of percussion-caps under a patent in 1824. In 1827 he invented a muzzle-loading, and in 1836 a breech-loading needle-gun, which was adopted in the Prussian army in 1840. In 1864 Dreyse was ennobled.

Driesch, HANS, physiologist and professor of Philosophy at Heidelberg (1911), was born at Kreuznach in 1867. His works on the organism, vitalism, individuality, &c. have been translated.

Driffield, GREAT, the chief town in the Wolds, East Riding of Yorkshire, 11 miles N. of Beverley by rail, is connected with Hull, 19 miles to the south, by a navigable canal. The surrounding district is fertile, and the town has a considerable corn and cattle trade, besides manufactures of flour, linseed-cake, and artificial manures. Pop. 5700.

Drift, a name formerly given to boulder-clay, a deposit of the Pleistocene epoch. More fully, it was called the Northern Drift, Glacial Drift, or Diluvial Drift, in allusion to its supposed origin. The old river-gravels of Pleistocene age were also often termed river-drift. The term drift has now fallen out of use. For an account of the deposits formerly termed drift, see BOULDER-CLAY, PLEISTOCENE SYSTEM. For the drift-men, see MAN.

DRIFT-WOOD is wood carried by tides and currents to a distance from its native locality. Thus the shores of the Faröe Islands, Iceland, &c. are often strewn with logs brought by the Gulf Stream. Fragments of drift-wood occur as fossils in many geological formations, as in the Carboniferous Sandstones, the Chalk, the London Clay, &c.

SAND-DRIFT is sand driven and accumulated by the wind. Deposits thus formed are occasionally found among the stratified rocks, but compared with other strata they are few, though, from their anomalous character, an acquaintance with their phenomena is of importance to the geologist. As a rule, the mineral ingredients of wind-blown sand are better rounded than the grains of an aqueous accumulation of sand—the latter being carried in suspension, and thus to a large extent escaping the mutual trituration to which the former are subjected. Moving sands are at the present day, in many places, altering the surface of the land. In the interior of great dry continents, as Africa, Asia, and Australia, extensive districts are covered with moving sands. The continuous blowing of a steady wind in one direction often covers a rich tract with this arid material. But the influence of the wind on loose sand is most evident along low sandy coasts, where hills, called 'dunes,' are formed entirely of it; they sometimes attain a considerable height, as much, for instance, as 200 or 300 feet. Dunes (q.v.) are advancing on the French coasts of the Bay of Biscay at the rate of about 60 feet per annum, covering houses and farms in their progress. Similar accumulations are forming on the coasts of Elgin, Cornwall, Wexford, and other parts

Section of Culbin Sandhills.

of the British Isles. The Culbin Sands, in Elgin and Nairn shires, cover a large district which at a period not very distant was rich arable land. The prevailing wind is from the west, hence the hills are slowly moving in an easterly direction, at the rate of a mile in somewhat less than a hundred years. A singular stratification exists in these hills. The prevailing west wind lifts, or rather rolls the particles of sand up the gentle incline of the western aspect of the hill, until they reach the summit, where they fall, forming a steep declivity to the east, equal to the angle of repose for sand. A shower consolidates the surface of the new bed, or a land-breeze carrying fine dust separates it by a very thin layer of finer material from the one that follows, and thus, as the hill moves eastward, a regular series of strata is formed at a high angle, as is shown by the diagram. The progress of the hill is represented by the dotted outline. Little can be done to arrest the progress of these devastating sand-drifts. It has been recommended to plant *Carex arenaria* and similar sand-loving plants, which have long creeping roots: they certainly check to a considerable extent the influence of the wind. A great forest of sea-pine seven miles in width has since 1789 been maintained along the

sand-dunes of the French *Landes* (q.v.), with great benefit to the country inland.

Drill (*Cynocephalus leucophæus*), a species of Baboon (q.v.), a native of Guinea, similar to the mandrill, but rather smaller and less ferocious.

Drill is a general name for the exercises by which soldiers and sailors are made efficient. In the army, there are three classes of drill. First, 'setting-up' and 'gymnastic' drill, to improve the physical development of the recruit; secondly, sword, lance, and bayonet exercises, gun-drill, riding, driving, stretcher, shelter-trench, and repository drill (the technical name for shifting heavy ordnance), &c., to teach him to handle his arms, horse, or tools to the best advantage; thirdly, marching, squad, company, squadron, battery, battalion and brigade drill, &c., to enable the men composing these various bodies to act together. After some weeks of such drill, there are added tactical exercises, such as signalling, outposts, skirmishing, which complete the instruction of the recruit. An ordinary recruit requires about four months' drill to become efficient in the infantry, two years' in the cavalry, and three in the artillery. In the navy, the drills vary in the same way with the nature of the duties required.

Drills. See BORING.

Drimys. See WINTER'S BARK.

Drinking Usages. See TOASTS.

Drinkwater, JOHN, born in 1882, worked in insurance offices, and from 1903 published reflective poems (*Swords and Ploughshares, Olton Pools, Tides, Loyalties, Seeds of Time, Preludes*), studies of William Morris and Swinburne, and plays in verse and prose, *Abraham Lincoln* (1918), a sort of chronicle play, proving a great success on the stage. *Mary Stuart, Oliver Cromwell, Robert E. Lee,* were later achievements in this refractory kind. He was one of the promoters of the Birmingham Repertory Theatre.

Dripstone, a projecting moulding or tablet placed over the head of a Gothic doorway or window, originally to throw off the water (whence it is also known as a water-table or weather-moulding), latterly as an ornamental appendage, serving to enrich and define the outline of the arch, and applied internally as well as externally. Ruskin points out that the dripstone is one of the chief features which distinguish the style of the rainy north from that of the more sunny south.

Driving (see COACHING, and RIDING AND DRIVING). Driving vehicles or riding furiously and recklessly in a public place, to the danger of the lieges, is an offence at common law in England, and may be prosecuted as culpable neglect of duty according to the law of Scotland. It has, however, been made a statutory offence, and many acts have been passed under which prosecutions are now as a rule brought. In the United States, furious driving in cities generally is a misdemeanour punishable by fine and imprisonment. In the absence of State laws, municipalities regulate the rate of driving.

Drogheda, a seaport, and, till 1898, county of itself, in the south-east of County Louth, built mostly on the north bank of the river Boyne, 4 miles from its mouth, 32 N. of Dublin by rail, and 81 S. of Belfast. The Boyne is crossed here by a railway viaduct 95 feet high. There are linen and cotton manufactures, ironworks, tanneries, breweries, and salt-works. It has a considerable export trade, chiefly with Liverpool (140 miles distant), in corn, meal, flour, cattle, linen, hides, butter, and eggs. Vessels of 500 tons reach the quay, and barges of 50 tons ply 19 miles up the Boyne to Navan. Pop. (1851) 16,845; (1891) 11,873; (1911—as extended in 1896) 12,425. Up to 1885 Drogheda sent one member to parliament. From the 14th to the 17th century, Drogheda (often called *Tredah*) was the chief military station in Leinster. Poynings' laws were enacted here in 1494, and about the same time a mint was set up. In 1649 Cromwell stormed the town after a desperate struggle, and for a stern lesson to the Irish put its stubborn garrison to the sword. Drogheda surrendered to William III. the day after the battle of the Boyne (q.v.).

Drohobycz, a town of Poland, in Eastern Galicia, 50 miles SW. of Lemberg by rail. It has extensive salt-works, petroleum-works, and dye-works. Pop. 27,000, half of whom are Jews.

Droits, ADMIRALTY. See ADMIRALTY DROITS.

Droitwich, a municipal borough in Worcestershire, on the Salwarpe, 6 miles NNE. of Worcester. It is a railway junction, and is connected by canal with the Severn. Originally a British town, and probably the Roman *Salinæ*, it was first known as Wych, from the salt-springs, to which Droit was afterwards prefixed, expressing a legal right to them. Its salt trade has been famous from remote times. Pop. 4600. Droitwich sent one member to parliament until 1885. The admirably equipped saline baths are visited by thousands.

Drôme, a department of France, on the east bank of the Rhone, to the south of the department of Isère. Area, 2508 sq. m. Pop. (1866) 324,231; (1921) 263,509. The surface is generally hilly, and even mountainous in the east, where spurs of the Alps rise to a height of 5900 feet; and, except in the Rhone valley, the soil is not very productive. Drôme is traversed by a number of affluents of the Rhone, the most notable being the Isère and the Drôme (75 miles), from which the department takes its name. Along the Rhone, however, where a Mediterranean climate prevails, the almond and olive flourish, though an occasional crop is lost from frost, and oil-nuts and the mulberry are extensively grown. Also, the cultivation of the vine was an important industry before the ravages of the Phylloxera affected it; Hermitage and the white wine Clairette de Die were especially famous. Wheat, potatoes, and melons are produced in large quantities, and the cultivation of truffles has become noteworthy. Coal, cement, and potter's clay are found; and there are manufactures of silk, woollen, straw, and iron goods, pottery, paper, leather, and glass, besides an active trade in the raw products of the district. The department is divided into the four arrondissements of Valence, Montélimar, Die, and Nyons, with the town of Valence for capital.

Dromedary.

Dromedary, a swift variety of the one-humped camel (*Camelus dromedarius*), bearing the same relation to it as race-horse to cart-horse. Its usual

pace is a trot, which, with terrible joltings to the rider, can be maintained often at the rate of nine miles an hour for many hours on a stretch. A journey of 600 miles can be performed at a slower rate in five days. After running for twenty-four hours, when in good condition, the dromedary is refreshed with a frugal meal of barley and powdered dates, along with a little water or camel's milk, and is then ready for another day of it. A gallop is a pace for which the dromedary is not adapted. Many varieties—e.g. for racing—are reared, and white forms are much prized in some parts of the East. Though now distinctive of North Africa, the dromedary seems to have been unknown to the ancient Egyptians. For general information, see CAMEL.

Dromore, a town, with linen manufactures, in the north-west of County Down, on the Lagan, 17 miles SW. of Belfast by rail. Pop. 2400. It is still the seat of a Roman Catholic diocese, as it was also of an Episcopal till 1842, when it was united with Down. Jeremy Taylor and Thomas Percy were bishops of Dromore.

Drone. See BEE.

Drontheim. See TRONDHJEM.

Dropsy (Gr. *hydrōps*, from *hydōr*, 'water'), a class of diseases always of serious import, though not often, perhaps, directly fatal. Dropsy is rather a symptom than a disease; it consists of the effusion of watery fluid from the blood into the skin and subjacent textures, or into the cavities of the body. When the effusion is chiefly in the superficial parts, the dropsy is called Anasarca (*ana*, 'upon,' *sarx*, 'the flesh'); when it is in the abdomen, it is termed Ascites; when in the space around the lungs, Hydrothorax. Dropsy most commonly depends on disease of the Heart (q.v.) or Kidneys (q.v.); in cases of ascites, the liver and spleen are often at fault. The treatment of dropsy is chiefly by Diuretics (q.v.) and other evacuant remedies, which remove the fluid from the textures by unloading the blood of its excess of serum. In other cases, where the power of the heart is at fault, cardiac stimulants are given. In all cases, the internal organs should be, if possible, submitted to a strict medical examination, and the treatment regulated accordingly. Mechanical means are also frequently used to relieve the patient of the fluid—in the case of the cavities of the body, Tapping (q.v.); in the cellular tissue either free incisions, or small tubes inserted through the skin, by which the fluid is allowed gradually to drain away.

Dropwort. See SPIRÆA, and WATER DROPWORT.

Droseraceæ, a small order of archichlamydeous dicotyledons allied to Saxifrages, and including about 100 species. They are small herbaceous plants, generally inhabiting marshy places, with leaves frequently circinate in bud, and usually covered with glandular processes or hairs. These are very frequently adapted to the capture and digestion of insects. See INSECTIVOROUS PLANTS.

Drosky. See CARRIAGE.

Drosophila. See FRUIT-FLY.

Drouet, JEAN BAPTISTE, COMTE D'ERLON, French marshal, was born 29th July 1765, at Rheims, entered a regiment of volunteers in 1792, and took part during the years 1793–96 in the campaigns of the Moselle, Meuse, and Sambre. His conduct in the Peninsular war was highly distinguished. After the fall of Napoleon, the Bourbons gave him the command of the 16th division, but he was shortly after arrested on the charge of conspiring against the royal family. On the return of Napoleon from Elba, he contrived to seize the citadel of Lille, in which he had been imprisoned, and held it for the emperor, who made him a peer of France. At the battle of Waterloo he commanded the first *corps d'armée*. After the capitulation of Paris, he fled to Bavaria, where he resided until the July revolution, when he returned to France, and received in 1832 the command of the army of Vendée. During 1834–35, he held the important office of governor-general of Algeria, and in 1843 was elevated to the rank of marshal. Drouet died 25th January 1844.—JEAN BAPTISTE DROUET (1763–1824) was a zealous revolutionist of the extreme Jacobin section; and LOUIS DROUET (1792–1873) was a very famous flute-player.

Drouyn de Lhuys, ÉDOUARD, a French statesman, born in 1805, was attached to the embassies at Madrid and at the Hague. In 1840 he was placed at the head of the commercial department under the Minister of Foreign Affairs, and shortly after was elected deputy for Melun; but he afterwards was deprived of his office because of his opposition to the government. Under Louis Napoleon's presidency he became Minister of Foreign Affairs, and in 1849 went to London for a short time as ambassador; after the *coup d'état* he became one of the vice-presidents of the Imperial Senate, and again Minister of Foreign Affairs. Being disappointed at the issue of the Vienna Conferences in 1855, he resigned his office. In 1863 he was recalled to his old post, resigning again in 1866. He died March 1, 1881.

Drowning. See ASPHYXIA, RESPIRATION (ARTIFICIAL), and HUMANE SOCIETY.

Drowning was long a customary mode of capital punishment. Tacitus, writing about the end of the 1st century, tells us that the Germans hanged their greater criminals, but that meaner and more infamous offenders were plunged under hurdles into bogs and fens. Drowning was also a Roman punishment. The Lex Cornelia decreed that parricides should be sewn up in a sack with a dog, cock, viper, and ape, and thrown into the sea. The Anglo-Saxon codes ordered women convicted of theft to be drowned. The punishment was in such common use throughout the middle ages that grants of capital jurisdiction ran *cum fossa et furca* (i.e. 'with pit and gallows'). The pit, ditch, or well was for drowning women; but the punishment was occasionally inflicted on men. In Scotland, in 1556, a man convicted of theft and sacrilege was sentenced to be drowned, 'by the queen's special grace.' So lately as 1611 a man was drowned at Edinburgh for stealing a lamb; in 1623 eleven Gypsy women were sentenced to be drowned in the Nor' Loch there. By that time the punishment of drowning had become obsolete in England. It survived in Scotland until 1685 (the year of the drowning of the Wigtown martyrs), and in France was employed so late as 1793 at Nantes in the infamous *noyades* of Carrier (q.v.). The offending wives of the Turkish sultans were wont to be sewn up in a sack and cast into the Bosporus.

Droylsden, Lancashire, a suburb of Manchester, 3½ miles E. of it, with railway station. Pop. 14,000.

Droz, ANTOINE GUSTAVE, novelist, was born at Paris, 6th June 1832, grandson of Jean Pierre Droz (1746–1823), an engraver of medals, well known in his day. At first Droz studied art, but soon to his profit exchanged the pencil for the pen, making a brilliant reputation that is not quite easy to understand in the pages of *La Vie Parisienne*, with his *Monsieur, Madame, et Bébé*, which, published in book-form in 1866, reached in twenty years its 120th edition. Later books are *Entre Nous* (1867), *Le Cahier bleu de Mademoiselle Cibot* (1868), *Autour d'une Source* (1869), *Un Paquet de Lettres* (1870),

Les Étangs (1876), *Tristesses et Sourires* (1883), and *L'Enfant* (1885). He died 22d October 1895.

Drugget (Fr. *droguet*), a woven and felted coarse woollen fabric, usually with a printed pattern, chiefly used for covering carpets, and hence called in some parts of Great Britain crumb-cloth. It is generally too thin to take the place of a proper carpet, but it is sometimes so employed. The name is also given to a stout dress fabric made with a linen warp and a worsted weft. It is made into petticoats, workmen's aprons, &c.; sometimes only the weft, but often both warp and weft, being dyed.

Drugs. See ADULTERATION, CHEMISTS AND DRUGGISTS, PHARMACOPŒIA, PHARMACY, and PRESCRIPTION; also such articles as ARSENIC, MORPHINE, OPIUM.

Druidism is commonly spoken of as the religious system of the Gauls and Britons, or of the Celtic peoples. Sir John Rhys, however, held that the real religion of the Celts was an Aryan Polytheism like that of Italians and Greeks; and that Druidism, in so far as found amongst the Celts of Gaul or Britain, was by them derived probably from pre-Celtic and non-Aryan aborigines (Ivernians, Iberians, Euskarians or Basques, Neolithic men?), and was thus non-Aryan in origin. There is no reason, he says, for holding that Druidism was found amongst the Brythonic races proper, though it was in force amongst the Goidelic (Gaelic) peoples of the British Isles. Cæsar thus describes the character and functions of the Druids: 'They attend to divine worship, perform public and private sacrifices, and expound matters of religion. A great number of youths are gathered round them for the sake of education, and they enjoy the highest honour in that nation; for nearly all public and private quarrels come under their jurisdiction; and when any crime has been committed, when a murder has been perpetrated, when a controversy arises about a legacy or about landmarks, they are the judges too. They fix rewards and punishments; and should any one, whether a private individual or a public man, disobey their decrees, then they exclude him from the sacrifices. This is with them the severest punishment. The persons who are thus laid under interdict are regarded as impious and wicked people; everybody recoils from them, and shuns their society and conversation, lest he should be injured by associating with them. They cannot obtain legal redress when they ask for it, nor are they admitted to any honourable office. All these Druids have one chief, who enjoys the highest authority amongst them. When he dies, he is succeeded by the member of the order who is most prominent amongst the others, if there be any such single individual; if, however, there are several men equally distinguished, the successor is elected by the Druids. Sometimes they even go to war about this supremacy. At a certain time of the year, the Druids assemble on the territory of the Carnutes, which is believed to be the centre of all Gaul, in a sacred place. To that spot are gathered from everywhere all persons that have quarrels, and they abide by their judgments and decrees. It is believed that this institution was founded in Britannia, and thence transplanted into Gaul. Even nowadays, those who wish to become more intimately acquainted with the institution generally go to Britannia for instruction's sake.

'The Druids take no part in warfare; nor do they pay taxes like the rest of the people; they are exempt from military service, and from all public burdens. Attracted by such rewards, many come to be instructed by their own choice, while others are sent by their parents. They are reported to learn in the school a great number of verses, so that some remain there twenty years. They think it an unhallowed thing to commit their lore to writing, though in the other public and private affairs of life they frequently make use of the Greek alphabet. . . . Beyond all things, they are desirous to inspire a belief that men's souls do not perish, but transmigrate after death from one individual to another; and they hold that people are thereby most strongly urged to bravery, as the fear of death is thus destroyed. Besides, they hold a great many discourses about the stars and their motion, about the size of the world and of various countries, about the nature of things, about the power and might of the immortal gods; and they instruct the youths in these subjects.'

It is easy to comprehend that this powerful priesthood did all it could to uphold the national cause against the Roman conquerors, and urged the people to rebellion; so much so, that the Emperor Claudius found it necessary to interdict formally the practising of Druidical rites, which seem, however, to have continued down to the extinction of paganism. Besides being priests and teachers of religion, the Druids appear also to have been adepts in the magic arts, and were versed in the mysterious powers of animals and plants. The oak-tree was especially sacred among the Druids. In oak-groves they frequently performed their rites, and many have even derived their name from this custom. They also had a special reverence for the mistletoe, when growing on an oak. According to Pliny, a Druid, clothed in white, mounted the tree, and with a knife of gold, cut the mistletoe, which was received by another, standing on the ground, in his white robe. The same author gives a curious account of the 'serpent's egg,' worn as a distinguishing badge by the Druids. It was formed, he says, by the poisonous spittle of a great many serpents twined together. Gathered at moonlight, and afterwards worn in the bosom, it was a mighty talisman. All these particulars refer properly to the Druids of Gaul, but Cæsar's testimony leaves no doubt that the Druidism of Britain was essentially the same. According to Whitley Stokes, the Druids never were in Ireland a hierarchy or separate class, as they are said to have been in Britain; but merely a species of wizards, enchanters, or sorcerers.

In all the countries anciently inhabited by Celts, there are found rude structures of stone, one of the most common forms of which is the so-called *Dolmen* (q.v.). The older archæologists—e.g. Stukeley—assumed that these were Druidical altars, but there is no proof that such was their destination or origin: similar structures are found in Scandinavia and other parts of the Continent. The same doubts prevail as to the larger monuments of this kind—the supposed Druidical temples of Carnac in Brittany, and of Stonehenge (q.v.; and see STANDING STONES). Speaking more generally, the historians and archæologists of the present day do not profess to know nearly so much about the Druids as did those who wrote concerning them in a previous generation. See Rhys, *Celtic Heathendom* (1888); D'Arbois de Jubainville, *Les Druides* (1906).

Drum (Ger. *trommel;* Fr. *tambour*, a modification of *tabour; timbrel* and *tambourine* are other forms of the word *tabour* or *tambour*), an instrument of percussion, in which a skin of parchment, stretched on a frame of wood or metal, is beaten with an instrument called a drumstick. There are three varieties of the drum: the kettle-drum, the side-drum, and the bass-drum. The first is the only one which can really claim to be a musical instrument, playing a definite note in harmony with the music it accompanies. The kettle-drum (Fr. *timbale*, Ger. *pauke*, Ital. *timpano*) consists of a kettle, or shell, of brass or copper, generally

hemispherical, over the mouth of which the skin is stretched by means of an iron ring, which is also provided with screws and keys for tightening the skin to tune it to any note within its compass. Two (often three or more) are required in a full orchestra; the larger should have a compass from F to C, the smaller from B♭ to F on the bass stave; and they require to be tuned to the proper notes, as indicated in the music. They are played upon with whalebone sticks, having at one end a wooden button covered with sponge or other soft material. The *roll*, a most effective part of its music, is performed with single alternate and very rapid strokes of the sticks, about one-fourth of the diameter from one side. The only military use made of the kettle-drum is in cavalry bands, which carry two, possibly because two are more easily balanced on a horse's shoulders than one, rather than from any musical reason.

The side-drum, or snare-drum, is more essentially a military instrument, though sometimes also used in orchestras. It consists of a brass or wood cylinder, with a skin *head* at each end. These are tightened by means of hoops over the heads, laced with an endless cord passing zigzagwise from head to head, and braced with leather braces, or more usually with rods and screws. Across the lower end several catgut cords, or snares, are tightly stretched in contact with the skin, causing a rattle when the other end is beaten. When anything is put between these snares and the skin to prevent the rattle, the drum is said to be *muffled*, and is so used at funerals. It is played upon on the centre of the upper end by means of two hard wood sticks with a knob at one end. The *roll* for the side-drum consists in striking two blows alternately with each stick. It is called daddy-mammy, from the sound. The side-drum was formerly used as a signal instrument, and the *drummer* is still an army institution (see BAND); but the Bugle (q.v.) does the signalling, the drum only being used with the music in marching.

The bass-drum (Ital. *gran tamburo* or *gran cassa*, Fr. *grosse caisse*) is of similar construction, having (commonly) two heads. The stick has a soft round knob. The centre of the head is struck. The side and bass drums being only used to mark the rhythm of the music, are not tuned to any particular note. The orchestral bass-drum is very often made much larger in diameter than the military instrument, and with a shorter cylinder.

A *Drum-head Court-martial*, so called because originally held round the big drum, is a hasty council or court-martial held in the field when it is necessary to punish an offender on the spot and without delay. By the Army Act of 1881 a *Summary Court-martial* was instituted to take its place in the British army.

The Tambourine (q.v.) is another species of drum. The ancient Romans used small hand-drums—some resembling tambourines and others kettle-drums—in their religious dances; and the Parthians are said to have used them in war to give signals. They are believed to have been first introduced to western Europe by the Crusaders.

Drum, a Celtic word meaning the back, and applied to a small hill or ridge of hills, enters into the composition of many place-names, especially in Ireland and Scotland, as *Drum*condra, *Drum*glass, *Drum*sheugh.

Drumclog, a moorland tract in Lanarkshire, on the borders of Ayrshire, 6 miles SW. of Strathaven. Here, 2½ miles E. of Loudon Hill, Claverhouse was defeated on 1st June 1679 in a skirmish with a party of 200 Covenanters, vividly described in Scott's *Old Mortality*. A monument marks the scene of the encounter.

Drum-major, the old title (till 1878) of the sergeant-drummer who commands the drummers, marches at the head of the battalion, and sets the pace. See BAND.

Drummond, HENRY, biologist and theologian, was born at Stirling in 1851, and studied at the University of Edinburgh and the Theological College of the Free Church; and in 1877 was appointed lecturer on Natural Science, and in 1884, professor of Natural Science at the Free Church College in Glasgow. He had travelled in the Rocky Mountains, in Central Africa, Japan, the New Hebrides, and Australia. In his book on *Natural Law in the Spiritual World* he sought by analogical arguments to reconcile evangelical Christianity with the doctrine of evolution. The book, published in 1883, reached in ten years a 29th edition; and was followed in 1894 by *The Ascent of Man*, an attempt to christianise evolution by laying stress on altruistic elements in natural selection, which he called 'the struggle for the life of others.' Other publications were a charming work on *Tropical Africa* (1888; 20th thousand 1890), followed by a series of small books, *The Greatest Thing in the World*, *Pax Vobiscum*, &c.; and he wrote CREATION for a former edition of this Encyclopædia. He died 11th March 1897. See Life by G. A. Smith (1899).

Drummond, THOMAS, R.E., born at Edinburgh in 1797, in 1820 joined the ordnance survey, whose work was facilitated by his improved heliostat and his adaptation of the lime-light (the so-called 'Drummond Light'). He became head of the boundary commission under the Reform Bill; private secretary to Lord Althorp, Chancellor of the Exchequer, in 1833; and Under-secretary for Ireland in 1835—a post in which he at once gained the confidence and affection of the people. His memorable saying, 'Property has its duties as well as its rights,' dates from 1838. He died 15th April 1840, in Dublin, where, alone of English secretaries, he lies in a grave of his own choosing among the people he was sent to govern. See the Life by Barry O'Brien (1889).

Drummond, WILLIAM, OF HAWTHORNDEN, a poet of considerable celebrity, was descended from an ancient Scottish family, and was born at his father's seat at Hawthornden, near Edinburgh, 13th December 1585. He was educated at the High School of Edinburgh, and afterwards at the university of that city, where he graduated Master of Arts in 1605. He next studied law and general literature at Bourges and Paris, and on his father's death in 1610 retired to Hawthornden, which, according to the learned Ruddiman, 'was a sweet and solitary seat, and very fit and proper for the muses.' He devoted his life to poetry and mechanical experiments. He was on the point of marrying Mary Cunningham of Barns, when she died in 1614 or 1615. He married Elizabeth Logan in 1632. He had to subscribe to the Covenant, but witnessed its triumph with a sinking of heart that the most sarcastic verses in manuscript could not relieve. He died 4th December 1649; his death, it is said, being hastened by his excessive grief for the fate of Charles I. Drummond enjoyed the friendship of many of his contemporaries, including Drayton, Montrose, and the great Ben Jonson, the last of whom paid him a memorable visit at Hawthornden in 1618–19. The two men were unlike in everything save that both were genuine poets, and Drummond's *Notes* of the greater man's talk (in Herford and Simpson's ed. of Jonson, i. 1925) is one of the most interesting chapters of literary history. His principal works are *Tears on the Death of Mœliades*—Prince Henry—(1613); *Poems: Amorous, Funerall, Divine, Pastorall, in Sonnets, Songs, Sextains,*

Madrigals (1616); *Forth Feasting* (1617); and *Flowers of Sion* (1623). His prose writings include a History of Scotland, known as the *History of the Five Jameses*, as well as some political tracts.

Drummond's verse abounds in the conceits, antitheses, and hyperboles of the period, and gives indication of a mind given to the luxury of melancholy. His sonnets are the best specimens of his muse. His mastery of different rhythms reveals his learning and the labour he gave to his verse. *The Cypresse Grove*, published with *Flowers of Sion* (reprinted 1907), is a masterpiece of 17th century prose.

His poems were edited in 1832 (Maitland Club), in 1833 (by Peter Cunningham), in 1857 (by W. D. Turnbull), in 1894 (by Wm. C. Ward), and in 1913 (by Professor Kastner). The rude macaronic, *Polemo-Middinia*, is often attributed to Drummond. See the learned and exhaustive Life by Professor Masson (1873).

Drummond Island, most westerly of the Manitoulin chain in Lake Huron, belonging to Michigan, measures 20 miles by 10.

Drunkenness. See INTOXICATION, ALCOHOLISM, DIPSOMANIA, INEBRIATES, and TEMPERANCE.

Drupe, in Botany, a succulent fruit containing a single seed or kernel, usually inclosed in a hard 'stone,' the *endocarp*. The succulent part is the *mesocarp*, the skin the *epicarp*. Examples are familiar in the fruits generally known as stone-fruits, the peach, plum, cherry, &c. The fruits of the genus Rubus (Raspberry, Bramble) are composed of many small aggregated drupes upon a common receptacle. See FRUIT.

Drury, DRU, a silversmith of London, was born 4th February 1725. He was devoted to the study of entomology and to collecting exotic insects, and published *Illustrations of Natural History* (3 vols. 1770–82, with upwards of 240 figures of exotic insects). His *Illustrations of Exotic Entomology* was edited in 1837 by J. O. Westwood, and appeared with nearly 700 figures by Moses Harris. Drury died 15th December 1803.

Drury-lane Theatre was first opened in 1663, by Killigrew, though earlier theatres had stood in Drury Lane. Killigrew's house was burned in 1672, and a new building, by Wren, was opened in 1674. In 1791 it was pulled down. The third theatre, completed in 1794, was burned down in 1806. The fourth was inaugurated in 1812 with a prologue by Lord Byron, the advertisement for which gave rise to the famous *Rejected Addresses*. Among proprietors and managers have been Cibber, Garrick, who opened the theatre in 1747 with Dr Johnson's prologue, Sheridan, and Macready; and most of the great English actors have trod the boards which, during and after the management (1879–96) of Sir Augustus Harris, were largely given over to pantomimes and spectacular pieces.

Druses, a remarkable people of Syria, forming three groups—the largest in Jebel Druz or Haurân (q.v.), a mountain district S. of Damascus; the second in southern Lebanon (q.v.); and the third on the western slopes of Anti-Lebanon and about Hermon. Many of the second and third groups migrated to the Haurân, as being too much dominated by Christian authority in Lebanon and Anti-Lebanon. A good many have emigrated to America. Conflicting statements as to their origin indicate probably a mixture of races. According to their own tradition, they were Arab tribes from Yemen who migrated to Mesopotamia, thence to the neighbourhood of Aleppo, where Darazi found them, and whence they came south. Another tradition traces their origin to the Cuthites (Karduchi or Kurds), with whom, after the second captivity of Israel, Esarhaddon re-peopled the wasted strongholds of Samaria. More than a thousand years later, the Mardi, a warlike tribe of Persian extraction, were transplanted thither by Constantine IV., in 686 A.D., to the number of 12,000, to act as a bulwark against Mohammedan invasion. The Arabs also, in sweeping through the mountain-fastnesses, left a permanent impression there. Thus, according to this view, Cuthites, Mardi, and Arabs, or rather Mohammedans of various races, combined to form that strange being—the modern Druse.

The nationality of these mountaineers having been consolidated, their peculiar and mysterious religion began gradually to be developed. Hakim Biamr Allah, or Biamrillah, one of the Fatimite khalifs of Egypt, and a Nero in cruelty, was the author of this system. He affirmed that he was the representative of God, and, having enlisted his confessor, Darazi, in his cause, he prepared to propound his doctrine. In the 407th year of the Hegira (1029 A.D.), the divine nature of Hakim, or rather the incarnation of the Spirit of God in him, was publicly announced at Cairo. This revelation, however, was unfavourably received by the mob. Hakim's confessor, Darazi, narrowly escaped the fate of a martyr to the impostures of his master. Retiring, however, he established himself on the western slopes of Hermon near Hasbeya, and there began to inculcate the principles of the new faith; and although he never acquired any mastery over the sympathies of the mountaineers, he at least in all probability left his name to them. Hamzé, a Persian mystic, and successively the disciple and vizier of Hakim, introduced into the newly promulgated religion all the elements of attraction and strength which it possesses; and him the Druses venerate as the actual founder of their faith.

The Druses form one of the very few sects among whom proselytism is discouraged. They are remarkable conservatists. For 800 years they have maintained a distinct religious and political independence and nationality. Into their faith the doctrines of the Pentateuch, the Christian gospel, the Koran, and the Sufi allegories are wonderfully interwoven. The following are their seven great principles: (1) Veracity (to each other only); (2) mutual protection and resistance; (3) renunciation of all other religions; (4) separation from all who are in error; (5) recognition of the unity of God; (6) resignation to his will; (7) obedience to the commands of God. They believe in one God in whom there are no parts, to whom they ascribe no attributes, before whom the tongue ceases to utter, the eyes to behold, but who has revealed himself ten times upon the earth under the form and name of mortal men. In Hakim, so Hamzé taught, had God revealed himself for the tenth and last time; there have been sixty-nine minor manifestations. They also believe that the number of existing souls never varies, and that all the souls in life now have lived, vested in some human form, from the beginning of the world, and will so continue to exist till the end of it; that when a man dies, his soul puts on a fresh humanity, which occupies a rank in moral dignity corresponding to the purity or impurity of the past life. When the soul has been purified from every stain, there will come a period of rest. Prayer is looked upon as an interference with the work of the Creator. The resurrection will be ushered in by war between the Mohammedans and Christians, and the Druses only wait for an Armageddon in which they believe they are destined to take a prominent part. As a religious body, the Druses are divided into two classes; the Akals, or those initiated into the Druse mysteries; and the Djahils, the uninitiated. The former do not adorn themselves with gold, or wear silk, or embroidered garments; they forbear using wine,

spirits, tobacco, and other luxuries. Yet the Akal is taught that when necessary, equivocation, or even falsehood, may be practised.

The most remarkable man produced by the Druses in the beginning of the 17th century has been the Emir Fakr-ed-din, who annexed Beyrout and Sidon, and threatened Damascus, and who was executed by the Turks. When Emir Beshir was chosen sheikh of the Druses in 1789, the authority of the Porte was only nominal in the Lebanon; by the help of Egypt he subdued his rivals. The Turks instigated the Druses to revolt against Egypt, and the final struggle between the Turks and Egyptians culminated in the defeat of the latter, owing to the assistance rendered to the Sultan by England, and Emir Beshir was exiled. After this, the Maronite Christians and the Druses took to murdering each other, and the strife reached its climax in 1860. From May to October of that year, accounts of the fearful barbarities practised by the Druses upon the Maronites followed each other with appalling frequency, until the indignation of Europe was roused against them. A conference of the five Powers which had guaranteed the independence of Turkey met at Paris, and a force (one-half French) and a European Commission were sent to Syria. They could not, however, get at the Druses, who retired into the Desert of the Haurân. It was ascertained beyond all doubt that the Turks and the low fanatical mob of Damascus were mainly chargeable with the crimes that had been committed; and that the retaliations of the Maronites were equally vindictive and horrible. Punishment was inflicted on those who were most to blame. In 1864 the commissioners drew up a constitution for the Lebanon, which was to be ruled by a Christian governor, appointed by the Porte; and to be divided into seven districts, under chiefs of the prevalent religion in each. Daoud Pasha was appointed governor, under whom and his successors disturbing elements were usually kept in check. The Druses of the Haurân were in active rebellion in 1896, but after some severe fighting agreed to pay taxes and serve as frontier guards in their own district. After further fighting in 1910, they accepted liability to military service. When Syria passed under a French mandate, Great Lebanon and Jebel Druz (Haurân) became states, and the Druses resisted French rule as they had Turkish. The Druses of the Haurân are reckoned at upwards of 50,000, those of Lebanon at 50,000, those of Anti-Libanus at somewhat less. The Haurân is now opened up by railway, and commercial interests have been developed, whereby the habits and customs of the Druses are being modified. They are a brave, handsome, and industrious people, and can almost all read and write. They abstain from excesses, never taste wine or tobacco, polygamy is unknown, the women are virtuous, and divorces are uncommon though simple enough, consisting in the husband telling his wife three times that she had better go back to her mother. They had no superior educational establishment until Daoud Pasha founded and endowed one at Abey. They have, with incredible toil, carried the soil of the valleys up and along the hillsides, which are laid out in terraces, planted with mulberry, olive, and vine. Their chief trade is the manufacture of silk, chiefly at Shimlan, 3000 feet above sea-level. Corn is also raised, though in very small quantity. Deir-el-kamar (q.v.) is the principal town, but of late Bakhlin, 6 miles distant, has been the Druse headquarters. Kunawat is the chief town of the Druses of the Haurân.

See ANSARS; the Earl of Carnarvon's *Druses of the Lebanon* (1860); De Sacy's *Exposé de la Religion des Druses* (1828); Churchill's *Ten Years' Residence in Mount Lebanon* (1853), and *Druses and Maronites* (1862); Laurence Oliphant's *Land of Gilead* (1880), and *Haifa* (1887); Miss G. L. Bell's *The Desert and the Sown* (1919).

Drusus, the name of a distinguished family of the gens Livia, and of some members of the Claudian gens. The most conspicuous of the Drusi were (1) M. Livius Drusus, tribune of the people in 122 B.C., the opponent of the democratic policy of his colleague, C. Gracchus. (2) His son of the same name, who, though identified by birth and sympathy with the patricians, renewed some of the most liberal measures of the Gracchi, and advocated the claims of the Italians to Roman citizenship. He was assassinated in 91 B.C., just before the outbreak of the Social War. (3) The most illustrious of the Drusi was Nero Claudius Drusus, commonly called Drusus Senior, the step-son of the Emperor Augustus, and younger brother of the Emperor Tiberius. His campaign against the Rhæti and other Alpine tribes (15 B.C.) is celebrated by Horace (*Odes*, iv. 4). Until his death in 9 B.C. he was engaged chiefly in establishing the Roman supremacy in Germany. The 'Fossa Drusiana,' a canal joining the Rhine with the Yssel, and other engineering works were constructed by his direction. For his exploits in Germany, Drusus was rewarded with the title of Germanicus, but the celebrated Germanicus (q.v.) was his son.

Dryads, wood-nymphs in Greek mythology. See NYMPHS. See also HAMADRYADS.

Dry-bulb. See HYGROMETER, THERMOMETER.

Dryburgh, a beautiful ruined Premonstratensian abbey, in Berwickshire, 5 miles ESE. of Melrose, on the Tweed, here crossed by a suspension bridge. It contains the dust of Sir Walter Scott and his son-in-law Lockhart; whilst Ebenezer Erskine (q.v.) is said to have been born close by. The abbey was founded in 1150 by David I., and not, as is commonly stated, by Hugh de Morville. It is said to have been more or less destroyed in 1322 and 1385; by Bowes and Latoun in 1544, and by the Earl of Hertford in 1545. See Spottiswoode's *Liber de Dryburgh* (Bannatyne Club, 1847).

Dryden, JOHN, was born at Aldwinkle, in Northamptonshire, on the 9th of August 1631. His father, Erasmus Dryden (the name until the poet's manhood was more usually spelt Dríden), was a cadet of a family of Border origin, which some generations before had settled at Canons Ashby, in the same county, but at some distance from Aldwinkle. The poet's mother was Mary Pickering, and it was at her father's house (the rectory of the parish of Aldwinkle All Saints) that Dryden was born. Very little is known of his early youth, but he seems to have passed it chiefly at Tichmarsh, near Aldwinkle, where his maternal grandfather also had property. He was entered at Westminster School when he was twelve years old, and proceeded to Trinity College, Cambridge, when he was nineteen, being matriculated on July 16, and elected to a Westminster scholarship on October 2. On July 19, 1652, he was punished slightly for some offence against discipline, and this is all that is positively known about his Cambridge career, except that he took his bachelor's degree in 1654. He never proceeded to the M.A., preferring to take that degree from Lambeth, and he seems on the whole to have had little affection for Cambridge. His father died in the same year (1654), and Dryden succeeded to two-thirds, and after his mother's death to the whole, of a small estate at Blakesley near Canons Ashby, then worth £60 a year, where he seems never to have resided. He, after the fashion of the time, continued to live at Cambridge till 1657, and then he went to London. Both the Drydens and the Pickerings were strong parliamentarians, and

Dryden seems to have had some, but vain, hopes of patronage from his cousin Sir Gilbert Pickering, a favourite of Cromwell. It is thought that he began early to do work for the booksellers, especially Herringman, a then frequent employer of young authors; but again we have little or no positive information respecting him till December 1, 1663, when he married Lady Elizabeth Howard, eldest daughter of the Earl of Berkshire, and sister of two not unknown men of letters who were Dryden's friends. Much scandal has been talked about this marriage on absolutely no solid ground, but it seems probable that it was not wholly happy, and that Lady Elizabeth, whose intellect was certainly not strong, may have had a bad temper. Three sons, Charles, John, and Erasmus Henry, were the offspring, and from this time Dryden occasionally resided at his father-in-law's Wiltshire seat of Charlton. He had several London residences, the best known of which was in Gerrard Street, Soho, a house now marked with a tablet. Very shortly after the wedding, Pepys on the 3d of February 1664 met Dryden, 'the poet I knew at Cambridge,' at Will's Coffee-house, and this is the first of the personal notices (very few in number) that we have of the poet.

The dramatic work of which further notice will be taken shortly now occupied Dryden almost entirely for many years—for no less than fourteen he wrote next to nothing but drama. He was made poet-laureate and historiographer-royal in 1670, the emoluments of which places (£200 a year) were increased by a pension of £100 in 1679. Some literary disputes and a quarrel with the malevolent Rochester, which brought Dryden on the 8th December 1679 a cudgelling by masked bravoes, are almost the only events of importance in this long period. The disturbances in public opinion which followed the Popish Plot provoked the splendid series of satires beginning with *Absalom and Achitophel*, and brought an increasing storm of libels in prose and verse on Dryden's head from the other side. In 1683, as part compensation for great arrears in his salary, and perhaps also as reward for his political services, a collectorship of customs in the port of London was granted him, but the value of this place is not known. In the epidemic of conversion which followed the accession of James II., Dryden was one of the chief seceders from the Church of England, and his sincerity in this act has been violently impugned. Controversy on such a point being here impossible, it must be sufficient to say that his previous state of mind on the subject appears to have been exactly that half-scepticism, with a kind of yearning for authoritative certainty, which has constantly disposed men to Roman Catholicism; that he gained (as can be proved) not one penny by the change of faith; and that he adhered to it when others 'reverted,' and when his own constancy inflicted the heaviest loss upon him. At the Revolution he did not take the oaths, and thus lost all his places and pensions. To supply this loss, he then returned to play-writing, and to the less uncongenial, if not quite so profitable work of translation. During the last ten years of his life (which saw the production of his famous translation of *Virgil*, and of the collection of his most accomplished verse called the *Fables*) we have, thanks to the accidental preservation of letters, a few more personal details about Dryden than at other times. Almost immediately after the publication of the last-named volume (at the end of 1699), an attack of gout, from which disease he had always suffered much, set in, and resulting in mortification of the toe, carried him off on May-day 1700. He was splendidly buried in Westminster Abbey. All his sons died before their mother, who lived till 1714, and was insane at the time of her death. The youngest, however, Erasmus Henry, had succeeded to the family honours and baronetcy, and to the estate of Canons Ashby, which, by a female descent, are still in the name.

Dryden's great literary work began early, though not plentifully or very promisingly, with some poems in the 'metaphysical' manner of Donne and Cleveland; but his stanzas on the death of Cromwell, though lacking ease and flow, have great merit, and the group of panegyrical poems, written after the Restoration, beginning with *Astræa Redux* and ending with *Annus Mirabilis*, exhibit wonderful command of a style of verse not hitherto attempted. Then, as has been said, Dryden turned all his energies for many years into dramatic work, which he confesses to have been distasteful to him, and which was done for profit simply. Between *The Wild Gallant* (1663) and *Love Triumphant* (1694) he produced a great number of plays, the best of which are the *Conquest of Granada* (1670), *Marriage à la Mode* (1672), *Aurungzebe* (1675), *All for Love* (1677), *The Spanish Friar* (1681), and *Don Sebastian* (1689). The comedies are disfigured by a double portion of the license in language and situation which was common at the time, and the earlier tragedies by their unnatural rhymed dialogue, and by the frantic rant of style which was fashionable; but they occasionally contain, especially in interspersed lyrics, and in a few set speeches, extremely fine poetry. It was Dryden's practice, too, to prefix or append to the published versions of these plays, essays which developed his astonishing talent for prose, which may be said to have produced English literary criticism, and which contain passages unsurpassed of their kind. It can hardly, however, be said that his full powers were shown till the appearance, in his fiftieth year, of *Absalom and Achitophel*. This, with his contribution to its second part, *The Medal*, *Macflecknoe* (a satire on the whig Shadwell), and with the didactic poems of *Religio Laici* (exhibiting the sentiments of a half-sceptical Anglican), and *The Hind and the Panther*, written after, and to justify his conversion, contain by far the most powerful work of the satiric and didactic kind in English. The rhymed heroic couplet is here adjusted to the purposes of invective, insinuation, and argument with unmatched dexterity, and is charged with an overwhelming force.

Besides these, Dryden exercised himself in various minor kinds, such, for instance, as the preparation of prologues and epilogues for other men's plays as well as his own, and in the composition of Pindaric odes, one of which, that on Mrs Anne Killigrew, shares with his own later 'Alexander's Feast' the position of the best work of this particular kind. He also began the practice of translating the classics, which led finally to the great translation of *Virgil* already referred to, and to his scarcely less popular *Juvenal*; and this in its turn led him to what he also called 'translation' of authors other than the classics, such as Chaucer and Boccaccio. These later paraphrases formed the nucleus of the *Fables*, in which the magnificence, the variety, and the flexibility of his poetical style appear as clearly as its vigour and weight appear in the satires and didactic pieces. The dedication of the *Fables* in particular, addressed to the Duchess of Ormond, when the author was nearly seventy, has a stately beauty nowhere exceeded. His general poetical characteristics, as far as they can be summed up in a very brief space, may be said to be the faculty of clothing in splendid verse of a pattern quite unknown before him, and never in its own way equalled since, almost any subject that presented itself for treatment. Of inventive, or rather creative origin-

ality he had, save as to matters of form, little; and the finest and most ethereal graces of poetry were not his. But he is hardly to be excelled in massive yet not ungraceful splendour of style, and not to be excelled at all in variety of accomplishment. His prose, less splendid than his poetry, is of equal merit as a vehicle of literature, and like his verse, is almost entirely of his own finding out. For a combination of familiarity and finish it has not yet been surpassed.

All earlier editions of Dryden's works were superseded by Sir Walter Scott's in 1808, reprinted in 1821, and in 1883–93 re-edited (in 18 vols.) by Professor Saintsbury. Those of Bell, Mitford, Christie, Hooper, and Sargeaunt (1910) are also useful. Churton Collins edited the *Satires* in 1893, and W. P. Ker the *Essays* in 1900. See Lives by Scott and Saintsbury (1881), Garnett's *Age of Dryden* (1896), Ward in the 'Cambridge English Literature' (vol. viii. 1912), Verrall's *Lectures on Dryden* (1914), Allardyce Nicoll's *Dryden and his Poetry* (1923), Pendlebury's *Dryden's Heroic Plays* (1923).

Dry-farming, a very important system of agriculture, first studied in the United States, and now largely practised there, is being introduced into South Africa and elsewhere in regions which have a light rainfall, and promises to enhance the value of large areas in many parts of the world. The principle is the conservation of the rain in the soil; and even in lands with a very small rainfall, satisfactory harvests can be secured by reducing the loss through evaporation to a minimum, and utilising the rain as completely as possible. Where one year's rainfall is insufficient for a harvest, methods can be employed for retaining one year's rainfall in the soil, so that in the second year nearly two years' rain is available for the crop. The method is to keep the surface-soil constantly in a loose state by careful tillage, so as to check as much as possible the capillary process which brings the moisture from below by small channels between the soil particles, and so carries on progressive evaporation to a very considerable depth. If one-half of the land carries the crop, the other may lie fallow; and its surface being kept constantly loose by the harrow or other apparatus, the first year's rainfall is retained in the ground to serve the second year's crop. Harrowing must immediately follow ploughing; and as a shower consolidates the surface-soil, and so promotes capillary evaporation from below, harrowing must always follow the falling of rain.

Drygalski, Erich Dagobert von, German polar explorer, was born 9th February 1865 at Königsberg, and studied there, and at Bonn, Leipzig, and Berlin. In 1891–93 he headed expeditions to western Greenland to study land ice. He became extraordinary professor at Berlin in 1899. In 1902–3 he led the 'Gauss' Antarctic expedition, which visited Kaiser Wilhelm II. Land, and obtained valuable scientific results.

Drying-machines are of many kinds. For the drying of long webs of calico and other fabrics, a machine, consisting of a series of metal cylinders revolving in an iron frame, and heated internally with steam, is employed. Centrifugal drying-machines or hydro-extractors consist of a circular wire-basket mounted on a shaft and set in a close metal jacket. The fabrics or stuffs to be dried are placed in the basket, which revolves at a speed varying from 700 to 2000 revolutions per minute. The water flies off by the centrifugal action, and escapes from the enclosing cylinder by a discharge-pipe. In the Blackman air-propeller, the wool or other textile is spread over a perforated surface which is in connection with a revolving propeller, with peculiarly shaped blades, placed at the top of a vertical trunk or shaft. This apparatus dries the wool by drawing heated air through it. There are special machines or methods for yarn, for use in paper-making, &c., elsewhere described.

Dryobalanops, a small genus of Dipterocarpaceæ, found in Borneo and Sumatra. The young leaves are red and drooping, and raise themselves as they mature. The sepals form long wings, which aid wind-dispersal of the fruit. Borneo or Sumatra camphor, valued in China, occurs in cracks in the wood.

Dryophis, a genus of non-venomous snakes in the sub-order Colubriformes, allied to Dendrophis; and, like that genus, of very elongated form, and mostly arboreal in habit. They are distinguished by a curious prolongation of the snout, which in some is slender, in some leaf-like. They are natives of tropical America and West Africa. The elongated snout is very marked in the associated genus Langaha.

Dryopithecus, a European Miocene fossil ape, thought by some to be near the direct line of man's descent.

Dry-point. See Engraving.

Dry Rot, a kind of decay, often very rapid, to which timber is subject. Its name is misleading, since this decay is associated with the presence of water, such as is found in unseasoned wood. It has proved ruinous to many valuable edifices, and has been the cause of many serious accidents. The ends of joists are often affected by it, so that upon being burdened with even a slight additional load, they are ready to break off by the wall; and the process of destruction has often gone far without a suspicion being entertained of anything wrong. Dry rot is occasioned by Fungi, the *mycelium* of which penetrates the substance of the timber, destroying its texture, and reducing it to a fragile or even friable mass. *Merulius lacrymans* and *Polyporus destructor* are species very commonly productive of this mischief; the first being by far the most common and formidable. Its German name is *Hausschwamm*. *Merulius lacrymans* first appears in small white points; a filamentous substance radiating from these gradually forms broad patches, sometimes many feet in diameter; from these long creeping shoots often proceed, and a network of filaments penetrates into every crevice, filling the whole mass of the timber with delicate filaments, which destroy the cohesion of its fibres. It often appears in the form of leathery laminæ.

Of the causes of dry rot, stagnation of air, as behind a wainscot or under a floor, is certainly one of the chief, and a knowledge of this fact suggests means of prevention which may often be easily and most advantageously employed. Another principal cause is insufficient drying of the timber itself; and much of the prevalence of dry rot is not improbably due to the practice of felling trees in spring when the wood is full of sap. Any circumstance which may tend to render the sap acidulous greatly increases the liability to dry rot. The production of fungi takes place with unusual rapidity when by fermentation or otherwise an acidulous condition of organic substances is produced. A fermentation and chemical change in the albuminous constituents of the wood is not improbably the immediate cause of dry rot, providing a soil suitable for the vegetation of fungi.

For the prevention of dry rot various processes have been employed, the object of which is to fill the pores of the wood with some chemical substance. Active inquiry as to methods of preservation of timber began about the middle of the 18th century, and the matter was rendered urgent by the premature decay of the ships of the royal navy at a time of long-maintained conflict. No satisfactory method was discovered, however, until the development of the railway and telegraph system led to

further inquiry with the view of preventing the destruction of sleepers and telegraph poles. The various processes of kyanising (corrosive sublimate of bichloride of mercury), margarysing (sulphate of copper), burnettising (chloride of zinc), have been replaced by the effective method of creasoting, invented by John Bethell in 1838. But without the use of any such means we have abundant evidence that well-seasoned timber, in favourable circumstances, may remain unassailed by fungi for many centuries.

Dual, in Grammar, is the form given in some languages to a noun or a verb when only two things are spoken of. Thus, in Greek, *patēr* is 'father;' *patere*, 'two fathers;' *pateres*, 'fathers.' Sanskrit, ancient Greek, Arabic, and Hebrew have the dual number, the last only in nouns. Modern Greek has lost the dual. The only trace of it in Latin is in the two words *duo*, 'two,' and *ambo*, 'both.' It is for the most part wanting in the Teutonic languages, but ancient Gothic had a dual form of the verb, and in Old English there were separate forms of pronoun for 'we two' (*wit*) and 'ye two' (*git*).

Dual Control. See EGYPT.

Dualism is the name given to a philosophical theory, according to which some two principles, of different nature, original, and incapable of being derived the one from the other, lie at the bottom of everything; as, for example, the ideal and the real, or the material and the thinking substance. In a narrower and theological sense, dualism means the assumption of two original beings, a good and an evil, as in the doctrine of Zoroaster (q.v.), or of two distinct principles in man, a bodily and a spiritual. The opposite of dualism is Monism.

Du Barry, MARIE JEANNE GOMARD DE VAUBERNIER, COMTESSE, favourite of Louis XV., was born August 19, 1746, at Vaucouleurs, the daughter of a dressmaker. Coming very young to Paris as Mademoiselle Lange, she became a milliner of more than dubious character, next the mistress of the disreputable Jean, Comte du Barry, by whose means she was presented to Louis XV., already, at sixty years of age, in his dotage of shame. Her handsome face, but still more her piquant if vulgar wit, amused the worn-out dotard, who procured her presentation at court as Comtesse du Barry, in 1769, by marrying her to Guillaume, Comte du Barry, the reprobate brother of her earlier reprobate protector. The Duc de Choiseul attempted to resist her influence, but was soon displaced, while she, with her confidant the Duc d'Aiguillon, governed France. On the death of Louis (1774) she was dismissed from court. In 1793 she was guillotined for wasting the treasures of the state and wearing mourning for the king.

See Lives by Vatel (3 vols. 1882-84), R. B. Douglas (1896), Noel Williams (1904), and Saint-André (1915).

Du Bartas. See BARTAS.

Du Bellay. See BELLAY.

Dubitza, a fortified town of Yugoslavia (Bosnia), on the Unna, in the 16th and 17th centuries a bone of contention between Austria and the Porte; pop. 4000.

Dublin, a maritime county in the province of Leinster, Ireland, containing the metropolis of that country; bounded N. by Meath, E. by the Irish Sea, S. by Wicklow, and W. by Kildare and Meath. It is the smallest but two of the Irish counties, having an area of 354 sq. m., of which $\frac{5}{7}$ths are arable and $\frac{1}{10}$th in wood. The coast, from its indentations with creeks and bays, is 70 miles long, and off it lie several islands. Dublin Bay, one of the finest in the kingdom, is 6 miles broad, with a sweep of 16 miles, and is generally deep. There are precipitous headlands, over 500 feet high, both at the north and south ends; and the bay is remarkably picturesque. The coast of Dublin is undefended by fortifications. Being within the Pale, the county was well fortified in medieval times, and the remains of many strongholds still exist. The surface of the country inland is mostly a level, rich plain, with slight undulations, but rising in the south in a hill-range, the highest point of which is Kippure, 2473 feet. North of this range the only prominent eminence is the Hill of Howth, 560 feet. The only river of note is the Liffey, which runs through Dublin city into Dublin Bay. The chief rocks are carboniferous limestone (calp prevailing round the city), granite, and some metamorphic rocks and greenstones. There are lead-mines near the Scalp. Granite and black limestone are much used in building. There is an important mineral spring (sulphur)—resembling that of Harrogate—at Lucan. The climate is mild. The soil is generally a calcareous gravelly clay. In the north and west are grazing and meadow farms, and around Dublin city villas, dairy-farms, and nursery-gardens. Dublin is one of the best-cultivated counties in Ireland, though much under one-third is usually in crop. Along the coast there are important fisheries of herrings, turbot, brill, sole, plaice, cod, haddock, and whiting. The manufactures are few and unimportant, save at Balbriggan, which is noted for its hosiery. The towns with a population of more than 10,000 are Dublin (q.v.), and its suburbs of Rathmines (38,190), Pembroke (29,260), Blackrock (8719), and Kingstown (q.v.). Pop. (1841) 372,775; (1881) 418,910; (1891) 419,411; (1901) 448,206; (1911) 477,196, of whom 78 per cent. are Roman Catholics. The county at large sends six members to the Free State parliament, not including city and university members. See county history by F. Elrington Ball (1902 *et seq.*).

Dublin, the capital of Ireland, stands on the river Liffey, where it falls into Dublin Bay, in 53° 20′ 38″ N. lat., and 6° 17′ 30″ W. long. By the Municipal Act of 1900 several urban districts were added, so that the area of the city is now 7911 acres. The population (1911) was 304,802. It is represented by twelve members in the Free State parliament, four for each of its three divisions, Dublin University by four, and the National University (which has colleges also in Galway and Cork) by four. Dublin is governed by a corporation consisting of Lord Mayor, twenty aldermen, and sixty town councillors.

Dublin stands on the low-lying shores of Dublin Bay and banks of the river Liffey, which flows through it from west to east, cutting the city into two well-defined divisions, north and south sides. The river is spanned by ten bridges for passenger and general traffic. The city is remarkable for the fine proportions of its main thoroughfares, the beauty of its surroundings, particularly on the south, where the mountains come into the view of the streets, and the magnificence of its public buildings. Two canals connect the Liffey harbour with the Shannon, one the Royal, bounding the city on the north, and the other the Grand, on the south, along which 'circular' roads may be said to run, covering a length of some 9 miles. The river is banked throughout by fine lines of walls and quays, the South Wall, a really great work, being 3½ miles long, and running far into Dublin Bay to the Pigeon House Light. Further protection is given to the harbour by the Bull Wall and the rebuilding and extension of the North Wall against the encroachment of the sands of the north shore. The latter is a fine work, and now extends eastward from Butt Bridge for a distance of 2500 yards.

Down to the Act of Union the north side was the chief residential portion of the city; but from early in the last century fashion changed, town houses of the country gentry were given up, and patronage was extended to the south side, so that now the suburbs extend along the whole coast to

Kingstown, and for miles westward. Many of the old houses still retain fine examples of 18th-century decoration, especially of the Italian stucco-work on ceilings and walls, for which the city was so noted. The finest thoroughfare, Sackville Street, is on the north side, being 600 yards in length and 40 in width; but the view is much interfered with by tram-poles and monuments, especially the latter in Nelson's Pillar, a fine structure 134 feet high and crowned by a statue, in the centre of the street, and O'Connell's monument, a magnificent work by Foley, at the south end. The reconstructed bridge here, the main crossing for traffic, is of noble proportions, and called after the name of the great 'Liberator.'

The public buildings nearly all date from the 18th century, when architectural schemes on a vast scale set in and were carried out at government expense. These are all of classical design, and give a stately grace and dignity to the city. Among the chief are the Bank of Ireland, facing Trinity College, at the foot of Dame Street, nearly to which the tidal waters of the river at one time found their way. The buildings cover an area of about 1½ acres, and were erected at varying intervals at a cost of £95,000. The main front is Ionic, and forms three sides of a receding square, with an open colonnade extending to the wings, which are connected with the east and west faces by curtain walls. The east front was built as an entrance to the House of Lords, and this chamber is preserved in its original condition. The House of Commons, which opened on the main entrance, was removed in the alterations made in 1802, after the purchase of the buildings from the government for a sum of £40,000. The principal hall, now the cash-office, is of fine proportions, and stands on the site of the original Court of Requests. Trinity College occupies a fine site in the centre of the city, its walls embracing an area of 28 acres. It consists of several courts running from its west entrance eastwards, and on the south side of these lie through the entire length the fine College Park and Fellows' Gardens. The academic buildings, due chiefly to the public spirit of the Irish houses of parliament in the 18th century, are worthy of such a splendid site, being classic in style, and constructed of massive granite and limestone. The Library (1712–32) is the earliest of these, and measures 270 feet in length. The upper room, extending the entire length of the building, is one of the finest of its kind in Europe, being lit by about 100 windows and fitted in carved oak, with a lofty vaulted pine roof. It contains 368,000 printed volumes and 2000 MSS., among which are many of the rarest kind; the finest is the *Book of Kells*, 'the most beautiful book in the world,' the beauty, intricacy, and colouring of the profuse illuminations being unrivalled. The Schools is one of the finest modern buildings in the British Isles, and is Byzantine Renaissance of the Venetian type in style. The University was founded in 1591, on the lands of the old Augustinian Monastery of All Hallows, which were granted by the Mayor and Corporation of the city for the new institution. The National University was founded in 1908, and occupies the buildings of the superseded Royal University at Earlsfort Terrace, and has constituent colleges in Dublin, Cork, and Galway. The Castle, at the head of Dame Street, consists of two courts, and the buildings have little architectural interest, except perhaps the chapel. The Record Tower is one of the four original towers which with the walls enclosed the Castle area. The Birmingham Tower was rebuilt in 1775. The Castle was till 1922 the official residence of the Viceroy, and the official centre of the government of Ireland. The Law Courts were transferred thither on the destruction of the Four Courts (1922). The National Museum, Library, Natural History Museum, National Gallery, Leinster House, and the College of Science form a splendid group of buildings and occupy a vast space of ground lying between Kildare Street and Upper and Lower Merrion Streets. The Museum contains the fine Royal Irish Academy collection of Irish antiquities of the Neolithic, Bronze, and Early Christian periods, the whole of which, numbering many thousands of specimens, is perhaps the finest yet brought together in Europe. The Library contains about 200,000 volumes, and is exceptional among the great libraries in being open to readers from 10 A.M. to 10 P.M. The National Gallery is one of the best of the minor European galleries, and has fine examples of the Italian and Dutch schools. The Natural History Museum has one of the most complete national collections of fauna yet made, and several fine specimens of the skeletons of the Irish elk (*Cervus giganteus*). The ceilings and walls of Leinster House, the old residence of the Dukes of Leinster, now housing the Free State parliament and the Royal Dublin Society, are finely decorated in Italian stucco-work. The society was formed in 1731, and devotes itself to the development of the agricultural industry of Ireland, to scientific and other pursuits. Its great annual Horse Show in August, of world-wide repute, is held in its fine premises at Ball's Bridge, a near suburb of the city. On the north side of the city stood till 1921 the Custom House, the finest building in Dublin, facing the river-mouth for a distance of 125 yards. The Four Courts, an extensive pile, was also on the north quay, at the west side of the city; the building was fourteen years in hand. Rebuilding was begun soon after its destruction. Kilmainham Hospital, standing farther west, was designed by Sir Christopher Wren, and erected for incapacitated soldiers on the lines of Greenwich Hospital. It is the only one of the great buildings not erected during the somewhat fevered building period of the 18th century. Here the Commander of the Forces in Ireland had his residence.

Dublin is remarkable in possessing two cathedrals belonging to one denomination (Church of Ireland). Christchurch, originally of Danish foundation (in 1038 by Sigtryg, king of the Dublin Danes), is the older of the two, and stood within the city walls. It suffered many vicissitudes, and was in a poor condition in 1870 when its restoration was undertaken at the expense of the late Mr Henry Roe, a Dublin distiller. It is now a very beautiful building within and without, a sum of £200,000 having been spent on the restoration, which took eight years to complete. St Patrick's Cathedral, long the rival of Christchurch and a more stately building, stood without the walls close by, and was erected originally as a collegiate church soon after the Anglo-Norman occupation. Early in the 13th century it was raised to the dignity of a cathedral, with the intention of superseding the earlier foundation. Christchurch, however, maintained its status throughout the subsequent centuries, and after the disestablishment of the Irish Church (1870), it was confirmed as the cathedral of the united dioceses of Dublin and Glendalough, while St Patrick's Cathedral was constituted a national cathedral, representative canons from each diocese in Ireland taking the place of the prebendaries of the old foundation. The latter cathedral was completely restored by Sir Benjamin Lee Guinness at a cost of £150,000. It is particularly associated with the name of its greatest dean, Jonathan Swift, and here he and 'Stella' lie buried side by side. Both cathedrals are now in the heart of the city, surrounded by many poor and mean streets.

Dublin is particularly well supplied with open spaces, the last erected being due to the munificence of Lord Iveagh, who has cleared away a foul nest of courts at the north side of St Patrick's, and converted the site into a well-laid-out public garden. The largest open space within the city is St Stephen's Green, 22 acres in extent; it is beautifully laid out, originally at the expense of Lord Ardilaun, and was presented to the city by him. Without the city on the north side is Phœnix Park, one of the finest in Europe. It embraces an area of 1752 acres, and within it are the Governor-general's official residence (till 1922 the Viceregal Lodge), the Zoological and People's Gardens, and several monuments, the most conspicuous being Wellington's, an obelisk 205 feet high near the east entrance. The park is largely used for sports, and is noted for its reviews held in the so-called 15 acres, which in reality is about 200 acres. Dublin is especially well supplied with hospitals and other similar foundations of all kinds, and few, if any, cities in these islands contain more charitable institutions ministering to the wants of the community.

Dublin is largely an official and residential city, and it contains few industries of any special note. It has, however, the largest brewery in the world. Dublin whisky, too, is famous, especially the pot-still; and its poplin is equally celebrated. The manufacture of this beautiful fabric, a combination of silk and wool, was first established in Dublin at the end of the 17th century by the Huguenot refugees, who fled here after the revocation of the Edict of Nantes. The export trade of Dublin is largely in agricultural produce, and vast quantities of live-stock, fowls, eggs, butter, bacon, and vegetables are shipped for the English markets. There is a very large export trade also in porter, whisky, and mineral waters. Dublin has a fine water-supply, drawn by a double line of pipes from the headwaters of the Vartry River near Roundwood, 24 miles distant from the city. The storage reservoir covers 400 acres, and has a depth of 60 feet; it holds 2,482,800,000 gallons, giving a supply of 12,000,000 gallons daily for 200 days. The embankment is 200 feet in length, 500 feet wide at the base, and 30 feet wide at the top. Another reservoir has been constructed near the older, which is 510 acres in extent, with a supply of 1,259,000,000 gallons. The immediate water-supply of the city is at Stillorgan reservoir, about 5 miles distant, which covers 26 acres, and has a capacity of 100,000,000 gallons, being a nine days' supply. The Rathmines township has its own water-supply at Glenasmole, taken from the Dodder River, 7 miles distant. It is held by two reservoirs with a united capacity of 516,000,000 gallons. Down to 1907 the Liffey was the medium of discharge of the whole sewage of the city, the volume of which, owing to the admirable water-supply and improved sanitation, long rendered the bed of the river particularly obnoxious to the inhabitants. In the year named the new main drainage scheme was put into operation. It consists of two great intercepting sewers running under the north and south quays, the north being carried under the bed of the river at Eden quay to join the south drain, and the united stream of sewage is finally discharged into purification-tanks at the Pigeon House. Here it is mixed with milk of lime, and after a period of rest the liquid portion is discharged into the estuary and the sludge into a steamer, by which it is carried out to sea. The total cost of this great work has exceeded half-a-million sterling.

In education Dublin takes a leading place among the cities and towns of the British Islands. While, with the exception of Trinity College, none of its institutions are well endowed, and the great majority are without any endowment, the standard of education maintained is a high one. Fellowships at Trinity College are awarded after an examination of an exceptionally severe kind, following upon years of long and patient study; but the principle of election without it has recently been introduced to be of partial application. Dublin and the National Universities have schools for the various professions, the former including divinity for students of the Church of Ireland; Maynooth is the seat of theology for the priesthood of the Roman Catholic Church. The College of Surgeons and the College of Physicians are licensed bodies for granting diplomas in medicine, and large numbers of students are trained by them in addition to those attending the university medical schools. The College of Science, already referred to, is a government institution, and affords a complete course of instruction in science as applied to industries and arts. The secondary schools are numerous, and most have been established by private enterprise; all the Roman Catholic schools and training colleges are in the hands of the various teaching orders. A great impetus was given to secondary education by the Intermediate Board (1878). The Primary Schools are under the control of the Irish Ministry of Education, which took over the functions of the National Board of Education, established in 1831. There are four Training Colleges; the Central, in Marlborough, open to all denominations; the Church of Ireland, in Kildare Street; and the Roman Catholic (men) in Drumcondra, and (women) in Blackrock. Tyrone House, in Marlborough Street, the seat of the National Board, was the old residence of the Beresford family.

At the mouth of the Liffey stood an early Celtic settlement known as *Baile-ath-Cliath* (the 'town of the hurdleford'), and Whitworth Bridge now stands on the site of the ancient passage. The real foundation of the city was due to the Danes, and the name *Dubh-linn* ('black pool') was given to the dark stretch of water below the ford where the Viking ships lay. Here the Norsemen established a kingdom, and their power was not destroyed, notwithstanding the great battle of Clontarf (1014), until after the Anglo-Norman settlement. Henry II. came to Dublin in 1172, and granted to 'his men of Bristol' the city and its liberties by royal charter. The Castle was commenced early in the 13th century, and was defended by a city wall with many towers and gates, all surrounded by a moat fed by the Poddle River, which still finds its way, now underground, to the Liffey. Dublin suffered much at the hands of the wild septs of Wicklow, the O'Byrnes and the O'Tooles, who swept down from their mountain heights on the rich settlement in the plain, against whom a ring of castles and peel-towers was built for protection, the remains of many of which still stand. The terrible massacre of Easter ('Black') Monday, 1209, is perpetuated in the name Bloody Fields in the township of Rathmines. Edward Bruce besieged the city in 1316, and in 1486 Lambert Simnel was crowned in Christchurch. During the Civil War the city and surrounding country suffered at the hands of the contending parties; James II. held a parliament in Dublin in 1689, and Mass was celebrated in Christchurch. Down to the Restoration Dublin remained practically a medieval city; but after it a great change came in the expansion and trade of the city, especially under the viceroyalty of the Duke of Ormonde. In the 18th century the city became in features what it largely still is, with its great thoroughfares, stately public buildings, and extensive streets and squares of private residences, the names of which are chiefly identified with successive viceroys—so much so that its growth may be traced thereby. Memorable recent events

have been the great strike of 1913–14, under James Larkin, the Easter Rising of 1916, in the quelling of which much of Sackville Street, including the General Post-office, was ruined, the first meeting of Dáil Eireann at the Mansion House in 1919, the burning of the Custom House by republican irregulars in 1921, the seizure of the Four Courts and of Kilmainham Gaol by irregulars, and the blowing up of the former on surrender, the handing over of Dublin Castle, the Viceregal Lodge, and other buildings to the Irish authorities, the disbanding of the Royal Irish Constabulary, and the withdrawal of British troops in 1922.

See *History of the County Dublin*, by F. Elrington Ball; *History of Dublin*, by S. A. O. FitzPatrick; *The Story of Dublin*, by D. A. Chart; *The Book of Trinity College*; *History of Trinity College*, by W. Macneile Dixon.

Dubois, GUILLAUME (1656–1723), Cardinal, son of an apothecary, became tutor to the Duc de Chartres; and when the latter (now Duke of Orleans) became regent in 1715, was the most powerful man in France. In 1717 he succeeded in forming the Triple Alliance between England, Holland, and France, which, with the accession of the emperor in 1718, became the Quadruple Alliance. He was appointed foreign minister and Archbishop of Cambrai; in 1721 he became a cardinal, in 1722 prime-minister of France.

Du Bois-Reymond, EMIL, physiologist, was born in Berlin in 1818, and in 1841 began the researches in animal electricity with which his name is chiefly identified. The results of his labours in this field are contained in several valuable publications, the most important of which is his great work, *Untersuchungen über tierische Elektrizität* (Berlin, 2 vols. 1848–84). In 1858 he succeeded Joh. Müller in the chair of Physiology at Berlin, and in 1867 he was elected permanent secretary of the Academy of Sciences. Five volumes of his collected memoirs, addresses, and lectures appeared in 1885–99. He died 26th December 1896.

Dubovka, a town in the Russian province of Saratov, on the Volga, with tanneries and a large trade in mustard and salt; pop. 15,000.

Dubrovnik, Croatian name of Ragusa (q.v.).

Dubuque, a city and port of Iowa, on the right bank of the Mississippi, built partly on bluffs rising 200 feet above the river, which is here crossed by an iron railway bridge, 165 miles WNW. of Chicago. It is the seat of an Episcopal and of a Roman Catholic bishop, and contains numerous churches, a city hall, a custom-house of marble, and several colleges. It has a number of manufactures, and a large river and railway trade, and is the chief centre of the great lead and zinc region of the North-west. The town is the oldest in the state. Julien Dubuque, a French trader, engaged in lead-mining here as early as 1788; but the first permanent settlement was made in 1833. Pop. (1910) 38,484; (1920) 39,141.

Du Camp, MAXIME (1822–94), was born at Paris, made repeated journeys in the East, and settled in Paris. Besides works on his Eastern travels, he wrote poems, romances, *Souvenirs Littéraires*, a history of the Commune (*Les Convulsions de Paris*, 1879), and *Paris, ses Organes, ses Fonctions, et sa Vie* (6 vols. 1875; 7th ed. 1884). See his *Souvenirs Littéraires* (1882–83; Eng. trans. 1893).

Du Cange, CHARLES DUFRESNE, SIEUR DU CANGE, generally styled Ducange, one of the greatest of French scholars, was born at Amiens, 18th December 1610, and became a parliamentary advocate in Paris, where he died, 23d October 1688. There was scarcely any branch of science with which he was unacquainted, but his favourite studies were classical philology and history. He wrote and edited several works on Byzantine and French history; but his principal productions are the *Glossarium ad Scriptores Mediæ et Infimæ Latinitatis* (3 vols. folio, Paris, 1678; much enlarged by the Benedictines of St Maur, 6 vols. folio, Paris, 1733–36, to which four supplementary volumes were afterwards added by Carpentier, a Benedictine) and the *Glossarium ad Scriptores Mediæ et Infimæ Græcitatis* (Paris, 1688; new ed. Breslau, 1889–91), which are indispensable to the student of the middle ages. A new edition of the Latin Glossary was published by G. A. Henschel (7 vols. Paris, 1840–50), and final supplements were added by Diefenbach (Frankf. 1857 and 1867); a completely new edition in 10 volumes appeared in 1883–88. Du Cange left a large quantity of valuable manuscripts, which have been preserved.

Ducat, a gold coin, formerly in extensive use on the Continent, deriving its name, probably, from being issued (in 1140) by the Duke of Apulia; according to some, from *Dukas*, the family name of the Byzantine emperors Constantine X. and Michael. The Apulian coin bore the legend—*Sit tibi, Christe, datus, quem tu regis, iste Ducatus* ('Be this *duchy*, which thou rulest, dedicated to thee, O Christ'). Such coins were extensively issued after the 12th century in Italy, especially at Venice, where they were called *zecchini* or sequins (from *zecca*, 'a mint'). Early in the 14th century the ducat was introduced into Hungary and Bohemia; it was adopted in 1559 by the imperial diet of Germany into the currency of the empire, and was afterwards coined in the several German states, and over the whole of the north of the European continent, Russia included. The ducat varied in weight and fineness; by far the most common, which was current in Austria, Russia, Hamburg, &c., was worth about 9s. 4d The modern Italian ducat was of much less value. There were silver ducats in Italy, worth 3s. 4d. sterling; and in Holland a *daalder* (4s. 2d.) was also called a ducat.

Ducato, CAPE (ancient *Leukatē*), an abrupt headland at the south-west extremity of Leukas or Santa Maura, one of the Ionian Islands, dreaded by sailors for the fierce currents around it. On the summit are remains of a temple of Apollo, and from here criminals were anciently cast into the sea. Here, too, tradition fixes the scene of Sappho's fatal leap, and that of Artemisia (q.v.) of Halicarnassus.

Du Chaillu, PAUL BELLONI, a distinguished traveller, was born in Louisiana in July 1837, and went to school in Paris for a while. Ere he was twenty years old he was already noted as an African traveller, a series of letters on the Gaboon country which he contributed to the *New York Tribune*—a foretaste of the final fruits of his first great journey—having long ere his return from it excited much interest. In 1855 he sailed from New York to West Africa, where he spent four years in exploring the region two degrees on each side of the equator, making many interesting discoveries, and travelling about 8000 miles, always on foot, and unaccompanied by white men. He returned to New York in 1859, where he afterwards resided, and lectured frequently. The results of his African travels he published in his work, *Explorations and Adventures in Equatorial Africa* (1861; revised ed. 1871), containing very important contributions to geographical, ethnological, and zoological science. Thus he gave valuable information about the then unknown Ogowe (q.v.) River, and about the cannibal tribe of the Fans. His contributions to zoology related mainly to the gorilla and other remarkable apes. He shot more than 2000 birds, 60 of which were

previously unknown, and killed over 1000 quadrupeds. Many of his specimens were purchased by the British Museum. The volume was, however, received with much distrust; and some critics asserted their belief that Du Chaillu's stories about the gorilla were entirely fabulous, and that he had never seen the animal alive, but had purchased his specimens. Du Chaillu's credit was, however, maintained by some men of the highest eminence, and particularly by Sir Roderick Murchison and Sir Richard Owen. The substantial accuracy of his statements was soon confirmed by a French expedition which explored the Ogowe River in 1862. In 1863–65 Du Chaillu revisited some of the scenes of his former explorations, vindicated the truthfulness of his former discoveries, and gave an account of his second expedition in *A Journey to Ashango-Land* (1867). He also published a series of books for the young, founded on his varied adventures, amongst which are *Stories of the Gorilla Country* (1868), *Wild Life under the Equator* (1869), *Lost in the Jungle* (1869), *My Apingi Kingdom* (1870), and *The Country of the Dwarfs* (1871). His *Land of the Midnight Sun* (1881) is a record of a stay during 1872–78 in Norway and Sweden. *The Viking Age* appeared in 1889. He died 29th April 1903.

Duchesne, André (in Latin, Chesnius, Duchesnius, or Quercetanus), French historian, was born in Touraine in 1584, and died in 1640. History and geography were his favourite studies from his youth, and under Richelieu's ministry he was appointed royal geographer and historiographer. His most important works are the histories of England, Scotland, and Ireland, of the popes down to Paul V., and of the House of Burgundy, and his collections of the early Norman and French histories. His industry was extraordinary; he is said to have left more than a hundred folios in manuscript.

Duchesne, Louis Marie Olivier, born in 1843 at St Servan, became in 1895 director of the French archæological school at Rome, and in 1910 an academician. An authority on early church history, he edited the *Liber Pontificalis* (1885–92), and wrote *Les premiers temps de l'état pontifical* (1898), *Origine du culte Chrétien* (new ed. 1905), *Histoire ancienne de l'église* (1906).

Duchesne, Père. See Hébert.

Dučić, Jovan, Serbian poet, born 1874, influenced by the French Parnassians and Symbolists.

Duck, any member of the family Anatidæ, order Anseres (see Goose). Notable are the short webbed feet, with small hind-toe; the netted scales in front of the lower leg; the bill rounded at the tip, with nostrils towards the broad root. There are over fifty species, which have a wide distribution, especially in the northern hemisphere. They are characteristically aquatic birds, swimming with much agility, diving comparatively little, preferring to grub in the shallows for water-plants, worms, and small animals. The waddling, awkward walk is well known in its exaggerated condition in the domesticated duck. Great flocks are often seen in migratory flight to and from their northern homes. The males (drakes) are in winter and spring markedly distinguished from the females, whose plumage is less handsome. In summer, however, the males generally resemble the females.

The most important genus is Anas, which includes the Common Wild Duck (*A. boschas*), with its domesticated form (*A. domestica*), and numerous other species. The Mallard or Wild Duck is very widely distributed from Britain to Japan, and also occurs in North America as far south as Florida and the West Indies. Mallards abound in Britain, though ousted from some parts by increased drainage of marshes. Their food is very varied, from seeds and roots to worms and frogs. They are often seen, with submerged head and upturned tail, grubbing in the mud by the loch side. Along with other 'wild ducks,' they breed in Britain, sometimes near the lakes or rivers which they frequent, sometimes in more elevated moorland districts. The parents often bring their very young brood to the lower waters, by swimming down the streams when swollen by rain, and it is interesting to see the little creatures hurried on, without injury, by the current, and passing along narrow rapids and over waterfalls of considerable height, much as pieces of cork might do, and with as little apparent injury. The nest is composed of grass, intermixed and lined with down, and the eggs are usually nine to twelve in number. The female shows marked parental care and affection for her brood.

The male (drake) of the common duck has the four middle tail-feathers recurved. The deep emerald green of the head and upper part of the neck, the white collar which separates the green from the dark chestnut of the lower part of the neck, and the deep blue iridescent *speculum* of the wing are marked characteristics of this beautiful bird. The plumage exhibits greater brightness of colours in the wild than in the domestic variety. At the close of the breeding season, the male of the wild duck assumes for a time a plumage more sober, and resembling that of the female; but before winter recovers the splendid plumage proper to his sex.

The Domestic Duck.—According to Darwin and most naturalists, the various breeds of domestic duck are all descended from the wild species above described. In domestication the excellence of the plumage and the elegance of the carriage are lost in a few generations, and more momentous changes follow in consequence of altered nutrition and the like, and largely from the decreased use of the wings and increased use of the legs. The size also increases. It is well known that the nest-building instinct has been unlearned, and even the brooding impulses are usually degenerate. Darwin distinguishes four breeds: the Common Domestic Duck, the Hook-billed Duck, the Call-duck, and the Penguin Duck. Of the first, several sub-breeds are well known—e.g. the Aylesbury—large and white; the Rouen—large, and coloured like the wild duck; the tufted ducks—with top-knots of downy feathers; the black Labradors. 'The duck was unknown to the ancient Egyptians, to the Jews of the Old Testament, and to the Greeks of the Homeric period,' but was kept eighteen centuries ago in Roman poultry-yards. See Darwin's *Variation of Animals and Plants under Domestication* (1868). For ducks as egg-producers, see Poultry.

There are many other European wild ducks—e.g. the small *A. crecca*, extending to North Africa; *A. acuta*, also found in North America; *A. strepera*, a distinctly north European form; *A. querquedula*, from middle and south Europe to Central Asia; *A. penelope*, in north Europe and Asia. Some closely related genera may be noted. The beautiful North American *Aix sponsa* is often brought to Europe; the Spoon-billed Ducks (*Spatula clypeata*, &c.), occurring in the temperate zones of both hemispheres, have markedly elongated bills; the Musk-duck (*Cairina moschata*), from Brazil and Paraguay, sometimes domesticated, is remarkable for the musk-like smell of the male preen-gland. Less nearly related to the true ducks are the Geese (see Goose), Swans (q.v.), Eiders (q.v.), and the stiff-tailed ducks, such as the wide-headed *Erismatura bucocephala*, rather like a diver in flight and habit.

Many wild ducks are shot for the market; the plumage is also used for decorative purposes. The uses of the domesticated variety are well known. See also Teal, Canvas-back, Wildfowl.

Duck (akin to Ger. *tuch*, 'cloth'), a coarse cloth or canvas, highly glazed, used for sails, sacking, smock-frocks, overalls, trousers, &c.

Duckbill, or DUCKMOLE. See ORNITHORHYNCHUS.

Ducking-stool, an apparatus at one time in use in England for the punishment of scolding wives. The *cucking-stool*, *ducking-stool*, and *tumbrel* have often been confounded, and indeed most writers appear to consider them but different names for the same thing, but, as Mr Llewellynn Jewitt points out, they are all three distinct varieties of punishment. The cucking-stool is mentioned in Domesday Book as having been in use in Chester, and the name (*cathedra stercoris*) casts a light upon the degrading nature of its origin. In it the culprit, who might be of either sex, was placed, usually before his own door, to be pelted and insulted by the mob. On the tumbrel again he was drawn round the town or village, seated in the chair, which was sometimes so constructed as to be suitable also for ducking; but the ducking-stool *par excellence* was specially made for purposes of immersion. There were various examples of the ducking-stool. Sometimes it 'consisted of a rough strong chair attached to one end of a beam, which worked on a pivot on a post bedded into the ground at the edge of the dam,' or the river, as the case might be. The woman was fixed in the chair with her arms drawn downwards. The executors of the punishment then took hold of a chain at the opposite end, and gave her a ducking on the 'see-saw' principle. Many ducking-stools and chairs are still in existence; that at Leominster was used as recently as 1809. The practice of ducking commenced in the latter part of the 15th century, and prevailed generally throughout the kingdom until the first part of the 18th century, and in isolated cases, as we have seen, even into the 19th century. See Llewellynn Jewitt in the *Reliquary* (vol. i. 1860); W. Andrews, *Old Time Punishments* (1890).

Duckweed, or DUCK-MEAT (*Lemna*), is the type of Lemnaceæ, a small order of very degenerate monocotyledons, probably allied to Araceæ. They are chiefly floating plants, mere flat green fronds, with roots hanging loosely in the water, and unisexual flowers—destitute of calyx and corolla—bursting through a membranous spathe in their margin. The Lemnaceæ are distributed throughout all parts of the world. Several species of duckweed are British, and cover the surface of stagnant ponds with green vegetation. Their flowers and fruits are rarely to be seen, but they spread rapidly by budding from their margins.

Duclaux, MME. See DARMESTETER.

Ducrow, ANDREW (1793–1842), the 'Colossus of Equestrians,' was born at Southwark, the son of a Belgian 'strong man.' He toured France successfully with his brothers and sisters; and having in 1825 become joint-proprietor of Astley's, left a large fortune, although the burning of his theatre (1841) unhinged his mind and caused his death.

Ductility is that property of solids in virtue of which they can be drawn out so as to increase their length at the expense of their cross dimensions. Thus silver is a very ductile metal, while platinum is not so ductile. But although platinum cannot be drawn out to any very great extent by the ordinary process of wire-drawing, it may be drawn out by Wollaston's process. Wollaston fitted a platinum wire into the interior of a hollow rod of silver, and then drew out the compound rod to an extent limited only by the ductility of silver. He then dissolved off the silver, and so obtained an excessively fine platinum wire, the diameter of which was, according to Leslie, $\frac{1}{30000}$ inch. Leslie also says that, by drawing out a thickly-gilt silver rod, a film of gold only $\frac{1}{2000000}$ inch in diameter could be obtained. See MALLEABILITY, WIRE.

Ductless Glands. See GLANDS, and separate articles, THYROID, &c.

Du Deffand. See DEFFAND.

Dudevant, MADAME. See SAND (GEORGE).

Dudley, a municipal, county, and parliamentary borough in a part of Worcestershire embedded in the south of Staffordshire, 8½ miles WNW. of Birmingham. Situated in the heart of the 'Black Country,' it is a thriving town with coal-mining, busy brass and iron foundries, brickworks, besides tanning and brewing. The iron industries include the making of bedsteads, fenders, vices, and anvils. A chief ornament of the place is the Renaissance drinking-fountain, erected in 1867 by the Earl of Dudley, a statue of whom was erected in 1888. On a hill to the north-east are the beautiful ruins of an old castle, said to have been founded in the 8th century by Dodo, a Saxon prince, the keep of which dates from the 13th century. It was burned in 1750. Near it are remains of a Cluniac priory (1161). The vicinity yields abundant limestone (see below); it is wrought out of caverns, and brought to the kilns through a tunnel one mile and three-quarters long, which is carried through the basalt of the Castle Hill. Pop. of municipal borough (1891) 45,724; (1911) 51,079; (1921) 55,908. Dudley has returned one member since 1832; the municipal borough dates from 1865.

Dudley Limestone is a highly fossiliferous Silurian limestone belonging to the Wenlock Series (q.v.), which forms some of the most picturesque eminences around the town of Dudley. The masses of corals, shells, and trilobites which abound in this rock, form, when weathered, extremely beautiful cabinet specimens.—*Dudley Locust* is the popular name for a trilobite (*Calymene Blumenbachii*), which is very abundant in the Dudley limestone.

Dudley, EDMUND (1462?–1510), lawyer and privy-councillor, was Empson's partner in carrying out the detested policy of Henry VII., whose son and successor sent him to the block. He was father of the Duke of Northumberland. See PERCY, GREY (LADY JANE), and LEICESTER.

Duelling. The duello (from the Lat. *duellum*, an old form of *bellum*) belongs to every age and country, uncivilised as well as civilised. The old 'ordeal by battle,' a sort of judicial decision, implied that the Almighty would give victory to the just cause, and was in vogue in England down to the reign of Elizabeth (see BATTLE, WAGER OF). Neither this nor the chance quarrel of two gentlemen carrying swords can be strictly considered a duel, which implies deliberation. The modern duel is prompted by the worst passions, hatred, revenge, jealousy, and often by the merest trifle. In France, where it has long flourished, it was punished severely by kings and parliaments, and Henry II., Henry IV., and Louis XIV. took stringent measures to put duelling down. Francis I., however, was in its favour, and even challenged Charles V. to single combat. It is said that during the earlier years of Henry IV.'s reign no less than 4000 gentlemen lost their lives in this way. In Louis XIV.'s day, duels of four and five a side were common, but his edict of 1679 completely suppressed it.

It is remarkable that at this moment there is but one group of countries—viz. the English-speaking lands—where duelling is not merely scouted and put down by law, but actually ridiculed. This cannot be explained by English respect for the laws, or from a strict religious sense; both these feelings being as strong when duelling was in high fashion. In the reign of William III. a severe act against it was passed, and in 1712 it again engaged the attention of the parliament.

Duels with the pistol prevailed in England for nearly a century; to within living memory, ministers and politicians resorted freely to this mode of settling a quarrel. Wilkes met Lord Talbot, and also Mr Martin, in 1763, by whom he was severely wounded. Mr Pitt was challenged by Mr Tierney for charging him with 'obstructing the defences of the country.' The day fixed for the encounter was a Sunday of May 1796, and at three o'clock the parties were found on Putney Heath, close to the Kingston Road. The duellists fired twice at each other; but on the second occasion Pitt discharged his pistol in the air. Pitt's great rival, Charles Fox, had been particularly severe on the powder supplied by the War Office. Mr Adam took offence at this charge, and challenged him. The parties met, and Fox was wounded. The buoyant humour of the man, which made him so many friends, was shown in his first remark, 'Adam, you'd have killed me if you hadn't used government powder.'

Another political duel took place in September 1809, between Mr Canning and Lord Castlereagh (q.v.); a yet more remarkable duel was that of the Duke of Wellington with Lord Winchilsea in the exciting year 1829. Lord Winchilsea charged the duke with the 'insidious design of introducing Popery.' The duke at once sent Sir Henry Hardinge to demand an apology. The meeting was at Battersea Fields. Lord Winchilsea was attended by Lord Falmouth, a second so completely unnerved that he had to be assisted in loading his pistols. The duke was gay and unconcerned. When their men were placed, the duke's second advanced with a paper in his hand. 'As for myself,' said he, 'if I do not express my open disgust for the whole affair, it is because I wish to imitate the moderation of the Duke of Wellington.' Lord Winchilsea was quite overwhelmed by this irregular lecture, his second faltered out that 'nothing had ever given him so much pain,' &c. To whom Sir Henry: 'Indeed, my lord, I don't envy your feelings.' A crowd had collected to see the sport. The duke hesitated a little and fired; Lord Winchilsea then fired in the air. Lord Falmouth now came forward with a paper. The duke, who had drawn near to listen, said in a low voice, 'This won't do: it is no apology.' Sir Henry pulled out his paper, and reading it, said: 'This is what we require; the word apology must be used.' At last the required word was furnished. Then Sir Henry gave the guilty pair a last rebuke. 'And now, gentlemen,' he said, 'without making any invidious reflections, I cannot help remarking that, whether wisely or unwisely the world will judge, you have been the cause of bringing this man into the field, where, during the whole course of a long military career, he never was before.' Here Lord Falmouth turned on his unhappy principal to tell him that 'he always thought, and had told him so, that he was completely in the wrong.' Lord Falmouth then attempted to vindicate himself. 'My Lord Falmouth,' was the duke's haughty reply, 'I have nothing to do with these matters.' He then touched his hat with two fingers, saying: 'Good morning, my Lord Winchilsea; good morning, my Lord Falmouth,' and rode away. It is remarkable that most of these fire-eating politicians —viz. Wellington, Castlereagh, Canning, Tierney— were of Irish extraction.

There have been three notable duels, each attended with fatal issue, and each arising out of a political quarrel. One was that of Mr Scott, editor of the *Champion*, killed by Mr Christie in 1821; the second was that of Sir A. Boswell in 1822, killed by Mr James Stuart of Dunearn, the quarrel arising out of a foolish ballad written by the former; the third was the well-known fatal encounter of Mr O'Connell with D'Esterre, in which the latter fell. Another fatal duel was that of Lord Camelford and Mr Best in 1804. In Ireland, before and after the union, there was a mania for duelling; and personages of the highest position, lord chancellors, judges, provosts, and all fought, or as the phrase went, 'blazed.' Of modern duels the most notable was that of Lord Cardigan with Captain Harvey Tuckett, in which the latter was wounded (1840). Up to 1843 duelling was almost recognised as an obligation, but in that year it received its *quietus*, owing to the fatal contest between Colonel Fawcett and Lieutenant Munro, his brother-in-law, in which the former was killed. Thereafter only one fatal duel was fought by Englishmen in England, between Lieutenants Hawkey and Seton, in May 1845, when the latter was killed. The last duel in Ireland (February 1851), between the mayor of Sligo and a lawyer, was a bloodless one.

In most countries, as we have said, duelling is still resorted to as reparation for personal insult or injury. In France, fencing is studied, as a necessary part of education and protection, by most public men and journalists. The encounters are generally harmless, and often *pour rire*. Two modern political duels excited the merriment of Europe, that of Gambetta and M. Fourtou, who 'fought' in a foggy morning at thirty or forty paces distance (1878), and that of General Boulanger, who spitted himself on the rapier of a retired attorney, M. Floquet, then first minister (1888). Perhaps the most notable political duel was that of Armand Carrel with Émile de Girardin (1836), when the former fell mortally wounded. In France, two seconds on each side regulate the proceedings, and one stands beside the combatants, ready with a walking-stick to beat down the weapons in case of unfair fighting. This precaution is not unnecessary, as one of the parties has been known to seize his adversary's sword with one hand, and try to 'finish' him. In Belgium the duel occurs seldom, though still enforced by social law, but the country is often selected by Frenchmen and others as the *terrain* of their encounters.

In other countries duels are comparatively rare. In the United States, where they were at one time fought with a savage ferocity and originality combined (in some sections, with bowie-knives), they are now practically unknown, save in the very backward states. None has been more famous than one of the earliest, in 1804, when Aaron Burr, the vice-president, killed Alexander Hamilton, the leader of the opposition. Later duels were those between Henry Clay and John Randolph, Andrew Jackson and Charles Dickinson, Thomas H. Benton and Lucas. By the common law, the survivor and the seconds are guilty of murder when one of the parties to a duel is killed.

The question of insult, the form of reparation, withdrawals, &c., led naturally to some complication, and there have been attempts to draw up rules and regulations. Towards the end of the 18th century, a number of duelling gentlemen ('delegates') met at Clonmel, and drew up a 'code,' conceived in a highly logical spirit. One specimen will suffice: 'Where the *lie direct* is the first offence, the aggressor must exchange two shots previous to apology, or three shots followed by explanation, or *fire on* until one is hit. The only satisfaction for a blow is to offer a cane which is to be laid on the offender's shoulders. If a blow be an answer to giving the lie, the lie is merged in the blow, which becomes the sole offence,' &c. There are so-called duels, in which lots are cast, and the party to whom the lot falls is bound to put an end to his own life. There have been cases of duels with sword and pistol between women.

By the laws of the German empire, duelling was an offence punishable with fortress-imprisonment, the length of which was proportioned to the nature and consequences of the encounter. Students' duels, so-called, really a form of sport (*Mensur*), ranging in seriousness from mere fencing matches to dangerous or even fatal encounters, were formerly treated as mere 'disciplinary offences,' unless the consequences were very serious. But public feeling turned against them; and from 1883 the imperial courts imposed fortress-imprisonment. In contradiction to the spirit of the public laws, duelling continued to be recognised in the German army, whence an officer was expelled in 1887 for refusing to challenge one who had insulted him. The Emperor William I., pious as he was, felt constrained to draw up regulations on the subject, introducing courts of honour, which, however, in serious cases, might authorise the encounter. These were abolished by the republican constitution. In 1844 the English War Office, moved thereto by Prince Albert, put a summary stop to the practice—issuing a number of regulations which threatened all concerned in a duel with court-martial and cashiering. For the law of the land makes no distinction between any of the methods of taking another's life, though the old attitude of the law to affairs of honour was fairly expressed by an Irish judge, who, when charging in a fatal case, declared that it was his duty to tell the jury that it was murder according to the law, 'but that for his part a fairer duel he had never met in his life.' In a work revised by him in 1853, Lord Cockburn similarly expressed his opinion that 'murder may be committed in duel required by society, and provoked by intolerable insult.'

See Dr Millingen, *History of Duelling* (2 vols. 1841); A. Steinmetz, *The Romance of Duelling* (2 vols. 1868); Rödenbeck, *Der Zweikampf* (1883); Constard de Massi, *Duelling in all Countries* (trans. 1880); William Douglas, *Duelling Days in the Army* (1887); Alfred Hutton, *The Sword and the Centuries* (1901); Edom, *L'Escrime et le Duel* (1908); and Thimm's bibliography (1896).

Duet, a composition in music for two voices or instrumental performers.

Duff, Alexander, a great Indian missionary, was born 26th April 1806, at a farm near Pitlochry, in Perthshire. When a student at St Andrews his character was powerfully influenced by Chalmers, and in 1829 he was ordained the first missionary from the Church of Scotland to India. On the passage out he was twice shipwrecked, and he did not reach Calcutta till May 1830. He began his work as a missionary on an entirely new plan, freely opening up Western science and learning to the natives of India as well as purely religious teaching—an innovation that marked the beginning of a real era in the social history of that country. In spite of much misapprehension and not a little violent opposition, his English school flourished, and in the course of time its indomitable promoter was cheered by the warm encouragement of some of the highest personages in the government. In 1834 Duff was obliged to return home, already invalided by his enthusiastic and restless energy; but he returned in 1840 to find his college maintaining its success, with an attendance of between six and seven hundred pupils. At the Disruption within the Church of Scotland in 1843, Duff, with the other missionaries in India, cast in his lot with the seceding body that formed the Free Church, and of course had in consequence to give his college into other hands, and begin his work again from the beginning. But for this the enormous energy of the man was adequate, and ere long his whole educational and missionary work was completely reorganised, and that on a much ampler scale than before. In 1844 Duff helped to start the *Calcutta Review*, and in 1849 was again obliged by ill-health to return home, traversing India on the journey. He was moderator of the Free Church General Assembly in 1851. In 1856 Duff returned to India, and guided his mission safely through the troublous time of the Mutiny. He was one of the founders of the university of Calcutta, but in 1863 was obliged by persistent ill-health to leave India permanently. In Scotland he laboured much to infuse missionary zeal throughout the community; he raised £10,000 to endow a missionary chair in the New College, Edinburgh, of which he agreed to be the first occupier. In 1873, to avert a threatening crisis within the Free Church, he was called a second time to the moderator's chair. He died in Edinburgh, 12th February 1878.

See his Life by Dr George Smith (2 vols. 1879; new ed. 1899), and a short Life by Prof. Thomas Smith (1883).

Duff, Sir Mountstuart Elphinstone Grant (1829–1906), born at Eden in Aberdeenshire, son of James Grant Duff (1789–1858; historian of the Mahrattas), was educated at Edinburgh and Balliol, and called to the bar. In 1857–81 he was (Liberal) M.P. for the Elgin Burghs, and delivered notable surveys of foreign politics to his constituents in the famous 'Elgin Speeches.' Successively Under-secretary for the Colonies and for India, he was in 1881–86 governor of Madras, and was made G.C.S.I. He wrote Lives of Sir Henry Main, Renan, and Lord de Tabley, *Notes of an Indian Journey*, and *Miscellanies, Literary and Critical;* but is best remembered for the fourteen volumes of his *Notes from a Diary* (1897–1905), which illustrate his exceptional all-round culture—classics, botany, archæology, religion, poetry, and the personal gossip of his time.

Dufferin and Ava, Frederick Temple Hamilton Temple Blackwood, Marquis of, G.C.B., G.C.M.G., the son of the fourth Baron Dufferin, was born at Florence on June 21, 1826, and succeeded to the peerage in 1841. Educated at Eton and Christ Church, Oxford, he first distinguished himself by contributions to literature, and published the popular *Letters from High Latitudes* in 1859. In 1860 he was sent by Lord Palmerston to Syria, to investigate the questions arising from the religious massacres, and on his return was created K.C.B. Lord Dufferin was successively Under-secretary for India (1864–66), and for War (1866). He was Chancellor of the Duchy of Lancaster from 1868 to 1872; in 1871 was created an earl; and was Governor-general of Canada (1872–78). His brilliant administration was remarkable for the wonderful development of the province of Manitoba. From 1879 to 1881 Lord Dufferin was ambassador at St Petersburg, whence he was transferred to Constantinople. After the collapse of Arabi's rebellion, Lord Dufferin went to Cairo to restore order in Egypt. To him was due the abolition of the Dual Control. In 1884 he succeeded Lord Ripon as Viceroy of India. His tenure of office was made memorable by measures for strengthening the Indian frontier; by the various attempts to delimit the Afghan frontier, which, though interrupted by the Russian attack on Penjdeh, were brought to a successful issue by the Anglo-Russian commission; and, above all, by the annexation of Upper Burma in Dec. 1885. That province had been reduced to submission, and the Tibetans had been defeated by the Sikkim expeditions, when Lord Dufferin resigned in 1888. He became ambassador at Rome, marquis (1888), and ambassador to France (1891–96), and died 12th February 1902. See his Life by Sir Alfred Lyall (1905). —His mother, Helen Selina Sheridan (1807–67), was the author of 'The Irish Emigrant,' 'The Bay of Dublin,' and other songs; see Memoir by her son prefixed to her *Songs, Poems, and Verses* (1894).

Duff-Gordon. See Gordon.

Duffy, Sir Charles Gavan (1816–1903), Irish patriot, was born in County Monaghan, and early devoted himself to journalism in Dublin and Belfast, returning to the former in 1842 to start along with Thomas Davis and John Dillon the famous *Nation* newspaper, as the organ of the Young Ireland party. Tried and convicted for sedition with O'Connell in 1844, but saved by the House of Lords quashing the conviction, he aided his great chief in the agitation for repeal, next helped him to found the Irish Confederation, and gave his heartiest sympathy to the patriotic dreams of Smith O'Brien. Again tried in 1848 for 'treason-felony,' he was acquitted, next revived the *Nation*, and carried in 1852 the borough of New Ross in the teeth of the Under-secretary for Ireland. He had an active share in promoting the Tenant League and the Independent Irish party, and on the break up of the latter, emigrated to Australia in 1856. After some time of practice at the Melbourne bar, he drifted into politics, and after the establishment of the Victorian constitution, rose in 1857 to be Minister of Public Works, of Lands in 1858 and 1862, and prime-minister in 1871. He was defeated next year, was knighted in 1873, and in 1877 elected Speaker of the Legislative Assembly. His little work, *The Ballad Poetry of Ireland*, had been for thirty years a household book in his native country, when in 1880 he published his striking *Young Ireland, 1840–50*, followed in 1883 by *Four Years of Irish History, 1845–49*. See the autobiographical *My Life in Two Hemispheres* (1898).

Dufresne, Charles. See Du Cange.

Dugdale, Sir William, antiquary, was born at Shustoke, near Coleshill, Warwickshire, 12th September 1605. He spent more than four years at Coventry free school, and then studied law and history under his father, to please whom, aged and palsied, he married before he was eighteen, and soon after whose death he purchased the neighbouring manor of Blythe (1625). Inspired with the notion of writing a history of Warwickshire, he came in 1635 to London, where, making the acquaintance of Spelman and other antiquaries, in 1638 he was created a pursuivant-at-arms extraordinary, with the title of Blanch Lyon, and in 1640 Rouge Croix pursuivant. During the Great Rebellion he adhered to the royalist cause, and from 1642 to 1646 was at Oxford, the king's headquarters, being made an M.A. and Chester herald, while pursuing his antiquarian researches. 'All the while that the power of the usurpers continued he was compelled to live depressed in a very low estate; but, as the darkest night hath its morning, so,' on the Restoration Clarendon got him the office of Norroy. In 1677 he was promoted to be Garter Principal King of Arms, at the same time receiving the honour of knighthood, 'much against his will, by reason of his small estate.' Evelyn describes him in 1685 as 'having his sight and his memory perfect;' but on 10th February 1686 he died in his chair at Blythe Hall. The *Monasticon Anglicanum* (3 vols. 1655–61–73), a history of English religious foundations, with their charters, &c., though planned and in part compiled by another antiquary, Roger Dodsworth (1585–1654), was concluded, arranged, indexed, and revised by Dugdale; there is a noble English edition of it by Bandinel, Caley, and Sir Henry Ellis (6 vols. 1817–30). The *Antiquities of Warwickshire* (1656; 3d ed. 1763–65) has been the model of every subsequent county history; of Dugdale's nine other works the chief are the *History of St Paul's Cathedral* (1658), *History of Imbanking and Drayning* (1662), *Origines Juridiciales* (1666), and *Baronage of England* (3 vols. 1675–76). In Anthony à Wood's words, 'What Dugdale hath done is prodigious. His memory ought to be venerated and had in everlasting remembrance.' See his *Life, Diary, and Correspondence*, ed. Hamper (1827).

Dugi. See Isola Grossa.

Dugong (*Halicore*), a genus of marine mammals in the order Sirenia. Along with the manatees, the dugongs exhibit the following general characteristics. The form of the body is fish-like, but somewhat depressed; the head is rounded, distinct, and not out of proportion to the body; there is hardly any neck; the tail is horizontally flattened; there are no hind-limbs, nor is there a dorsal fin. In relation to the aquatic habit, the fore-limbs are paddle-shaped flippers, the skin is almost hairless except about the mouth, there are no external ears, and the nostrils have valves. The very small eyes, with imperfect lids, have a nictitating membrane, which is absent in Cetaceans. The nostrils are at the end of the snout. The lips are thick and bristly. The bones of the skeleton are very massive and heavy, a condition which, as Sir William Flower notes, must help these animals to keep to the bottom while feeding on algæ. The skull is in many ways peculiar, but is not like that of Cetaceans. The usual separate terminal ossifications or epiphyses on the vertebræ are absent; so too are the clavicles; there is no fused sacrum, and a most rudimentary hip-girdle, without trace of hind-limbs. There are no canine teeth. The brain is relatively small, with few convolutions. The tongue is small, fixed, and very rough. The stomach is chambered; the long muscular intestine is provided with a cæcum. The two ventricles of the heart are partly separated by a deep cleft, and the arteries form complex networks (*retia mirabilia*), which may aid the animals when under water. The larynx is not modified as in Cetaceans. The lungs are very long and narrow, and the diaphragm is very oblique. The teats are two in number, behind the arm-pits. The placenta is diffuse. The animals are sluggish, herbivorous, inoffensive, and gregarious. Halicore and Manatus are the only living genera; Rhytina is recently extinct; Halitherium is an important fossil form referable to this now moribund but once flourishing order.

The dugong differs in many important respects from the manatee. A few of its numerous peculiarities must be noticed. The upper jaw is very massive and turned sharply downwards, overlapping the lower, which is also crooked. The males possess two tusk-like projecting incisors, but the corresponding teeth abort in the females. The front-teeth of the lower jaw abort, and are absorbed. The jaws both bear rough horny plates. There are five to six molar teeth of a primitive sort, with

Dugong (*Halicore dugong*).

persisting pulps and no enamel. Only two or three are in use at a time. The dark, elephant-like, tough skin bears short sparse bristles. The tail is deeply notched. The fingers are nailless. The

cæcum is thick and simple. Of the three species of Halicore, one (*H. tabernaculi*) is restricted to the East African coast and the Red Sea; another (*H. dugong*) inhabits the Indian and Pacific oceans, eastward from the home of the last to the Philippines; and the third (*H. australis*), the waters of Eastern and Northern Australia.

The dugongs keep to the water, rising to the surface to breathe. They never venture ashore, but graze at the bottom in shallow water. Their food consists chiefly of seaweeds, which they gather in with their thick lips. They are sociable but stupid, often to their own undoing. They are known to attain a length of about 10 feet, but larger sizes are alleged. The habit the dugong has of lifting its round head out of the water, and of carrying its baby under its arm, is suggested as a possible foundation for the mermaid myth, which the name of the order (Sirenia) recalls. Their peculiar, feeble cry may also have aided the imagination of early observers. The female bears one young one at a time, and exhibits an affection said to be proverbial. When the young one is speared, the mother is readily taken. The flesh of the dugong is eaten and esteemed, especially when young. The Australian species is killed for the sake of its oil, which is free from disagreeable smell, and said to have the medicinal qualities of the cod-liver equivalent. According to Rüppell, it was with the skin of the Red Sea dugong (not 'badger-skins,' as in A.V.) that the Jews were directed to veil the tabernacle.

Cuvier called the Sirenia herbivorous Cetaceans, De Blainville emphasised their connection with elephant types, and some modern zoologists maintain their affinity with Ungulates. No conclusion is yet possible, except that they have no direct connection with Cetaceans. Even the fossil forms, Flower observes, have not in this case helped much towards solving the riddle of Sirenian affinities. All that can be certainly said is that the order is at once peculiar and primitive.

See MANATEE, RHYTINA; J. F. Brandt, *Symbolæ Sirenologicæ* (St Petersburg, 1846–68); Huxley's *Anatomy of the Vertebrates;* Flower's *Osteology of the Mammalia,* &c.

Duguay-Trouin, RENÉ, one of the most celebrated naval officers of France, was born 10th June 1673, at St Malo. From 1689 to 1697 he cruised about as a sort of privateer, inflicting immense damage on the enemies of France. Louis XIV., as a reward for his daring exploits, admitted him into the state navy, and gave him the command of a frigate. In 1707 he engaged a part of the English fleet at the entrance of the Channel, burned one ship, captured three others, and about sixty transports; but the most glorious of his triumphs was the attack and capture of Rio Janeiro in 1711, with a small fleet, after hostilities had lasted for eleven days. The city was ransomed for 610,000 crusados (£96,000). For this he was ennobled, and was successively named *chef d'escadre,* member of the council of state, lieutenant-general, and naval commandant at Brest. In 1731 he was sent into the Levant, to obtain reparation for the damages done to French commerce. He died 27th September 1736. See his *Mémoires* by Beauchamps (4 vols. Paris, 1740; Eng. trans. 1742), and Life by La Landelle (2d ed. 1876).

Du Guesclin. See GUESCLIN.

Duiker. See BUSH ANTELOPE.

Duisburg, a town of Rheinland, 16 miles N. of Düsseldorf by rail, in a fertile district between the Ruhr and the Rhine, with both of which it is connected by a canal. St Salvator's church dates from the 15th century. In and near the place are great ironworks and coal-mines. There is very extensive river shipping and shipbuilding, the Duisburg-Ruhrort harbour being exceptionally large for an inland place. Manufactures include bridges, boilers, machinery, rolling-stock, enamel, copper goods, pulleys, cranes, bricks, beer and spirits, besides corn-mills and saw-mills. Pop. (1816) 4508; (1885) 47,561; (1910) 229,483; (1919) 244,302, nearly half Protestants. Duisburg is an ancient town. In the 13th century it was a member of the Hanseatic League, and afterwards a free town of the German empire, but at the close of the war in 1815 it became finally Prussian. French occupation (from 1921) was a heavy blow.

Dujardin, FÉLIX (1801–60), born at Tours, was professor of Zoology at Rennes, is notable for his study of Foraminifera and of Protoplasm (q.v.).

Dukas, PAUL, French composer, born in Paris, 1st October 1865, studied at the Conservatoire, where he afterwards became a professor. Best known in Britain by his symphonic piece *L'Apprenti Sorcier,* he composed also the opera *Ariane et Barbe Bleu* and other works, and wrote music criticism.

Duke (Fr. *duc,* Lat. *dux,* from *ducere,* 'to lead'), a term applied originally to any military leader. The title came first into formal use when Constantine separated the civil and the military commands in the provinces. From that time forth, the military governors of provinces were either counts or dukes. But these titles originally stood to each other in an opposite relation to that which they afterwards assumed. 'All provincial generals,' according to Gibbon, 'were *dukes,* but no more than ten among them were dignified with the rank of *counts,* or companions, a title of honour, or rather of favour, which had been recently invented in the court of Constantine.' See COUNT. Both were strictly prohibited from interfering in any matter which related to the administration of justice or the revenue. When the Germanic barbarians invaded the provinces of the empire, the military chiefs of their tribes (called by names cognate with *heretoga* or *herzog*) were sometimes identified with the *duces;* but amongst the Franks and Longobards, the functions of the so-called *dux* were rather those of the old German *Graf* (Lat. *Comes;* see COUNT). By-and-by the ordinary count became the lieutenant of the duke, and the government of the latter extended to several provinces; whereas that of the former was confined to one province, or even to a single locality. The power of the dukes grew so rapidly, in consequence of the dissensions of the Merovingians, that, towards the end of the 6th century, they arrogated to themselves the right to dispose of the crown. In the 10th century, the East Frankish empire fell into the five hereditary dukedoms of Franconia, Swabia, Bavaria, Saxony, and Lorraine. In the west, the dukes of the Isle of France, Aquitaine, Burgundy, Normandy, Gascony, and others assumed the crown and sceptre, promulgated laws for their subjects, struck money with their own image, and made war in their own name against the crown. The confederation of the feudal lords had assumed such dimensions, that about the period of the Norman invasion of England nothing remained directly under the crown except a few towns, of which Reims and Laon were the chief. The rest of the kingdom was divided amongst the dukes and the counts, under an obligation, which they almost always evaded, of service and fidelity to the crown. But by 1514 these regal duchies had been either extinguished or reunited to the crown.

The duchies which were granted to members of the royal family—that of Bourbon, erected in 1327; of Orleans, in 1344; of Auvergne, Berri, Touraine, Valois, and Alençon at later periods

—enjoyed none of the privileges of independent sovereignty which had belonged to the ancient duchies; and when the Montmorencies were created dukes in 1551, they enjoyed no other privileges than those of titled nobles. The duke-peers, as they were called, were simply the first class of nobles in France, just as dukes are in England. Several prelates enjoyed this rank—as, for example, the Archbishop-duke of Reims. There were also in France dukes for life, or patent dukes, who dated only from the reign of Louis XIV. Swept away by the Revolution, the title was restored by Napoleon, who conferred it, with rich endowments, on his marshals. Several ducal peers were created by Louis XVIII. and Charles X. In Germany, the dukedom passed through phases very similar to those which it exhibited in the earlier history of France. The title of grand-duke was first bestowed on Cosmo de' Medici, Grand-duke of Tuscany, by Pope Pius V. in 1569; it was assumed by the princes of the imperial family of Russia, and was used by certain German reigning princes. Archduke (q.v.) was Austrian only.

William the Conqueror, Duke of Normandy, may be held to have brought the title as a separate dignity into England; but it was merged in the crown until the reign of Edward III., who, in 1337, conferred the dukedom of Cornwall on the Black Prince, his eldest son, and in 1351 that of Lancaster on Henry Plantagenet, his cousin. These were dukedoms by tenure, Cornwall (q.v.) being in the one case erected into a duchy, and palatine jurisdiction being in the other conferred within the county of Lancaster. In later cases the dignity of duke was personal, and unaccompanied with grants of lands and annuities. In 1362 Edward III. conferred the dukedom of Clarence on Lionel, his third son, and the dukedom of Lancaster on John of Gaunt, his fourth son and husband of the then heiress of the former Duke of Lancaster. Two other sons of Edward III. were in 1385 made Dukes of York and Gloucester respectively by their nephew Richard II. This king first extended the title beyond the royal house. In 1386 he made his favourite, Robert de Vere, Duke of Ireland, and in 1397 he created five dukes and a duchess in one day—viz. the Dukes of Hereford, Surrey, Exeter, Albemarle, and the Duke and Duchess of Norfolk. The creation of dukes was at that time by patent, there being an inaugural ceremony of girding with the sword in parliament. In the reign of Henry VI., the recipients of dukedoms included Humphrey Stafford, Duke of Buckingham, Henry de Beauchamp, Duke of Warwick, and William de la Pole, Duke of Suffolk. Henry VIII. made his illegitimate son, Henry Fitzroy, Duke of Richmond, and his brother-in-law, Charles Brandon, Duke of Suffolk. Three dukes were created by Edward VI., Edward Seymour (the Protector and king's uncle) being made Duke of Somerset; Henry Grey, Duke of Suffolk; and John Dudley, Duke of Northumberland. Yet on Elizabeth's accession, in consequence of attainders and extinctions, the only remaining duke was Thomas Howard, Duke of Norfolk; and on his execution and attainder, the title of duke was non-existent in England. James I. in 1623 made the Scottish Duke of Lennox Duke of Richmond, and his favourite, George Villiers, Duke of Buckingham. Charles I. conferred the dukedom of Cumberland on Prince Rupert. Charles II. (q.v.), besides creating General Monk Duke of Albemarle, and the Marquis of Worcester Duke of Beaufort, bestowed the dukedoms of Monmouth, Grafton, Northumberland, and St Albans on four of his natural sons. Under William, Anne, and George I. a number of holders of lower dignities in the peerage were advanced to the rank of duke. From the accession of George II. comparatively few dukedoms have been created, except those conferred on younger members of the royal house. Since the accession of Henry IV., the dukedom of Lancaster has been merged in the crown; there was no Duke of York from 1827 to 1892; and the dukedom of Cornwall is held by the heir-apparent.

The introduction of the title duke into Scotland seems to have arisen out of the claims of precedency made by Henry IV., when Duke of Lancaster, over the Scottish princes, who were merely earls, at international congresses. The first Scottish dukes were made in 1398—viz. David, eldest son of Robert III., who was made Duke of Rothesay; and the king's brother, Robert, Earl of Fife and Menteith, who was made Duke of Albany (q.v.). The dukedom of Albany (the old name for Scotland) was an empty honour unconnected with lands, and the only instance of a Scottish dukedom that did not possess more or less of a territorial character. David, Duke of Rothesay, died without issue in Falkland Castle, in 1402, and in virtue, it has been assumed, of the original constitution of that dukedom, the title in later times belonged to the heir-apparent of the Scottish crown. Prince Henry, eldest son of James VI., was, at his baptism in the Chapel Royal at Stirling, invested with the dignity of Duke of Rothesay, with appropriate solemnities, including the imposition of a ducal crown. The title of Duke of Ross was given by James III. to his second son, James, who became Archbishop of St Andrews; and the same king, on the eve of the rebellion in which he lost his life, bestowed on his devoted adherent, David, Earl of Crawford, the title of Duke of Montrose. The dukedoms of Ross, conferred on Henry, Lord Darnley; of Orkney, bestowed on the Earl of Bothwell on his marriage with Queen Mary; and of Lennox, given to Esmé Stewart, Earl of Lennox, cousin-german of Darnley, were the only other Scottish creations before the union of the crowns. Hitherto the jealousy of the feudal nobles had been so great an obstacle to the extension of this title beyond the near relations of the royal house, that James, Earl of Arran, though regent of Scotland and next heir to the throne in Queen Mary's minority, had to derive his title of duke (Châtellerault) from France. Ten Scottish dukedoms appear on the Union Roll of 1707, of which Hamilton alone dated before the Civil War. Rothesay, which had been overlooked, was added in 1714. Of these eleven dukedoms, two are extinct, and Queensberry is conjoined with Buccleuch. A duke (except a royal duke) in the peerage of the United Kingdom is styled 'Your Grace' and 'The Most Noble.' His wife is a duchess. For the designation of his sons and daughters, see COURTESY TITLES. His parliamentary robe is of scarlet, with four doublings of ermine. For the form of his coronet, see CORONET.

Duke of York's School, an alternative name for the Royal Military Asylum (q.v.) near Dover.

Dukeries. See WORKSOP, and *The Dukeries*, by R. M. Gilchrist (1913).

Dukhobortzi ('Warriors of the Spirit'), a sect of Russian mystics, traceable to the middle of the 18th century, who depend upon an inward light, like the Quakers, attach little importance to the sacraments, priesthood, and services of the church, refuse military service, and reject the doctrine of the Trinity and the divinity of Christ. The Emperor Alexander I. allowed them to settle in Taurida, in South Russia; Nicholas I., in 1841, transferred them to Transcaucasia. In 1899 a body of them emigrated to Canada, where, in spite of occasional eccentricities, they have proved industrious and successful colonists in Saskatchewan and British Columbia. See RASKOLNIK; RUSSIA; Maude, *Peculiar People* (1905); *Chambers's Journal* for 1912.

Dukinfield, a Cheshire municipal borough, adjoining Stalybridge; pop. 20,000.

Dulce, a lagoon of Guatemala (q.v.) communicating with the Atlantic.

Dulce Domum, the famous song still sung, with the aid of a band, at Winchester College on the eve of the break-up day for the summer holidays. The origin of both words and music is very uncertain—it is usual to ascribe the former to one Turner, probably him who became Bishop of Ely and was one of the Seven Bishops under James II.; the latter, to Johannes Reading, organist of the college from 1681 to 1689. A school tradition makes both the work of a home-sick Wykehamist, who was kept at school during the holidays for a misdemeanour, and who played it incessantly until he pined away and died. See vol. ii. (pp. 576–79) of Chappell's *Popular Music of the Olden Time*, where, with the Latin text and the music, a good translation by Bishop Charles Wordsworth is given.

Dulcigno (Serb *Ulčinj*, Albanian *Ulkun*), a port of Yugoslavia, 20 miles SW. of Scutari. Old Dulcigno fell into the hands of the Turks in 1571. In the 16th and 17th centuries it was the most famous den of pirates on the Adriatic. In 1880, with the approval of Turkey, the representatives of the Western powers arranged that Dulcigno and its territories should become Montenegrin; and, after endless procrastination, the Turks expelled the Albanian troops by force, and the Montenegrins were able to take possession. Pop. about 5000.

Dulcimer, a musical instrument resembling a flat box, with sounding-board and bridges, across which run wires tuned by pegs at the sides, and played on by striking the wires with a small piece of wood in each hand, or more usually with two cork-headed hammers. The dulcimer in its simplest shape (closely akin to the psaltery, which, instead of standing on a table or on legs of its own, was carried in the hand like a harp) is one of the most ancient of instruments, appearing in Assyrian sculptures; and may be regarded as the ancestor of the piano. The czimbalom of Hungarian bands is essentially a dulcimer.

Dulong and Petit's Law. See ATOMIC THEORY.

Dulse (*Rhodymenia palmata*), a seaweed, one of the Florideæ (see SEAWEEDS), growing on rocks in the sea, and used as food by the poor on the coasts of Scotland, Ireland, and other northern countries. It is eaten raw or roasted, and with vinegar. It is an important plant to the Icelanders, and after being washed and dried, is stored in casks, to be eaten with fish or boiled with milk. In Kamchatka, a fermented liquor is made from it. Sheep are fond of it.—One or two other edible Florideæ bear the same name on different parts of the coast, and the pungent *Laurencia pinnatifida* is known as pepper dulse.

Duluth, a prosperous city of Minnesota, capital of St Louis county, and as a lake port one of the chief shipping centres in the United States, is picturesquely situated at the west end of Lake Superior, 156 miles NNE. of St Paul, and is the terminus of a number of important railways. It has one of the finest harbours in the United States, protected by a natural breakwater known as Minnesota Point, which is 7 miles long and about 750 feet broad. The navigable St Louis River affords also abundant water-power. The United States government has expended liberal sums of money in the improvement of the harbour, by dredging and the construction of piers. The ship-canal (depth about 23 feet) through Minnesota Point forms the chief entrance way between Lake Superior and the harbour. The grain elevators handle vast quantities of wheat. Duluth imports coal and other commodities, and exports iron, copper, lumber, wheat, wool, hides, &c. The industries comprise extensive steel works, large flour and lumber mills, stockyards, slaughtering and cold-storage establishments, &c. Advantageously situated at the head of navigation of the great chain of lakes, and with immense deposits of iron, copper, granite, and freestone in the vicinity, the town has rapidly increased in population and in wealth. Pop. (1880) 3483; (1890) 33,115; (1900) 52,969; (1910) 78,466; (1920) 98,917. The city of Superior, Wisconsin, adjoins Duluth.

Dulwich, a beautiful suburb of London, in Camberwell, 4½ miles SSE. of St Paul's Cathedral, and a little to the west of Sydenham. It is noted for its college and picture-gallery.

DULWICH COLLEGE, or 'College of God's Gift at Dulwich,' was founded in 1619 by Edward Alleyn (q.v.) the actor. The old college buildings occupy three sides of a quadrangle, and comprise the chapel, chaplain's house, alms-rooms, and the Lower School, or Alleyn's School, in which 160 boys receive a second-grade education at a nominal fee. The Upper School, giving a first-grade education, was, in 1870, transferred to new buildings in the Italian style of the 13th century. It provides accommodation for about 600 boys. The foundation also includes an almshouse for the maintenance of twelve poor brethren, twelve poor sisters, and twelve out-pensioners. The picture-gallery, specially rich in Dutch paintings, had been collected for Stanislaus, king of Poland, and was bequeathed to the college by the painter, Sir P. F. Bourgeois (1756–1811).

Duma (in full, Gossudarstvennaya Duma, 'state council'), the elected house of the parliament of the Russian empire, first assembled 1906. The fourth Duma (1912–17) ended with the monarchy.

Dumas Davy de la Pailleterie, ALEXANDRE (1803–70), was the grandson of a certain Count (or Marquis) Alexandre Davy de la Pailleterie and Marie-Cessette Dumas, a pure-bred Haytian negress, and the son of General Alexandre Davy-Dumas—a brilliant and daring cavalry officer, 'the Horatius Cocles of the Tyrol'—and Marie-Louise-Elizabeth Labouret, daughter of a tavern-keeper and small landowner at Villers-Cotterets, and was technically, therefore, a quadroon. He was born and reared at Villers-Cotterets. The general, who had been put on half-pay by Napoleon, died when his son was four years old; and as the Emperor continued to behave as meanly to his widow and children as the First Consul to himself, the first years of a most prodigal life were years of decent penury and thrift. 'Dumas, who was afterwards an omnivorous reader, was an idle and unscholarly lad, and the local teachers could make nothing of him; but he had the run of the great forest about his native hamlet, he became an expert woodman, he developed a magnificent constitution, a turn for letters, and a very pretty talent at billiards, and when, at twenty or so, he got at last to Paris, he was physically as fit for the struggle for existence as any of the strong and ardent generation to which he belonged.

He began, through the influence of General Foy, as a clerk in the bureau of the Duc d'Orléans (afterwards Louis-Philippe); but his mind still ran on literature, and he spent some years in reading and in trying to learn to write. He had only published a volume of short stories, and collaborated—with Ph. Rousseau and young Adolphe de Leuven—in a couple of farces, when at seven-and-twenty he forced the door of the Théâtre Français with his first five-act play, *Henri Trois et sa Cour*

(1829), and at one stroke operated that revolution in the theory and practice of historical drama which the Hugolater is fond of ascribing to the poet of *Hernani* (1830). In 1831 he did the same for domestic tragedy—the *pièce* of MM. Augier and Sardou—with *Antony*, perhaps the boldest, adroitest, and completest achievement in plan, construction, and effect in the literature of the modern theatre; failed in verse with *Charles VII. chez ses Grand Vassaux*—an excellent play; and scored a tremendous success (in collaboration with Goubaux and Dinant) with *Richard Darlington;* and in 1832 he carried the romantic 'history' to what seems to be its culmination in *La Tour de Nesle* (in collaboration with Gaillardet). He was, indeed, the very genius of the stage. He broke ground with the ease, the assurance, the insight into essentials, and the technical accomplishment of a master, and he retained these qualities until the days of *Mme. de Chamblay* (1868) and *Les Blancs et les Bleus* (1869). His dialogue is bright, appropriate, vivid, eminently constructive and explanatory; he never eludes or tampers with his situation, but faces his problem boldly, and wrings his interest from the clash of character and the presentation of emotion in action; his plots are made and conducted with admirable adroitness and lucidity; his expositions are models of clarity; his effects are brought off with surprising certainty and vigour. 'All I needed,' he said of himself, 'was'—not scenery, nor choruses of monks, nor Hernani's horn, nor any merely decorative stuff of that sort—but 'four trestles, four boards, two actors, and a passion;' and the vaunt was absolutely justified. Dumas is the soundest influence in drama of the century, and to his example is owing not a little of the best of Barrière and Augier and the dramatist of *Monsieur Alphonse* and *Denise*.

The *romantiques* were a Byronic set, and Dumas, whose good temper was exuberant, and whose sense of the liveableness of life remained unalterable, was at first as Byronic as the rest. In 1832, however, he fell ill of cholera, went to Switzerland to recuperate, and wrote for the *Revue des Deux Mondes* the first of his famous and delightful *Impressions de Voyage*. He was fond of adventure and change; his capacity of producing agreeable and brilliant 'copy' was amazing; and these traveller's notes of his—in which a good deal of history and romance is worked in with abounding vivacity and wit—were among the best liked of his many benefactions to the public. He kept them going almost to the end. A prodigious worker (he would write for weeks on end, at the rate of sixteen or eighteen hours a day), he was wont, after months of production, to renew himself with a round of hundreds, or thousands, of miles; and he never failed to put the experience into print. Thus, *En Suisse* (1832) was followed by *Le Midi de la France* (1840), by *Les Bords du Rhin* and *Une Année à Florence* (1841), by *Le Spéronare* and *Le Capitaine Arena* (1842), by *Le Corricolo* (1843)—it was of the last two it was said that Dumas had discovered the Mediterranean—by *De Paris à Cadix* and *Le Véloce* (1845), and, finally, after years of work on other lines, by *Le Caucase* (1859), *De Paris à Astrakhan* (1860), and *En Russie* (1865). All these are certainly his own. Of those that he redacted from the MSS. of other men it is unnecessary here to speak.

But it was as a story-teller pure and simple that Dumas was destined to gain the better and larger part of his abounding and enduring success. And this is perhaps the place to discuss the question of what is his own share in his own work. He exhausted, it appears, some ninety several collaborators, and his debates with certain among them—with Gaillardet and Maquet, for example—by no means redounded to his credit. But it is none the less a fact that apart from him his assistants were mostly unreadable, while in conjunction with him they were Alexandre Dumas—that is to say, perhaps the most popular among modern novelists, and assuredly one of the greatest masters of the art of narrative in all literature. The truth, as stated by Edmond About, appears to be that Dumas took whatever he could get from whomsoever he could get it; that, the thing being carefully devised in consultation, the collaborator of the period was told off to prepare a first draft; and that Dumas re-wrote the result—'En y semant l'esprit à pleines mains,' says About—thus minting it in his own die, and informing it with his own immense and radiant personality. 'What a gainer you would be,' exclaims his son of him: 'rien qu'à reprendre ce que tu as donné!' and there is no doubt—for the present writer at least—that Dumas gave a vast deal more than he took. At the same time it is undeniable that his thefts were many and flagrant. Trelawny's *Adventures of a Younger Son*—to take but a single instance—appears in his collected works; and it is even told of him that he was with difficulty restrained from signing a book of the *Iliad*, which somebody else had run into prose to fill a gap in the columns of *Le Mousquetaire*.

He has told us that from the first it was a purpose of his life to put the history of France into novels; and his earliest essay was the *Isabelle de Bavière* of 1836. It was followed by *Pauline*, *Le Capitaine Paul*, and *Pascal Bruno* in 1838; by *Acté* in 1839; and by *Othon l'Archer*, *Le Capitaine Pamphile*, and *Maître Adam le Calabrais* in 1840—all on other lines; and then the historical vein cropped up anew in *Le Chevalier d'Harmenthal* and *Ascanio*, both produced in 1843. For the amazing decade that was next to come there is no parallel in the story of literature except the first ten years of the author of *Waverley*. In 1844, with a number of digressions and excursions into new provinces—as *Cécile*, *Fernande*, *Amaury*, *Sylvandire*, *Monte Cristo*—appeared *Les Trois Mousquetaires*; in 1845 *Vingt Ans après*, *La Fille du Régent*, and *La Reine Margot;* in 1846 *La Guerre des Femmes*, *Maison-Rouge*, *Le Bâtard de Mauléon*, *La Dame de Monsoreau*, and *Les Mémoires d'un Médecin;* in 1848—the Théâtre-Historique and a run through Spain, Algiers, and a part of Morocco having absorbed the greater part of 1847—*Les Quarante-Cinq* and the beginnings of *Bragelonne*, which was finished in 1850; and in 1849 *Le Collier de la Reine*. The next two years witnessed the production of work so varied as *La Tulipe Noire* and *Le Trou de l'Enfer* (1850), and *La Femme au Collier de Velours* (1851); but in 1852 the historical inspiration was again turned on, and the result was the masterpiece called *Olympe de Clèves*. Between that year and 1854 were produced the ten delightful volumes of *Mes Mémoires*, with *Ange Pitou* and *La Comtesse de Charny*, which were the work of 1853. Other achievements in the romance of French history were *Ingénue* (1854), *Les Compagnons de Jéhu* (1857), *Les Louves de Machecoul* (1859), and *Les Blancs et les Bleus* (1867-68), in which last the sequence at length found end. Other works of the same period, but done on other lines, were *Isaac Laquedem* (1858), which promised to be one of Dumas's best works; *Catherine Blum* (1854); *Les Mohicans de Paris* and *Salvator* (1854–59), in which is formulated the type of the French detective as he appeared to Gaboriau, Féval, and Ponson du Terrail; *Le Meneur de Loups* (1857); *Black* and *Le Capitaine Richard* (1858); *Le Père Gigogne* and *Le Père la Ruine* (1860); *Jane*, *Mme. de Chamblay* and *La Princesse Flora* (1861); *La San-Felice* (1864); and

La Terreur Prussienne (1867). In most of these there are touches of good Dumas; but the best period is that which begins with the *Mousquetaires* and ends with *Isaac Laquedem* and *Les Mohicans de Paris*.

The list is nothing like complete, nor have we space to do more than refer in passing and in general terms to the cloud of drama (all the great historical novels were cut out into great historical plays: the *Mousquetaires* cycle supplied at least three: as also were *Monte Cristo*, which was played in four parts, *Gabriel Lambert*, *Mme. de Chamblay*, and so forth), history, *causerie*, journalism, redaction, in whose midst this enormous production went on. In the same way and for the same reason we can only note that Dumas took active and conspicuous part in the Days of July; that in 1837 he received the red ribbon; that in 1842 he married Mlle. Ida Ferrier, from whom he promptly separated; that in 1855 he went into exile at Brussels, and stayed there two years; that from 1860 to 1864 he was in Italy, helping Garibaldi (whose life he wrote and who made him Directeur des Fouilles at Pompeii) and conducting and writing a journal; and that in 1868 he founded the *D'Artagnan*, published the *Histoire de mes Bêtes*, which of its kind is as good narrative as the first volume of *Monte Cristo* itself, and produced the last but one of his plays. By this time the end was near. *Procumbit humi bos*, says his son of the way in which he sank under his work. He had got rid of a series of fortunes (three-fourths of them were given away), and he quitted Paris for the last time with only a couple of napoleons in his pocket. He went to his son's villa at Dieppe, and there, on 5th December 1870, he simply faded out of being.

In life he was very much of a scapegrace and a madcap, and even more of a prodigal. His morals were loose, he was vain as only a man of colour can be, his literary conscience was (to say the least) imperfect, his veracity was that of Hugo and Berlioz and the *romantiques* in general; he could—and did—commit astonishing offences in taste; but his humanity was boundless in degree and incorruptible in quality, he was generous to a fault, he is not known to have dealt a single foul blow. 'I love and admire you,' said Michelet, 'for you are a force of nature.' 'Foncièrement bon,' was George Sand's verdict, 'mais . . . trop souvent ivre de puissance;' and the fact is that he was a prodigy of gaiety, kindliness, and charm ('Il respirait la bonté,' M. Rodin told the present writer), and a prodigy of temperament and power and the capacity of life and invention and achievement. He talked still better than he wrote; and he wrote without any of those affectations of style which were the daily bread of many of the men of 1830, and with an ease, a gusto, a sincerity of mind, a completeness of method that are irresistible. And the lesson of his greater books—of the Valois cycle, for instance, and the long sequence of the *Mousquetaires*—is one by which the world may well have profited. Love, honour, friendship, loyalty, valour, the old chivalric virtues—these were his darling themes; and he treated them with a combination of energy and insight, of good sense and good feeling, of manliness of mind and beauty of heart, that has ranked him with the great benefactors of the race.

ALEXANDRE DUMAS, son of the preceding, was born (20th July 1824) in Paris when his father was but twenty-one years old. He was soon legitimised, and at sixteen, after a thorough course of training at the Institution Goubaux, and the Collège Bourbon, he left school for the world and letters and the society to which his father, then almost at his apogee, belonged. He was essentially respectable, however, and having sown a certain quantity of wild oats, and made a few experiments in literature, he settled down to serious work, and began to take life in earnest. He started in fiction; he went on to drama; he took to theorising about art, morals, politics, religion even, and succeeded in all. He was made a member of the Institute in 1874, and at his death, 27th November 1895, was acknowledged to be the best playwright, and one of the greatest artists in words of latter-day France.

His novels—from *La Dame aux Camélias* (1848) to *L'Affaire Clemenceau* (1867)—are all readable, and more often than not are worth reading. His essays, letters, speeches, prefaces, and prelections generally are brilliant and admirable in form, and in matter daring, paradoxical, suggestive in a very high degree. Of his sixteen plays, there is scarce one that is not literature, while five or six of them, as *Le Demi-Monde* (1855), *Le Fils Naturel* (1856), *Les Idées de Mme. Aubray* (1867), *Une Visite de Noces* (1871), *Monsieur Alphonse* (1873), *Denise* (1885), are masterpieces of construction, characterisation, and writing. Other famous dramas in which he had a share (and a very large one) are *Le Supplice d'une Femme* (1865), the chaotic original of which is due to Émile de Girardin; *Héloïse Paranquet* (1866), in collaboration with M. Durantin; and *Les Danicheff* (1876). He may have assisted George Sand in preparing several of her novels for the stage—*Le Marquis de Villemer* among them—and he completed and produced his father's *Joseph Balsamo* (1878).

He was a brilliant yet dubious combination of African and French. At bottom he was fantastic, mystical, violent, with a passion for abnormal problems and desperate solutions. But it is not for nothing that his mother was a Parisian: his method was logical to a fault, he built as for all time, he was an artificer even in theory, and his paradoxes are developed with scientific exactness and precision. A bitter and dazzling wit; an intelligence of uncommon energy, daring, and intensity; a morality that is so genuine as to be sometimes offensive; an incorruptible honesty; a style hard, polished, chaste, flexible as a perfect sword-blade; and a dramatic gift as real as his father's—these were his qualities, and they made him not only remarkable but distinguished. See Claretie, *Alexandre Dumas fils* (1883).

Dumas, JEAN BAPTISTE ANDRÉ, a great French chemist, was born at Alais, Gard, 14th July 1800. He studied at Geneva, and coming to Paris in 1821, was first a lecturer in the École Polytechnique, then professor of Chemistry in the Athénée, the École Centrale des Arts et Manufactures (founded by himself), and finally, the Sorbonne. He now wholly devoted himself to chemical studies; and his views on chemical equivalents, and especially his memoir on the atomic theory, soon attracted attention over all Europe. His views on the laws of substitutions involved him in a long discussion with the great Berzelius. His researches in organic Chemistry (q.v.), especially his masterly papers on the ethers, ethereal oils, indigo, and the alkaloids, placed him in the first rank of chemists. In 1849–51 he was minister of agriculture and commerce, and he also held offices under the Second Empire. In 1875 he was called to fill Guizot's chair in the Academy; and he died at Cannes, 11th April 1884. His chief works are *Traité de Chimie appliquée aux Arts*, and *Leçons sur la Philosophie Chimique*. See a forty-page memoir by Prof. A. W. Hofmann in *Nature* for 1880; and Maindron, *L'Œuvre de J. B. Dumas* (1886).

Du Maurier, GEORGE LOUIS PALMELLA BUSSON, caricaturist and book-illustrator, an English

subject, descended from a French family who fled to England at the time of the Revolution, was born in Paris, 6th March 1834. In 1851 he came to London, and studied chemistry at University College, but returning to Paris he adopted art as a profession, studying under Gleyre, and in Antwerp and Düsseldorf. In England he rapidly acquired reputation as a designer of exceptional dexterity. He illustrated Thackeray's *Esmond* and *Ballads*, Foxe's *Book of Martyrs*, &c.; and much of his work is to be found in *Once a Week* and the *Cornhill Magazine*. Joining the staff of *Punch*, he became the graceful satirist of modern fashionable life. He wrote originally for *Harper's Magazine* three novels illustrated by dainty drawings—*Peter Ibbetson* (1891), *Trilby* (1894, the phenomenally successful story of an artist's model in the Quartier Latin, dramatised in 1895), and *The Martian* (1897). In 1897 was published also *A Legend of Camelot: Pictures and Poems*. He suffered from failing sight, lectured for a while, and died 8th October 1896. See Moscheles, *In Bohemia with Du Maurier* (1896); T. M. Wood, *George du Maurier* (1913).—His son Sir Gerald (born 1873) became well known as an actor-manager.

Dumbarton, the county town of Dumbartonshire, lies mainly on the left bank of the Leven, a little above its influx to the Clyde, and 15 miles WNW. of Glasgow. Its High Street curves for five furlongs parallel to the Leven; and its chief public building is the Burgh Hall and Academy, a French-Gothic pile of 1866, restored since the fire of 1883. In 1658 the magistrates of Glasgow are said to have wished to make Dumbarton their harbour, but the offer was declined on the ground that 'the influx of mariners would tend to raise the price of butter and eggs to the inhabitants;' and in 1700 the right of levying dues on all vessels navigating the Clyde was sold to Glasgow for £260. Dumbarton now ranks merely as a sub-port; but its shipbuilding, with the subsidiary industries, has attained important dimensions since the opening of great shipyards in 1834 and 1844. Between the town and the Clyde rises the Rock of Dumbarton (280 feet), a double-peaked, basaltic eminence, which is crowned by the picturesque castle, a building of no great strength now or architectural merit, but one of the four Scottish fortresses that continued to be maintained after the Treaty of Union. Dumbarton was made a free royal burgh in 1222, and unites with Clydebank (since 1918) to return one member to parliament. Pop. (1851) 5445; (1881) 13,782; (1901) 19,985; (1921) 22,933. The capital of the Britons of Strathclyde, and termed by them *Alcluith* ('height on the Clyde'), by the Gaels *Dunbreatan* ('fort of the Britons'), Dumbarton has also been identified, more doubtfully, with the Roman *Theodosia*. Anyhow, the history of its Rock extends over more than a thousand years, from its capture by Picts and Northumbrians (756), by Vikings (870), to Wallace's captivity here (1305), the child Queen Mary's residence (1548), and its daring surprise by Craufurd of Jordanhill (1571). A younger son of the Marquis of Douglas was made Earl of Dumbarton in 1675, and he is referred to in the well-known song, 'Dumbarton's drums beat bonny, O!'

Dumbartonshire, a Scottish county, 25 miles long and 1¼ to 15½ miles broad, with an area of 245 sq. m., of which 30 belong to a detached south-eastern portion. Loch Lomond (22 by 5 miles) lies on the eastern boundary, and sends off the Leven 7 miles to the Clyde; the southern is washed by the Clyde's broadening estuary; and the western, for 17 miles by its offshoot, Loch Long, which forms with the Gare Loch (7 miles by 7 furlongs) the wooded Roseneath peninsula. The surface, almost everywhere hilly or mountainous, culminates in Ben Vorlich (3092 feet); and the scenery, with its sea-lochs, lake, woods, and glens, is lovely as that of few regions in Scotland. The rocks include mica-slate, sandstone, and limestone; and coal is mined in the detached portion, which nowhere exceeds 480 feet above sea-level. The climate is mild and humid. Barely a fourth of the entire area is in tillage; but many sheep and cattle are reared. Roseneath Castle is a seat of the Duke of Argyll. Since 1728 bleach and print fields, dyeing and cotton works, have multiplied in the Vale of Leven; shipbuilding is an important industry; and there is ample communication by steamboat and rail. The chief towns are Dumbarton, Clydebank, Kirkintilloch (in the detached portion), Helensburgh, Alexandria, and Renton. Dumbartonshire returns one member to parliament. Anciently part of the Levenach or Lennox, it retains some vestiges of Antonine's Wall, and has memories of St Patrick, Bruce, Rob Roy, Smollett, and Henry Bell. Pop. (1801) 20,710; (1881) 75,333; (1921) 150,861. See Joseph Irving's *History of Dumbartonshire* (1860; recast by John Irving, 3 vols., 1917–25), and *Book of Dumbartonshire* (1879), with Sir W. Fraser's *Chiefs of Colquhoun* (1860) and *The Lennox* (1874).

Dumb-bells, double-headed weights swung in the hands for the purpose of developing the arms, muscles of the chest, &c. See Gymnastics.

Dumb Cane (*Dieffenbachia seguina*), a plant of the order Araceæ, aberrant in its almost arborescent character, but agreeing with them in its acridity, which is in none of them more highly developed. It has a cylindrical stem, with ringed scars and oblongo-ovate leaves. It is a native of the West Indies, and has received its English name from the property which it has of producing dumbness when chewed, its acrid poisonous juice causing an immediate swelling of the tongue, accompanied with excruciating pain. It has, however, been used medicinally. Many species and varieties of Dieffenbachia are in cultivation as foliage plants.

Dumbness. There is hardly any condition of the vocal organs compatible with life in which speech is entirely prevented; for when the larynx is so diseased that no voice-sounds are produced there (Aphonia, q.v.), whispering is in general still possible. Even after complete removal of the tongue, tolerably good power of articulation may be recovered. Only when the larynx is completely obstructed, so that no air can pass by the mouth, and breathing is carried on entirely through a tracheotomy tube, is speech rendered impossible.

The usual causes of dumbness are, first and most important, deafness, congenital or occurring in early life; and even this, patient training (see Deaf and Dumb) is able to overcome, showing clearly that it is the want of hearing the sounds to be imitated which leads to the absence of speech in so-called 'deaf-mutes'; secondly, morbid conditions of the brain and nervous system, idiocy, hysteria and allied conditions, localised disease of the brain (see Aphasia). Lunatics and malingerers sometimes maintain silence for long periods. It occasionally happens that a child, obviously not deaf nor unintelligent, from diffidence or laziness, does not begin to speak till long past the usual age, but persists in expressing his meaning by signs. This can usually be remedied by sending him to live for a time among strangers, by whom his signs are not understood.

Dum-dum. See Kala-azar.

Dumdum (*Dam Damá*), a municipality 4½ miles NE. of Calcutta. Pop. with troops, 13,000. This was the scene of the first open manifestation against

the greased cartridges, in the sepoy mutiny of 1857. There is an arsenal and a manufactory of ammunition. The name is associated with 'expansive' bullets first made there; but the Dumdum bullets are not all necessarily of that nature.

Dumfries', the county town of Dumfriesshire, the 'Queen of the South,' stands on the Nith's left bank, and is connected with its Kirkcudbrightshire suburb of Maxwelltown by three bridges, of which the middle one was founded about 1280 by Dervorgilla Baliol. By rail it is 90 miles S. by W. of Edinburgh, and 33 WNW. of Carlisle. Corbelly Hill, in Maxwelltown, on which are a Catholic convent (1882) and an observatory, commands a splendid view of the surrounding hills, the Solway Firth, and the Cumberland Mountains. Dumfries itself is scattered somewhat irregularly over a gentle elevation. It is built of red sandstone, and among its chief edifices are the Scottish baronial county buildings (1866); the post-office (1887–88); the Mid Steeple (1707), ascribed to Inigo Jones, but really by one Tobias Bachup of Alloa; Greyfriars' Church (rebuilt 1867), with a spire of 164 feet; the Academy (1802); and, in St Michael's churchyard, the mausoleum (1815) of Robert Burns, who here spent his last five years in a small house still standing, and a statue of whom was erected in 1882. The Crichton Institution (1835–70) is a lunatic asylum; rather nearer is the infirmary (1871). The manufacture of tweeds, introduced in 1847, is the leading industry. Hosiery ranks next; and there is a busy trade, both local and transit, pork and live-stock being staple commodities. The opening, however, of the railways in 1850–69 has greatly diminished the river traffic, though large sums had previously been spent in improving the 14 miles of the Nith's channel between the town and the Solway. Dumfries was made a royal burgh by David I., and it united till 1918 with Annan, Kirkcudbright, Lochmaben, and Sanquhar in returning one member to parliament. Pop. (1851) 13,166; (1921) 15,778. For the town's memories of Bruce and Burns, of Border wars, and of both the '15 and the '45, see W. M'Dowall's *History of Dumfries* (2d ed. 1873).

Dumfriesshire, a Scottish Border county, bounded SE. by Cumberland, and S. for 21 miles by the Solway Firth. Its greatest length, from south-east to north-west, is 53 miles; its breadth varies between 13 and 32 miles; and its area is 1103 sq. m. From Clydesdale and Tweeddale it is shut off by a sinuous rim of high green rounded mountains — Lowther Hill (2377 feet), Queensberry (2285), Hartfell (2651), White Coomb (2695), and Ettrick Pen (2269). Thence, though broken by Cairnkinna (1819 feet), Birrenswark (920), and some lesser eminences, the surface has a general southward slope to the dead level of Lochar Moss, a peat bog, 10 by 3 miles, now largely reclaimed. Three beautiful rivers, the Nith, Annan, and Esk, all run to the Solway; and the Annan belongs wholly to Dumfriesshire. At Moffat are mineral springs. Besides several lakes round Lochmaben, there is 'dark Loch Skene' (¾ by ¼ mile; 1680 feet above sea-level), which has its outlet by a waterfall, the Grey Mare's Tail. The Enterkin Pass has been rendered famous by Defoe and Dr John Brown. The strata are Silurian, Old Red Sandstone, Carboniferous, and Permian, with intrusive igneous rock; reptilian footprints have been found in the sandstones of Corncockle Moor, in Annandale. The minerals include coal (at Sanquhar and Canonbie), sandstone, limestone, antimony (no longer worked), and (at Wanlockhead) lead, silver, gold. The climate is mild, with a mean temperature of 45° F. Only about a fifth of the entire area is arable, the uplands being pastoral or waste. Sheep, cattle, and pigs are largely reared; and there are valuable salmon-fisheries. The county is traversed by two chief lines of railway (1849–50). It returns one member to parliament. Towns and villages are Dumfries, Annan, Lochmaben, Sanquhar, Moffat, Lockerbie, Langholm, Ecclefechan, Thornhill, and Gretna Green. Drumlanrig Castle (1689), a seat of the Duke of Buccleuch, is the chief mansion. Among antiquities are Roman stations at Birrens (excavated in 1895) and Birrenswark, Ruthwell (q.v.) Cross, and the castles of Lochmaben and Caerlaverock. Among its families are the Maxwells, Johnstones, Jardines, Kirkpatricks, and Douglasses; among its worthies, Bruce (probably not a native), Allan Cunningham, Thomas Carlyle, and (by residence) Robert Burns. Pop. (1801) 54,597; (1881) 76,140; (1921) 75,365. See Sir H. Maxwell's *History of Dumfriesshire* (1896).

Dumont, Pierre Étienne Louis, the apostle of Benthamism, was born at Geneva, 18th July 1759, and in 1783 accepted the charge of the French Protestant Church at St Petersburg. In 1785 he became tutor in London to the sons of Lord Shelburne, afterwards Marquis of Lansdowne. His superior talents, liberal sentiments, and fine character soon recommended him to the illustrious Whigs of that period; with Romilly, in particular, he formed a close friendship. During the early years of the French Revolution, Dumont was at Paris, where he became greatly attached to Mirabeau, regarding whom he has given the world much valuable information in his posthumous *Souvenirs sur Mirabeau* (1832). In this work he claims to have composed for him many of Mirabeau's most eloquent speeches. In 1791 Dumont returned to England, and formed an intimacy with Bentham (q.v.), whose unpublished works he abridged and edited. He returned to Geneva in 1814, and became a member of the representative council. He died at Milan, 30th September 1829.

Dumont d'Urville, Jules Sébastien César, born at Condé in Calvados, 23d May 1790, entered the navy in 1807. Sent as captain of the corvette *Astrolabe* to obtain tidings of La Pérouse, he made a three years' voyage (1826–29) in southern seas, and made surveys of parts of the coast of Australia, Tasmania, New Zealand, the Fijis, New Caledonia, &c. His *Voyage de Découvertes* (22 vols.) contains records of this voyage, and of his botanical and entomological observations. In 1837–40 he made a great voyage of antarctic exploration, discovering Joinville Island and Adélie Land. The record of this *Voyage au Pôle Sud* (1854) comprises 22 vols. He died a rear-admiral, 8th May 1842.

Dumouriez, Charles François (1739–1823), a French general, was born at Cambrai, son of an army commissary who was also a fair poet. At eighteen he entered the army, and served with distinction during the Seven Years' War until the conclusion of hostilities in 1763. After some time spent in rambling travel, he was appointed by Choiseul army quartermaster-general, and was next employed on a secret mission to Poland. On his patron's fall, he was recalled. He was flung into the Bastille, and afterwards imprisoned at Caen, whence he was set free by Louis XVI. and appointed commandant of Cherbourg. As the Revolution drew on, Dumouriez began to attach himself more closely to the popular party, and in 1790 became connected with the Jacobin Club, and during the same year was appointed commandant at Nantes. He now attached himself to the Girondists, and through their influence held for a short time the office of Minister of Foreign Affairs, which he resigned to take the field. The allies were advancing in great force. By a series of bold and

rapid manœuvres, Dumouriez prevented the enemy from sweeping over the plains of Champagne, and finally took up his position at Grand-Pré. Succours quickly arrived, and the victory at Valmy (q.v.) compelled the invaders to retreat. It was mainly the admirable strategy of Dumouriez at this critical period that saved France. In 1792 he overthrew the Austrians at Jemappes; but in 1793, at Neerwinden, he sustained a severe defeat. Denounced as a traitor, he fled to the Austrian camp. After wandering through Europe, he settled in England. Besides his *Mémoires* (1794), see the German Life by Boguslawski (1878–79).

Dum Palm (*Hyphæne crinita*, *H. thebaïca*), a genus of palms, allied to the fan-palm (Chamærops), but remarkable for the repeated fork-like branching

Dum Palm (*Hyphæne crinita*).

of the stem. It is abundant in Upper Egypt and Central Africa, sometimes growing amidst the very sands of the desert. The spongy tissue of the pericarp is eatable, and resembles gingerbread in flavour.

Dun, a root borrowed from Celtic by the Teutonic languages, signifying a hill or height. Besides giving rise to the Fr. *dunes*, Ger. *dünen*, Eng. *downs*, it enters extensively into the names of places (becoming often *dum*, *don*), as *Dun*kirk, *Dum*barton, *Done*gal. The adverb *down* comes through *adown* from *of dūne*, 'off the hill.' And see HILL-FORTS.

Düna. See DWINA.

Dünaburg (Lettish *Daugavpils*, Russian *Dvinsk*), a town of south-eastern Lettland, with some manufactures and a large trade, on the Düna, in the district of Latgale, 120 miles SE. of Riga, is of great military importance, owing to the strength of its fortifications. It was formerly the capital of Polish Livonia. Taken in 1920 from the Bolsheviks by the Poles, it was handed over to the Letts. Pop. 40,000.

Dunajec, a river of Poland, formed by two streams that rise in the Tatra, flows generally north-eastwards by Neu Sandec (Nowy Sacz) to the Vistula, about 40 miles below Cracow. It marks the line of the Russian front in 1915 in the Great War.

Dunbar, a town on the rocky coast of Haddingtonshire, backed by the Lammermuirs, 29 miles E. of Edinburgh by rail. Little remains of its sea-built castle, the stronghold from 1072 to 1435 of Gospatric and his descendants, the Earls of Dunbar and March. It stood many sieges, the most famous that of 1339, when 'Black Agnes' held it for six weeks against the English; but it was dismantled in 1568, the year after Queen Mary's abduction thither by Bothwell. Dunbar was the scene, too, of Cromwell's great victory over Leslie, 3d September 1650. Chief buildings are the barracks and the parish church, which, rebuilt in 1821, has a tower 108 feet high. Fishing is the principal industry. The Victoria Harbour was formed in 1844. Dunbar was created a royal burgh by David II., and till 1885 it united with North Berwick, Jedburgh, Haddington, and Lauder in sending one member to parliament. Pop. 3800.

Dunbar, PAUL LAURENCE (1872–1906), poet, born at Dayton, Ohio. His parents had been slaves, and he himself became a lift-boy. For a short time he tried journalism, and was employed in the Library of Congress. To his *Lyrics of Lowly Life* (1896) W. D. Howells wrote an introduction, drawing attention to him as 'the only man of pure African blood and of American civilisation to feel the negro life æsthetically, and express it lyrically.' Later volumes are *Lyrics of the Hearthside* (1899), *Lyrics of Love and Laughter* (1903), and *Lyrics of Sunshine and Shadow* (1905), in which the best work is in negro dialect. He also wrote some novels.

Dunbar, WILLIAM, by general consent the greatest of Scottish poets before Burns, was apparently a Lothian, probably an East Lothian, man, but his family and the time and place of his birth are unknown. From Walter Kennedy's clumsy attack upon Cospatrick in the *Flyting*, it has been inferred that Dunbar was of the family of the Earls of March. That he was or claimed to be of noble birth appears from his poetical begging-letters to King James IV. From childhood he had been taught to look forward to a bishopric, the preferment which a landless cadet considered his due; but 'the lerit sone of erll or lord' was set at table below a prelate 'that vont was for to muk the stabell.' In 1477 Dunbar appears in the records of St Andrew's University as Bachelor of Arts, and in 1479 as Master. He may have studied also in Paris. In his *Visitation of St Francis*, a fiend in the form of the saint urges the Franciscan habit upon him, as the brethren had often done before, but Dunbar leaps aside from it, excusing himself on the ground that among the saints he knows of seven bishops to one friar:

> Quhairfoir ga bring to me ane bischopis weid,
> Gife evir thow wald my saule yeid into Hevin.

The wording of the poem does not make it clear whether Dunbar had ever taken the vows of the order; if so, he had in some way been freed from them, and the friars had importuned him to return. At all events, many years ago he 'did beir the freiris style,' and he had travelled through England and Picardy in friar's habit, preaching and flattering. His confession of 'mony wrink and wyle' practised by him at that time, has set his biographers imagining anything from Bohemianism to highway robbery and murder. However likely *à priori*, such conjectures are unsupported by evidence. Probably about 1490 he attached himself to the service of James IV. It is clear that he travelled much on the Continent on the king's business, but as the public records do not, as a rule, afford means of determining which embassies he accompanied, one is driven to seek information in *The Flyting of Dunbar and Kennedy*. The two poets in this playful contest in scurrilous vituperation are under no restrictions as to the truth of their libels, and the doubtful order of the stanzas makes it difficult to make out the story at all. It is certain, however, that parts were written by Kennedy when Dunbar was believed to be in Denmark and in Paris. Dunbar tells how his ship was driven along the coasts of Holland, Denmark, and Norway, till those on board were famished. Kennedy refers to difficulty in crossing the Alps, and to a voyage from the Forth in the *Katherine*. The *Katherine* was the ship that carried Bothwell and

Blackadder to France in 1491. Dunbar seems to have been attached to this embassy. He may have accompanied Blackadder to Spain and Rome in 1494–96. *Of the Warldis Instabilitie* apparently reminds the king of services at home and in France, England, Ireland, Germany, Spain, and Italy. In 1500 he was granted a pension of £10 a year for life, or until he should be promoted by the king to a benefice of £40 or more. The instalment due in December of the next year was 'payit to him eftir he com furth of Ingland.' This renders it all but certain that he was 'the Rhymer of Scotland,' official or unofficial, who received gifts from Henry VII. at that time, and that he was the author of the poem in praise of London which an English chronicler transcribes, under the year 1501, with this introduction, which might be biographically useful were it not ambiguous: 'This yere in the Cristmas weke the Mair had to dyner the Ambassadours of Scotland, whom accompanyed my lord Chaunceler and other lordes of this Realme; where sittyng at dyner one of the said Scottes givyng attendaunce vpon a Bisshop, ambassadour, the which was reported to be a prothonotary of Scotland and seruaunt of the said Bisshopp, made this Balade folowyng.' The ambassadors, who included Andrew Forman, Apostolical Protonotary and Bishop Postulate of Moray, had gone to London to conclude the marriage of James and the Princess Margaret. With Anglophil leanings, Dunbar henceforward attaches himself to the queen. His best work, outside of satire and realism, is undoubtedly *The Thrissill and the Rois*, a heraldic allegory of the approaching royal marriage, in which the aureate vocabulary, in other hands heavy, perfunctory, and conventional, is at its worst melodious, and at its best passes into another style by which brilliant pre-Raphaelite effects are achieved. In this poem, and in the similar dream-allegory, *The Goldin Terge*, the old motifs of the rose garden and the May morning have new life given to them by the poet's genius; but they can hardly be said to be rejuvenated. *Sen that I am a presoneir*, however, comes nearer to Henryson's freshness.

Dunbar's pension was raised in 1507 to £20, and in 1510 to £80, and the king was accustomed to allow him a new gown at Yule. In return he seems to have combined the functions of court chaplain and court poet. In March 1503–4 the king's offering 'at Maister William Dunbarris first mes' was seven French crowns. Many of the poems are connected with the amusements of the court, as those on the negress in whose honour a tournament was proclaimed; on a dance in the queen's chamber; on the Abbot of Tungland, who made himself wings, and came to grief in an attempt to fly. Dunbar is seldom content with such a mere record of the facts as the narrative of the queen's visit to Aberdeen in 1511. He boldly transfers *The Dance of the Sevin Deidly Synnis* and *The Tournament* between a tailor and a souter, from the court of Scotland to the court of Hell. Extravagant, boisterous humour, scalding satire, and Rabelaisian realism run through his most characteristic work. The grotesque vividness of *The Sevin Deidly Synnis* is perhaps unequalled in the language. The same command of metre and vocabulary which made possible the verbal melody of *The Merle and the Nychtingaill*, and *Done is a battell on the dragon blak*, is used in *The Dance* to render the hurly-burly of Hell on a day of pageantry; in *The Fenyeit Freir of Tungland* to give the clamour of birds; and in *The Flyting* words clatter like sword-blades. Appeals to the king to grant a benefice are numerous and varied. Dunbar seems to have grounded his hopes mainly on the queen's influence. The disappearance of his name from the Treasurer's Accounts after Flodden may therefore mean that Margaret had preferred him to a benefice. His religious poems have been assigned, for no very convincing reason, to the period of retirement from court supposed to follow. The only evidence that he survived Flodden is the colophon of *Ane Orisoun*: 'Quod Dunbar quhen the Gouernour past in France;' which would indicate that he was alive in 1517. Lyndsay's *Testament and Complaynt of the Papyngo*, written in 1530, speaks of him as dead.

From that time, though his influence can be traced at least as late as George Buchanan and Alexander Montgomerie, his name is scarcely to be found for two centuries. Allan Ramsay then discovered his poems in the Bannatyne MS., and printed some in mangled form in *The Evergreen* (1724). Hailes and Pinkerton continued what Ramsay began. Dunbar was known, though but slightly, to Burns, to whose genius his own, except on the purely lyrical side, is close akin. Dunbar was a Chaucerian with limitations; and he was much more than a Chaucerian. To the mature Chaucer he owes little. Unless *The Freiris of Berwik* be his, he shows no trace of the *Canterbury Tales*, except, perhaps, in *The Tua Mariit Wemen and the Wedo*, where the theme of the *Wife of Bath's Prologue* is placed in gorgeous setting, and worked out with daring and unexpected success in the old alliterative verse that Chaucer despised. He is greatest as humorist, satirist, and master of technique, and in all respects shows that he belongs to a grimmer and more fiercely personal age than Chaucer. He passes out of the rose garden into the world of Villon.

Some of Dunbar's poems were printed by Chepman and Myllar (1508; ed. Stevenson for the Scottish Text Society, 1918); the rest are for the most part preserved in the great manuscript collections, for which see the Scottish Text Society's editions. David Laing's edition of Dunbar's works (1834–65) has been superseded by that of the Scottish Text Society (ed. Æ. J. G. Mackay and others, 1893), and by Professor Schipper's (Vienna, 1894). Dr Baildon's (1907) is inferior but easier of access and manipulation. See Lives by Dr Schipper (1884) and Oliphant Smeaton (popular, 1898); the various histories of English and Scottish literature; Professor G. Gregory Smith in the 'Cambridge English Literature' (vol. ii. 1908), and his *Transition Period* (1900).

Dunbarton. See DUMBARTON.

Dunblane, an old-fashioned town of Perthshire, delightfully situated on the left bank of Allan Water, 5 miles N. of Stirling by rail. Founded by St Blane, a 7th-century bishop, its church was rebuilt in 1141 by David I. as a cathedral; but except for the Romanesque four lower stages of the steeple (128 feet), that cathedral is now a First Pointed edifice of a hundred years later—its glory the west window, of which Ruskin said he knew 'nothing so perfect in its simplicity.' The choir, with its carved oak stalls, was restored in 1873; the ruinous nave in 1891–95. In 1661 the saintly Robert Leighton chose Dunblane as the poorest and smallest of Scotland's sees; his path near the river still bears the name of the Bishop's Walk, and the library which he bequeathed to his diocese is still preserved in the town. There are also a mineral spring, the Queen Victoria school for soldiers' children, and a fine hydropathic (1876); 2½ miles to the east is the battlefield of Sheriffmuir. Pop. 3000.

Duncan, ADAM, VISCOUNT (1731–1804), admiral, was born at Dundee, and, entering the navy in 1746, commanded the *Valiant* at the reduction of Havana (1762). Save at the battle of Cape St Vincent (1780), he had little opportunity of distinguishing himself during thirty-three years, though he had risen to be admiral, when in 1795 he was appointed to the command of the North Sea squadron, with the special design of watching the Dutch fleet. Duncan's blockade of the Texel was

one of the most effective on record, and the Dutch trade was almost ruined. In the spring of 1797 the mutiny of the Nore spread to Duncan's seamen, and his position was for some weeks very critical. But the insubordination was ultimately quelled; and on the 11th of October he gained the brilliant victory of Camperdown (q.v.). He was rewarded with the title of Viscount Duncan of Camperdown. See Life by third earl (1898).

Duncan, HENRY, D.D. (1774–1846), from 1798 was minister of Ruthwell, in Dumfriesshire, where, in 1810, he established the first savings-bank. See Life by his great-granddaughter, Mrs Hall (1910).

Duncan, THOMAS, R.S.A. and A.R.A. (1807–45), was born at Kinclaven, Perthshire. He studied in the Trustees' Academy, Edinburgh, under Sir William Allan; and was his successor as head-master of that school, and one of the most distinguished members of the Royal Scottish Academy. His portraits, and historical and fancy subjects, evince delicate feeling for female beauty, and keen appreciation of the humorous in Scottish character. His drawing is always careful and correct, and his colouring is especially remarkable for delicacy and richness.

Duncansbay Head (also DUNCANSBY), a promontory, 210 feet high, forming the north-east extremity of Caithness, 1¾ mile E. of John o' Groat's House, and 18 N. by E. of Wick.

Duncker, MAXIMILIAN WOLFGANG (1811–86), was born at Berlin, son of the bookseller, Karl Duncker (1781–1869). After studies at Bonn and Berlin, and six months' political imprisonment, he studied history at Halle, became extraordinary professor there in 1842, supported the right centre in the National Assembly in 1848, and the Old Liberal party in the Prussian chamber in 1849–52. He obeyed a call to a Tübingen chair in 1857, whence he was recalled to Berlin to fill a position in the ministry of state. In 1867–74 he was director of the state archives of Prussia. His greatest work is his *History of Antiquity* (5th ed. 9 vols. 1878–86; trans. by Evelyn Abbott, 1877–82). See the Life by Haym (1891).

Dundalk, a thriving Irish seaport-town, the capital of County Louth, situated on Dundalk Bay, 55 miles north of Dublin, and 58 south of Belfast by rail. It has salt-works, a distillery, iron-foundries, flax-spinning, brewing, and shipbuilding. There is a brisk export trade, especially in the grain, dairy products, and live-stock of counties Louth, Monaghan, and Cavan, with Liverpool and Holyhead (79 miles across), and through its branch railway to Greenore, also with other ports. The harbour has been much improved. Pop. (1871) 11,327, nine-tenths Roman Catholics; (1911) 13,128. It sent one member to parliament till 1885. Edward Bruce took Dundalk in 1315, and held his court here till killed in battle three years later. It was taken by Cromwell (1649) and by Schomberg (1689).

Dundas, (1) a baronial castle, dating from the 11th to 15th centuries, with modern additions, on the south bank of the Firth of Forth, near South Queensferry, the seat from about 1124 till 1875 of the family of Dundas.—(2) A town of Wentworth county, Ontario, at the head of Burlington Bay, at the west of Lake Ontario, with a number of mills and manufactories. Pop. 5000.—(3) An island of British Columbia, 40 miles NE. of Queen Charlotte Island, and separated by Chatham Sound from the most southerly of the Alaskan islands.—(4) A group of nearly 500 islets (also called the Juba Islands), all of coralline formation, lying off the east coast of Africa, in about 1° S. lat., with only one secure harbour.—(5) A strait in North Australia, separating Melville Island from Coburg Peninsula, about 18 miles broad.

Dundas (of Arniston), the name of a Scottish family singularly distinguished for legal and political talent. Sir James Dundas, the first of Arniston, received the honour of knighthood from James VI., and was governor of Berwick. His son, Sir James Dundas, was appointed a judge of the Court of Session in 1662, and took his seat on the bench under the title of Lord Arniston, but was soon after deprived of his office for refusing to abjure the 'National and Solemn League and Covenant.' He died in 1679. His eldest son, Sir Robert Dundas, who also rose to the bench, died in 1726.—ROBERT DUNDAS, the son of the preceding, was born 9th December 1685; became a member of the Faculty of Advocates in 1709; and in 1717 was appointed Solicitor-general for Scotland, an office which he filled with great ability in a period of much political confusion. In 1720 he was made Lord Advocate; and in 1722 was chosen to represent Midlothian in the British parliament, where he honourably distinguished himself by his attention to Scottish affairs. Sir Robert Walpole coming into power in 1725, Dundas resigned his office, when he was elected Dean of the Faculty of Advocates. In 1737 he was raised to the bench, when, like his father and grandfather, he took the title of Lord Arniston. On the death of Lord President Forbes of Culloden in 1748, he was appointed his successor. He died in 1753. As an advocate, Dundas was a powerful and ingenious reasoner, and though somewhat disliked on the bench, his ability was universally admitted.—ROBERT, his eldest son, was born 18th July 1713, studied at Edinburgh and Utrecht, was admitted to the Scottish bar in 1738, and rose to be Lord Advocate (1754) and President of the Court of Session (1760). He died at Edinburgh, 13th December 1787. See *The Arniston Memoirs*, by George W. T. Omond (1887).

Dundas, the RIGHT HON. HENRY, VISCOUNT MELVILLE and BARON DUNIRA, brother of the preceding, was born 28th April 1742, and educated at the High School and university of Edinburgh. He was admitted a member of the Scottish bar in 1763. As a younger son of a pretty numerous family, his circumstances were rather straitened; but his assiduity, his large share of the family talent and presumably also of the family influence, soon procured him advancement in his profession. He was successively appointed Depute-advocate and Solicitor-general. In 1774 he was returned to parliament for Midlothian, in 1775 was appointed Lord Advocate. Two years later, he was made keeper of the King's Signet for Scotland. Dundas's career in parliament was highly successful, though not very creditable to his political consistency. Although elected in opposition to ministerial influence, he soon allied himself with the party in power, and became a strenuous supporter of Lord North's administration, being one of the most obstinate defenders of the war with the American colonists. When Lord North resigned in 1781, Dundas continued to hold the office of Lord Advocate under the Rockingham ministry. On the question of the war with America, Dundas had been opposed to Pitt; but when the Coalition Ministry was formed by Fox and Lord North, he passed over to the side of his old opponent, and became Pitt's ablest coadjutor. When Pitt returned to power in 1784, Dundas was appointed President of the Board of Control. That same year he introduced a bill for restoring the estates in Scotland forfeited on account of the rebellion of 1745. In 1791 he was appointed principal Secretary of State for the Home Department. He also held a great number of other offices, one of which, the treasurership of the navy, involved him some years after in much trouble. Dundas's aptitude for business was undeniable. Many of the most important public

measures originated with or were directly promoted by him. Among such were the formation of the fencible regiments, the supplementary militia, the volunteer corps, and the provisional cavalry; in short, the whole of that domestic military force raised during the war consequent on the French Revolution. When Pitt resigned in 1801, Dundas did the same. In 1802, under the administration of Mr Addington, he was made Viscount Melville and Baron Dunira. In 1805 he was accused of 'gross malversation and breach of duty' while acting as treasurer of the navy. The trial commenced 29th April 1806; but in spite of the splendid array of Whig talent against him, Dundas was acquitted on all charges involving his honour, 'though it must now be allowed,' says Lockhart, 'that the investigation brought out many circumstances by no means creditable to his discretion.' Thereafter he lived mostly at Dunira, his seat near Comrie. He died at Edinburgh, 28th May 1811. A stately column, surmounted by a statue, was erected to his memory in Edinburgh in 1821, by officers and seamen of the navy. See Life by J. A. Lovat Fraser (1916), and Omond's *Lord Advocates of Scotland* (1883).

Dundee is perhaps *Dun-Tay*, the 'hill or fort on the Tay.' The Latin form was *Taodunum*. Boece gives the fanciful version *Deidonum*, the 'gift of God.' *Dunde* appears to be the oldest form of the name, and occurs in documents of the 11th century. Dundee is a city in Forfarshire, on the N. bank of the Tay estuary, here 2 miles broad, and 10 miles from the river-mouth; 59 miles NNE. of Edinburgh, 20 ENE. of Perth, and 14 S. by W. of Forfar. In population it is the third town in Scotland. The city proper stands mainly on the slopes between the Law (571 feet high, composed of trap, and showing traces of ancient vitrification), Balgay Hill, and the Tay. The most striking architectural features of the town are the town-house, erected by the 'Elder Adam' in 1734, in the Roman Ionic style, with a spire 140 feet high; the Albert Institute (erected 1867, from designs by Sir Gilbert Scott), and Victoria Galleries (1889), containing free library, museum, and picture galleries; the Royal Exchange, in the Flemish Pointed style of the 15th century, opened 1856; the Eastern Club-House; the Kinnaird Hall, holding 2000 people; the Royal Infirmary, opened 1855, and largely extended in 1899 and 1907; the post-office; the technical college and school of art; the high school; the Morgan Academy; Dens Road School; the Provincial Training College; St Paul's Episcopal Church; Balgay Industrial School; the branch public lib-

Tay Bridge, looking towards Dundee.

raries; the Tower of St Mary, called the 'Old Steeple,' 165 feet high, and dating from about the 15th century (restored 1872).

The most important addition to the architecture of Dundee in recent years is the building containing the Caird Hall and the new Council Chambers. This structure took its origin in April 1914, when Sir James Caird, Bart., offered £100,000 for the purpose. He did not live to see the building completed; but his sister and heiress (Mrs Marryat) gave an additional sum of £75,000. The hall was opened in 1923. It is seated to accommodate 3300 persons. All the municipal departments are provided for within the same building, which also includes the Marryat Hall for special functions.

Dundee College was founded in 1880, when Miss Baxter of Balgavies gave a donation of £120,000, and Dr Boyd Baxter the sum of £10,000, and teaching was commenced in 1883. In 1890 it was affiliated to the university of St Andrews, the college retaining its individuality and a measure of financial authority, under the terms of the agreement. In 1895 the union was dissolved, but was reconstituted in 1897.

Dundee's public parks include the Baxter Park, 36¾ acres; Balgay Park, 35¾ acres; Lochee Park, 23 acres. In 1912 Sir James Caird presented the Den of Mains as a pleasure-ground for the citizens.

Dundee is the chief seat in Great Britain of the manufacture of coarse linen fabrics (Osnaburgs, sheetings, ducks, dowlas, drills, canvas, and cordage). But since 1855 jute has formed the staple trade of the city. The raw material is imported from India, and the products are yarns, bags and sacks for grain, coffee, guano, and other commodities, tarpaulins, covers, and Hessian cloth (the foundation of linoleum), and carpets of great beauty. The trade in preserves and confectionery is important. The 'whalers of Dundee' have been world-famous owing to their employment in Antarctic exploration; but in recent years the whaling industry has been much restricted. Shipbuilding and marine engineering are carried on to a large extent. The harbour includes tidal basins, large wet docks, graving docks, and a slip.

Direct railway communication of Dundee with the south, established in 1878 by the erection of the Tay Bridge (single line), was interrupted by a disaster on the night of 28th December 1879, when, during a violent WSW. gale, the 13 large central spans of the bridge, with a passenger train containing 75 persons, fell into the river. The new bridge (double lines) is 10,700 feet, or fully 2 miles long, comprising an abutment at the south end, and 85 piers supporting girders. The rails at the south end are 83 ft. 6 in. above high water, and at the north end 26 ft. 6 in. Long spans of 245 feet occur near the middle of the river, where also the girders

are placed above the railway, to give the maximum room for shipping. The new bridge is parallel to the line of the old bridge, but 60 feet farther west, and the cutwaters of the old piers are still visible. It was opened for traffic in 1887, and cost £670,000, economy being effected by the utilisation of many of the girders of the old bridge. It has been proposed to use the piers of the old bridge to form a road-bridge connecting Fife with the North of Scotland. Pop. (1841) 63,732; (1871) 120,724; (1881) 140,239; (1901) 161,173; (1921) 165,004, including Broughty Ferry, annexed in 1913. Dundee sends two members to Parliament. Since 1889 it has been styled a city, and since 1892 its chief magistrate has been entitled Lord Provost. Among persons of note connected with Dundee may be mentioned Boece; 'Bluidy Mackenzie;' James Bowman Lindsay, linguist and electrical pioneer; Thomas Dick, the 'Christian philosopher'; Admiral Duncan; the 'saintly' M'Cheyne; George Gilfillan; Thomas Erskine of Linlathen. On account of its geographical situation, its harbour and its castle, Dundee was frequently mentioned in early documents. Edward I. was here twice. Wallace is said to have taken the castle in 1297, and thereafter it was occupied by the Scots and English alternately until the decisive battle of Bannockburn. The Duke of Lancaster burned Dundee in 1385, and the Marquis of Montrose pillaged it in 1645. Charles II. lived here, after his coronation at Scone, in 1650. General Monk sacked and burned it in 1651, killing 1200 citizens and soldiers. Dundee was one of the first Scottish towns to adopt the Reformation. Wishart the martyr preached here during the plague of 1544.

Dundee, an inland town of Natal, 34 miles NE. of Ladysmith, has coal-mines and a battlefield (1899); pop. 4000.

Dundee, Viscount. See Graham (John).

Dundonald, Thomas Cochrane, Earl of, seaman, was the eldest son of Archibald, ninth earl (1749–1831), who beggared himself over chemical discoveries. Born at Annsfield, Lanarkshire, on 14th December 1775, he was destined for the army, but, after a desultory education, was permitted to enter the navy (1793). He served in the fiords of Norway, for five years on the North American station, then in the Mediterranean, and in March 1800 received the command of a crazy little sloop of 14 *four-pounders* and 54 men. In a fifteen months' cruise he took or retook upwards of fifty privateers and merchantmen, 122 guns, and 534 prisoners; his most dashing achievement being the capture by boarding of a Spanish frigate of 32 heavy guns and 319 men, with a loss to himself of but 3 killed and 18 wounded. His own capture by three French line-of-battle ships followed shortly, his speedy exchange, his promotion to post-captain, a half-year of study at Edinburgh University, fifteen months on a 'collier,' protecting non-existent Orkney fisheries—at length, in February 1805, he returned to prize-taking, and in April came sailing into Plymouth Sound, with £75,000 of prize-money for his own share, and a tall gold candlestick at each mast-head.

The next four years were mainly spent in harassing the enemy's coasts—cutting out ships, blowing up semaphores and batteries, and in 1808, with 80 of his own men and as many Spaniards, defending for twelve days the almost untenable Fort Trinidad at Rosas. Meanwhile, in 1805 he had stood unsuccessfully for Honiton on 'patriotic' (no bribery) principles, but by rewarding his few supporters with double the current price, had secured a cheap victory at next year's election. In May 1807 Westminster returned him at the head of the poll; and at once proceeding, with more zeal than discretion, to war against naval abuses, he was at once ordered off to the Mediterranean.

In April 1809 he was selected by the Admiralty for the hazardous service of burning the French fleet of fifteen sail (848 guns), then blockaded in Aix Roads by a stronger force under Lord Gambier. On the night of the 11th the huge boom guarding the entrance was shattered. Explosion vessels and fireships caused a panic. Daylight showed almost the whole French fleet aground—an easy prey. Gambier, however, was fourteen miles away. Cochrane's signals met with no response; consequently only four of the enemy's ships were destroyed. It was the last blow he was to strike for England.

He received the knighthood of the Bath; but to Gambier were voted the thanks of parliament, after 'a most honourable acquittal' by the friendly court-martial which ensued on Cochrane's protest against that vote. Thus discredited, put upon half-pay, Cochrane pursued his crusade against naval corruption, till in June 1814 he, the hero, the high-born, the Radical reformer, was placed in the dock as a fraudulent stock-jobber. A lying rumour of Napoleon's overthrow had sent up the funds; and he, with two others, was tried for propagating it, and selling out upwards of a million sterling with a gross profit of £10,000. Those two others—an uncle one—were certainly guilty. Lord Cochrane, by some held innocent, was sentenced to pay a fine of £1000, to suffer a year's imprisonment in the King's Bench, and to stand for an hour in the pillory. The last part of the sentence was remitted; but his name was struck off the navy list, and he was expelled from parliament, and formally degraded from his knighthood. Westminster re-elected him; and in March 1815 he broke out of gaol, and reappeared in the House, to be torn thence by tipstaves, lodged in the strong-room for the three months yet to run of his sentence, and next year mulcted anew in £100.

Weary of inactivity and of fruitless attempts at self-justification, in 1818 he once more girt on his sword, to rescue Peru and Chile from Spanish thraldom. As commander-in-chief of Chile's small, ill-equipped navy, he stormed with 300 men the fifteen strong forts of Valdivia (1819), and cut out a frigate from under the batteries of Callao (1820), in two and a half years making Chile mistress of her own waters, and her flag respected from Cape Horn to Panamá. He squabbled over his reward, as also over that (including the marquisate of Maranham) for his services, only less brilliant, on behalf of the infant empire of Brazil (1823–25).

For the cause of Greek independence he could do little or nothing, through lack of both ships and men (1827–28); so, returning to England, he devoted himself to the task of procuring his reinstatement in the navy. But it was not till May 1832, under the 'Sailor king' and Lord Grey's Whig administration, that a 'free pardon' was granted to the Earl of Dundonald—he had succeeded to the title ten months earlier—and that he was gazetted a rear-admiral. Restored to the honour of knighthood (1847), commander-in-chief on the North American and West Indian station (1848–51), and rear-admiral of the United Kingdom (1854), he died at Kensington, 31st October 1860, in his eighty-fifth year, and was buried in Westminster Abbey. He had married in 1812 Miss Katherine Corbet Barnes—a runaway Scottish marriage; she bore him Thomas, the eleventh earl (1814–85), and three other sons, of whom two entered the navy.

Much might be written of Lord Dundonald's inventions, his application of steam-power and the screw-propeller to war-ships; still more of his 'secret war-plan' to overwhelm fleets and fortresses

by sulphur fumes and the like. It was submitted to committees in 1812 and 1846, and condemned as too inhuman, though irresistible, infallible. But from the inventor one ever reverts to the tall, big, splendid sea-captain, brilliant, daring, cool, prompt, and sagacious, faultless afloat, though ashore out of his element. He equalled the old Elizabethan adventurers; he might, had Fate suffered it, have rivalled Nelson.

See the *Narrative of Services in the Liberation of Chili, Peru, and Brazil* (1859), nominally his own, and *Autobiography of a Seaman* (2 vols. 1860-61), which breaks off in 1814, and has been completed in the Life by the eleventh earl and H. R. Fox Bourne (2 vols. 1869); also the monograph in the 'Men of Action' series (1896) by the Hon. J. W. Fortescue; a book on the trial by J. B. Atlay (1898) in defence of the verdict; and Lord Ellenborough, *The Guilt of Lord Cochrane* (1914).

Dundrum Bay, an inlet of the Irish Sea, in County Down, is 13 miles wide across the entrance, and forms a long gentle curve cutting 5 miles into the land.

Dunecht. See CRAWFORD (EARL OF).

Dunedin, capital of the provincial district of Otago, and the most important commercial city in New Zealand, is situated at the head of Otago Harbour, on the east side of South Island, towards its southern extremity. It is 190 miles by sea from Lyttelton, and 150 miles from Invercargill, and 139 by rail. Since its foundation by an association of members of the Free Church of Scotland in 1848, the city has rapidly increased in importance; chiefly after the year 1861, when the discovery of extensive gold-fields in the neighbourhood caused a sudden increase of population. Dunedin is as well laid out as the hilly nature of its site will allow; it is well paved and lighted. It is supplied with water from the Water of Leith valley

and the Silverstream. For additional supplies it looks to the Waipori, whose falls furnish electric power. Dunedin is the seat of an Anglican and a Roman Catholic bishop. There are many handsome churches and buildings; the Bank of New Zealand, completed in 1882, is one of the finest in the city. Other edifices are the post-office, hospital, government buildings, mechanics' institute, lunatic asylum, &c.; and the inhabitants of the city possess places of recreation in the Botanical Gardens and the grounds of the Acclimatisation Society. The theatre was burned down in 1875, and rebuilt. There is a carriage-drive through the reserve called the Town Belt, which encircles the city, and a fine racecourse, near Ocean Beach, 2 miles distant. The high school and the university, which is affiliated with that of New Zealand, are flourishing institutions. The erection of an observatory in the Town Belt was sanctioned in 1920. There are several daily papers and numerous weeklies and monthlies. Woollens are manufactured and frozen meat prepared. The street tramways are mostly electric. Railways connect Dunedin with Christchurch to the north and Invercargill to the south. Dunedin has frequent communication with the other dominion ports, with Melbourne and the home country; and since the opening and deepening of the Victoria Channel from Port Chalmers, large steamers can approach the wharf. For purposes of defence, two batteries have been erected on the headlands at Ocean Beach, and a third on Otago Heads. The city was originally to have been named New Edinburgh, but on the suggestion of Dr William Chambers of Edinburgh its name was changed to Dunedin, the Celtic designation of the Scottish capital. Pop. of the city proper (1871) 14,857; (1881) 24,372; (1911) 41,529; (1921) 58,074, or with suburbs, which largely consist of adjacent boroughs, 72,255.

Dunes, from the same root as Dun (q.v.), 'a hill,' the name given to the sandhills or mounds which stretch more or less along the sea-coast of the Netherlands and parts of the north of France. In the *Battle of the Dunes*, fought near Dunkirk in 1658, Turenne defeated a Spanish army under Don John of Austria and the great Condé. See DOWNS and DRIFT; also DUNKIRK.

Dunfermline, a 'city' of Fife, the chief town of its western district, 16 miles NW. of Edinburgh, and 20 E. by S. of Stirling. It stands on a long swelling ridge, 3 miles from and 300 feet above the Forth, and, backed by the Cleish Hills (1240 feet), presents a striking aspect from the south. It is a place of hoar antiquity, from 1057 till 1650 a frequent residence of Scotland's kings, and for more than two centuries their place of sepulture. Malcolm Canmore here founded in 1072 a priory, which David I. remodelled in 1124 as a Benedictine abbey. The nave alone of its church, Romanesque to Third Pointed in style, was spared at the Reformation, and now forms a stately vestibule to the New Abbey Church (1818–21), in building which Robert Bruce's grave was discovered. There are ruins of the 'frater-house' or refectory, of the 'pended tower,' and of the royal palace (*circa* 1540); but of Malcolm's Tower only a shapeless fragment is left, and the 'Queen's House' (1600) was wholly demolished in 1797. Abbot Pitcairn's house is assigned to the 13th century. Little else survived the great fire of 1624. Quite modern are the Gothic corporation buildings (1876–79), with their peaked clock-tower; the spired county building (1807–50); St Margaret's Hall (1878), with a fine organ; the Carnegie Public Library (1881); the Carnegie Baths (1877–1905); the high school (1886–1915); and St Margaret's Roman Catholic Church. In 1903 Mr Andrew Carnegie made over £500,000, and in 1911 £250,000, to be held by trustees for behoof of his native town, to maintain Pittencrieff as a pleasure-ground, encourage horticulture, establish a theatre for first-class plays, provide education in music and the arts, and promote social well-being. The staple industry is damask linen-weaving, which dates from 1716. Dunfermline is the chief seat of the table-linen manufacture in the United Kingdom. Engineering works, iron-founding, &c. are also carried on; and in the neighbourhood are many collieries. Dunfermline was made a royal burgh in 1588. Its area was increased well-nigh fourfold in 1911 by the inclusion of Rosyth and intervening country. At Rosyth a tract of land extending over 3 miles on the north shore of the Firth of Forth, at St Margaret's Hope, opposite

South Queensferry, and just above the Forth Bridge, was acquired by the government in 1903, and a naval base was constructed. Docks, roads, and dwellings grew rapidly during the Great War, and Dunfermline's population was greatly increased. In 1925 it was decided to close the naval base. The ruined 16th-century castle of Rosyth, a rock-island connected with the shore by a causeway, was said, by baseless tradition, to have been the birthplace of Oliver Cromwell's mother. Population of Dunfermline (1801) 5484; (1881) 17,085; (1901) 25,250; (1921) 39,886. The parliamentary burgh unites (since 1918) with Cowdenbeath, Inverkeithing, and Lochgelly to return one member. For Dunfermline's worthies, reference may be made to our own articles on St Margaret, James I., Robert Henrysoun, Charles I., Ralph Erskine, Sir Noel Paton, and Mr Andrew Carnegie.

Dungannon, a municipal borough in County Tyrone, 40 miles W. of Belfast by rail, and 8 W. of Lough Neagh. It has manufactures of linen and coarse earthenware; and in the vicinity are the largest lime-quarries and collieries in Ulster. Pop. (1851) 3835; (1881) 4081; (1911) 3830. Till 1885 it returned one member to parliament. Dungannon was the chief seat of the O'Neils till 1607. Its castle was destroyed in 1641.

Dungans. See ZUNGARIA.

Dungarvan, a seaport of County Waterford, 141 miles SW. of Dublin by rail. Population 5000, chiefly engaged in hake, cod, herring, and other fisheries. The exports are grain, butter, cattle, and fish. Dungarvan has the remains of an Augustinian abbey, founded in the 7th century by St Garvan. It has besides the remains of walls built by King John, who also built the castle. Till 1885 Dungarvan returned one member to parliament. Dungarvan Bay is 3 miles wide, about the same in length, and one to five fathoms deep.

Dung-beetle, a name given to a number of lamellicorn beetles (in the sub-families Coprophaga and Arenicolæ), which live in great part on the dung of quadrupeds. One of the commonest, the Black Dor (*Geotrupes stercorarius*), is interesting in many ways, for its elaborate burrows and stores under cow-dung and the like, for the 'stridulating' noises made by both sexes by rubbing part of the abdomen against a ridge on the hindmost leg, for the little ticks (*Gamasus coleoptratorum*) by which it is generally infested, and for its association with another nearly-related beetle (*Aphodius porcus*) which finds its way into the burrow, eats the Geotrupes' eggs, and lays its own in the liberal supply of food thus thievishly appropriated. Among the other British species of Geotrupes, *G. typhœus*, with three horns on the front of the thorax in the males, is found especially on heaths where there are sheep. The sacred beetle or Scarabee (q.v.) (*Ateuchus* or *Scarabœus sacer*) is a well-known dung-beetle. They roll pellets of dung along with great industry, and often appear unable to resist stealing them from one another. A related form (*Sisyphus schäfferi*), the pill-rolling beetle, is said to lay its eggs inside the pellets of dung, and both sexes are described as taking part in rolling these to a place of safety. The scarabee used also to be credited with laying eggs within the pellets, but this appears to be erroneous. *Copris lunaris* is a common European dung-beetle, which makes burrows and stores dung for the larvæ. There are many other forms. The Dor and others feign death, stretching out their legs in rigid epileptic-like fashion. Crows and other birds are said to prefer them alive.

Dung-beetle (*Geotrupes stercorarius*).

Dungeness, a headland on the south coast of Kent, 10½ miles SE. of Rye, with a lighthouse.

Dungeon. See DONJON.

Dunite, so named from Dun Mountain, near Nelson, New Zealand, is a crystalline rock consisting almost entirely of olivine. A black granular mineral akin to chromite and picotite also occurs in it. The olivine may be altered into serpentine.

Dunkeld, a town of Perthshire, 16 miles NNW. of Perth. It lies in a deep romantic hollow, on the great east pass (of Birnam, q.v.) to the Highlands, on the left bank of the Tay, which here is spanned by Telford's handsome bridge (1805–9). It is environed by dark-wooded and craggy mountains. Dunkeld is a place of great antiquity, and a Culdee church was founded here about 815. In 1107 Alexander I. revived the bishopric, one of whose holders was Gawin Douglas (1474–1522), translator of Virgil's *Æneid*. The place was successfully held by a small Cameronian regiment, under Cleland, against 5000 Highlanders, 21st August 1689. The cathedral, mainly in Pointed style, was built between 1318 and 1501, and comprises nave, choir, chapter-house, and tower. At the Reformation it was unroofed, but the choir has been renovated, and is now the parish church. Of two or three ancient monuments, the most interesting is one to the Wolf of Badenoch (Alexander Stewart, Earl of Buchan, who died in 1394). The Duke of Athole's grounds, unsurpassed in Scotland for extent and beauty, lie on the west and north of Dunkeld, and include Craigvinean and Craig-y-Barns; 50 miles of walks, and 30 miles of drives; falls of the Bran (upper one 80 feet), near Ossian's Hall at the Rumbling Bridge; and wide larch-woods, including what are claimed to be the first two larches planted in Britain (in 1738), although the point has been disputed.

Dunkers. See TUNKERS.

Dunkery Beacon. See EXMOOR.

Dunkirk, or DUNKERQUE, the most northerly seaport of France, on the Strait of Dover, in the department of Nord, 161 miles N. of Paris, and 67 W. of Ghent. It is a very strong place, as well from fortification works, as from the ease with which the surrounding country can all be laid under water. As a seaport it is one of the most important in France; and great harbour works have been sanctioned and in part carried out under the laws of 1879, 1903, and 1919. The town itself is well built and cleanly, Flemish rather than French; its principal features, the Gothic church of St Eloi with a handsome though rather incongruous Corinthian portico, the fine detached belfry (196 feet), and the statue of Jean Barth (q.v.). Dunkirk has manufactures of linen, jute, hemp, fishing-lines, oils, soap, beet-root sugar, &c. Forming as it does the outlet for the great manufacturing department of Nord, its trade by sea is very extensive. It is an important market for nitrates, sugar, and wool. Its cod and herring fisheries are actively prosecuted. Pop. (1872) 34,342; (1886) 38,004; (1901) 40,329; (1921) 34,748.

Dunkirk is said to owe its origin to the church built by St Eloi in the 7th century, in the midst of the dreary sandhills or dunes, and hence its name, 'Church of the Dunes.' It was burned by the English in 1388, taken by them under Oliver Cromwell in 1658, but sold to Louis XIV. by Charles II. for 5,000,000 francs in 1662. By the

treaty of Utrecht in 1713, the French were compelled to destroy the fortifications of Dunkirk, which were again restored, however, in 1783. In 1793 the Duke of York laid siege to Dunkirk, but was forced to retire, with severe loss.

Dunkirk, a port of entry of New York, on Lake Erie, 40 miles SW. of Buffalo by rail, with a commodious harbour and a busy lake traffic. The terminus of a division of the Erie Railroad, Dunkirk contains large workshops and warehouses of the company, besides extensive locomotive works, lumber-mills and several ironworks. Pop. 19,000.

Dunlin (*Pelidna alpina* or *cinclus*), one of the Sandpipers (q.v.), a common British shore-bird, occurring in great flocks. It generally breeds further north, and is widely distributed in Europe. The plumage varies considerably; in winter it is ashen-gray above and white beneath; in summer there is much less uniformity, more brown and black, and a black horseshoe band on the breast.

Dunlin, Summer and Winter Plumage.

It exhibits great activity in running about, searching and probing for its food. Another species (*P. temminckii*) is common in Europe and North America. The Curlew Sandpiper (*P. subarquata*), with a more curved bill and deep-red breast, also occurs on European and British shores. These three species are sometimes included in the genus Tringa, along with the Knot (*T. canutus*) and other Sandpipers (q.v.). 'When flying in great autumnal flocks, the aerial movements of the dunlin are extremely beautiful, each individual of the vast assemblage yielding so instantaneously to the same impulsion as to exhibit alternately the upper and the under surface of the body, so that we have for a time a living moving cloud of dusky brown, and then a brilliant flash of snowy whiteness.'

Dunlop, JOHN BOYD (1840–1921), inventor, was born at Dreghorn, Ayrshire, and educated at Irvine and Edinburgh. He practised as a veterinary surgeon in Belfast, and in later life lived in Dublin. His principal invention was the pneumatic tire, for which he opened a factory in Dublin, afterwards removed to Coventry.

Dunmore, a borough of Pennsylvania, adjoining Scranton, has silk, woollen, sparking-plug and stove works, and coal-mines; pop. 20,000.

Dunmow, GREAT, a small market-town of Essex, on the Chelmer, 11 miles NNW. of Chelmsford, and 32 NNE. of London.—At Little Dunmow, 2 miles ESE., are remains of a stately Augustinian priory, founded in 1104. The Dunmow Flitch of Bacon (see *Piers Plowman*, passus x.) was a prize instituted in 1244, by Robert Fitzwalter, on the condition 'that whatever married couple will go to the priory, and kneeling on two sharp-pointed stones, will swear that they have not quarrelled nor repented of their marriage within a year and a day after its celebration, shall receive a flitch of bacon.' The first recorded award was in 1445, two hundred years after it had been instituted. After 1751, up to which date only five presentations had taken place, the flitch was not again claimed till 1855; since then many awards have been made. See W. Andrews, *History of the Dunmow Flitch* (1877).

Dunnage, on shipboard, is a name applied to miscellaneous fagots, boughs, bamboos, odd mats or sails, and loose wood of any kind, laid in the bottom of the hold to keep the cargo out of the bilge-water; or wedged between parts of the cargo to keep them steady.

Dunnottar Castle, the ancient seat, now in ruins, of the Keiths, the Earls Marischal of Scotland, on the Kincardineshire coast, 1½ miles S. of Stonehaven. It occupies the top of a rock 4½ acres in extent, and 160 feet high, overhanging the sea, with a deep though dry chasm between it and the mainland, and it is approached by a steep winding path. The area is surrounded by a wall, and covered with dismantled buildings of very various ages, the oldest the square tower and the chapel. Blind Harry records a fabulous story that Wallace in 1296 took the rock, and burned the castle together with the kirk and 4000 Englishmen. During the Commonwealth, the Regalia of Scotland were hid in the castle from the republican army, and before the garrison surrendered to Cromwell's troops in 1651, the Regalia were carried out, according to one account, by Mrs Granger, wife of the minister of Kinneff, a neighbouring parish, and buried under the flagstones of its church, where they lay in safety till the Restoration. Rival claims upon the king's gratitude then involved the Keiths, the Ogilvies of Barras (the family of the governor), and the Grangers in bitter feuds, in which none of the royalists showed up well. For three months in 1685 no fewer than 167 Covenanters were confined with the most barbarous cruelty in the 'Whigs' Vault.' Dunnotar Castle was dismantled after the rebellion of 1715, on the attainder of the last Earl Marischal.

Dunois, JEAN, called the Bastard of Orleans, Count of Dunois and Longueville, one of the most brilliant soldiers that France ever produced, was born in Paris, 23d November 1402, the natural son of Louis, Duke of Orleans, brother of Charles VI., and was brought up in the house of that prince along with his legitimate children. His first important military achievement was the overthrow of the English at Montargis (1427). He next threw himself into Orleans with a small body of men, and bravely defended the place till the arrival of the famous Joan of Arc, whose religious enthusiasm combined with the valour of Dunois restored the drooping spirits of the French, and compelled the English to raise the siege. This was the turning-point in the fortunes of the French nation. In 1429 Dunois and the Maid of Orleans won the battle of Patay, after which he marched, with a small body of men, through the provinces then overrun by the English, and took the fortified towns. The capture and death of Joan of Arc arrested for a moment the progress of the French arms, but the heroism of Dunois was irresistible. He took Chartres, the key of Paris, forced Bedford to raise the siege of Lagny, chased the enemy from Paris, and within a very short period deprived them of all their French conquests except Normandy and Guienne. In 1448–50 he drove the English from Normandy, and in 1455 he had swept them from Guienne also, and permanently secured the freedom of France from all external pressure. For his par-

ticipation in the league of the nobles against Louis XI. he was deprived of all his offices and possessions, which were, however, restored to him under the treaty of Conflans (1465). He died 24th November 1468. There is no name so popular in France as that of Dunois; there is no hero so national; he laboured twenty-five years for the deliverance of his country, and this *alone*—his sword was never unsheathed, except against the English. He never had a force under him which could enable him to win a victory that might balance Agincourt or Crécy, but the multitude and constancy of his petty successes served the cause of France more effectively than greater and more dear-bought victories would have done.

Dunoon, a favourite watering-place of Argyllshire, extending, with Hunter's Quay and Kirn, 3 miles along the west shore of the Firth of Clyde, 7 miles W. of Greenock. The seat for centuries of a castle of the Stewarts, in 1563 it received a visit from Queen Mary, and in 1643 was the place where thirty-six Lamonts were cruelly hanged by the Campbells. But the present well-built town has wholly arisen since 1822—with its baronial burgh buildings, its piers, its esplanade, its half-dozen churches, the Convalescent Homes (1869), and the statue (1896) to Burns's Highland Mary, born here. Pop. (1841) 1296; (1911) 6859; (1921) 14,735. The apparent increase is due to the 1921 census being taken in the holiday season.

Dunraven, Windham Thomas Wyndham-Quin, Earl of, born at Adare Manor, Limerick, 12th February 1841, studied at Christ Church, Oxford, served in the 1st Life Guards (1865–67), acted as *Daily Telegraph* correspondent in the Abyssinian expedition and Franco-German war, and succeeded his father as 4th Earl in 1871. He was Under-secretary for the Colonies (1885–87); advocated 'devolution' as a solution of the Irish question; competed for the America Cup (1893, 1895); and wrote on travel, sport, and politics.

Duns, a police-burgh of Berwickshire, 44 miles ESE. of Edinburgh, has superseded Greenlaw as county town, partly in 1853, now wholly, and has a town-hall, county buildings, and a corn exchange. Thomas Boston was a native; and on round, turf-clad Duns Law, which rises 700 feet above the sea, and 280 above the town, Leslie encamped with the Covenanting host in 1639. The form Dunse was altered in 1882 to Duns, the spelling till 1740. Pop. (1834) 2656; (1881) 2437; (1921) 1868.

Dunsany, Edward John Moreton Drax Plunkett, 18th Baron, was born in London 24th July 1878, fought in the South African and Great Wars, stood for West Wilts (1906) as a Conservative, and wrote many volumes of plays and prose tales.

Dunsinane, one of the Sidlaw Hills in Perthshire, 1012 feet high, 8½ miles NE. of Perth. On its top are remains of a prehistoric fortress—'Macbeth's Castle.'

Dunsink, a hill 4 miles NW. of Dublin, the site of the observatory of Trinity College.

Duns Scotus, Johannes, was one of the most influential of the medieval schoolmen. Little is known of his history. His name alone seems to be the chief reason for the different conjectures as to his birthplace, which is variously given as Dunstane, a village in Northumberland, Dun (now Down) in the north of Ireland, and Duns in Berwickshire. He was probably born about 1265 A.D., or, according to others, about 1274. While still young, he is said to have entered the Franciscan order, studied at Merton College, Oxford, and lectured there on philosophy and theology. The reports of the number of his auditors, and that 30,000 students then thronged to Oxford, may be taken as testifying in an exaggerated way to the popularity of his instructions. In 1304 he was transferred to Paris, then the intellectual centre of the world, and in 1308 to Cologne, where he died, in November of the same year, at the age of forty-three, or, according to the other account, thirty-four. His works consist chiefly of commentaries on the Bible, on Aristotle, and on the *Sentences* of Peter Lombard. The first are not contained in the collected edition (edited by Luke Wadding, Lyons, 1639). The last occupy seven out of its twelve vols. folio (vols. v.–x. called *Opus Oxoniense*, vol. xi. called *Opus Parisiense*—the latter edited from students' note-books, but containing the author's latest views).

Duns Scotus was at once the critic of preceding scholasticism and the founder of a new type of thought. The great schoolmen of the 13th century, especially Albertus Magnus and Thomas Aquinas, had systematised and defended the Christian theology by means of the forms and doctrines of the philosophy of Aristotle. In this way philosophy became the handmaid of religion, and the authority of Aristotle was recognised by orthodox teachers. On certain points indeed—such as the eternity of matter and of the world—his theological position compelled Aquinas to diverge from Aristotle. But the disagreement of Duns Scotus went much deeper. He contended that Aquinas was wrong in subordinating the practical to the theoretical, and seeking in speculation instead of in practice for the foundation of Christian theology. This contention struck at the root of the whole Aristotelico-Christian philosophy. Theology, he holds, rests on faith, and faith is not speculative but practical—an act of will. Will is the moving principle of intellect, not intellect the basis of will. 'Will,' he says, 'is the mover in the whole kingdom of mind, and all things are subject to it.' The whole apparatus of proofs by which Aquinas had built up a system of Christian theology is subjected by Duns Scotus to a searching criticism, conducted with consummate dialectical skill, and abounding in refined distinctions, which gained for him the title of 'Doctor Subtilis.' In his own system Duns Scotus maintained a strict theological orthodoxy. He carried on a zealous controversy against the Dominicans (the order to which Aquinas belonged) in defence of the doctrine of the Immaculate Conception, a doctrine which gradually gained ground in the church, until in 1854 it was finally declared to be a necessary part of Catholic faith. In philosophy he was influenced not only by Aristotle, but also by Neoplatonic doctrines which reached him to a large extent through the *Fons Vitæ* of the Jewish Ibn Gebirol (Avicebron, q.v.). By this influence in particular, his mode of applying the realist doctrine of universals, and his explanation of the nature of things, were much modified. His psychological doctrine of the supremacy of will over intellect led to his treatment of morality as depending on the mere will of the Deity. The good is good, he held, because God commands it. See Aquinas, Franciscans.

The controversies between Thomists and Scotists were continued long after the deaths of their leaders. Among notable Scotists were Nicholaus de Lyra (1340) and Petrus de Aquila (1345); and William Occham, the Nominalist, was originally a disciple of Scotus, the apostle of Realism. See Scholasticism, Nominalism, Realism. At a later period, when the followers of Duns Scotus or *Dunsmen* opposed the new classical studies, the name *dunce* came to be used contemptuously for an opponent of learning, an ignoramus.

For a further account of the views of Duns Scotus, the 'Doctor Subtilis' of the schools, see K. Werner's

J. Duns Scotus (Vienna, 1881); E. Pluzanski's *Essai sur la Philosophie de Duns Scot* (Paris, 1887); the histories of philosophy of Ritter, Erdmann, and Ueberweg; Prantl's *Geschichte der Logik;* and Hauréau's *Philosophie Scolastique.*

Dunstable, a town in the south of Bedfordshire, at the east base of the Chiltern chalk-hills or Dunstable Downs, 34 miles NW. of London. An old-fashioned, brick-built place, with two main streets crossing at right angles, it has a fine priory church, partly Norman, which since 1865 has undergone restoration. In 1110 this Augustinian priory was the scene of the earliest miracle play on record, so that Dunstable claims to be the birthplace of the English drama. It has also an ancient celebrity for larks and for straw-plait, which still is the staple industry. The grammar-school (1715) was rebuilt in 1888. Dunstable, which stood at the intersection of Watling and Icknield Streets, was the site of an Eleanor Cross (demolished 1643), and the scene of Cranmer's annulment of Queen Catharine's marriage. It was made a municipal borough in 1864. Pop. 9000.

Dunstable, or DUNSTAPLE, JOHN, 'astronomer, mathematician, musician and what not,' is generally held to have been born at Dunstable in Bedfordshire, but he may have been a native of Hertfordshire. Little is known of his life. He died 24th December 1453. He enjoyed a European reputation—short-lived but apparently fully deserved—as one of the earliest musicians who laid the foundations of the great schools of the 16th century. Misreading of a reference in the *Proportionale* of Johannes Tinctoris (1445–1511) has led some absurdly to claim for him the invention of counterpoint. He is, however, by far the greatest English musician of the first half of the 15th century. Some examples of his music survive.

Dunstaffnage Castle. See ETIVE (LOCH).

Dunstan, ST, Archbishop of Canterbury (960–988), was the son of a West Saxon noble, and was born near Glastonbury. There at the abbey he was educated by some resident Irish scholars, and while still a boy he lived some time at the court of Athelstan, but seems to have been unpopular with his young companions, who ill-used him and procured his banishment on the charge of practising unlawful arts. After a stay at Winchester with his kinsman Bishop Ælfheah, to whom he made his profession as a monk, he retired to Glastonbury, where he gave himself entirely to study and to music. It was at this time of his life that he built himself a cell 5 feet long by 2½ feet broad, where he retired to pray, and where heavenly visions were vouchsafed to him. Here also he worked in metals, and it was while labouring at his forge that his famous temptation by the devil took place, which he ended by promptly seizing the fiend by the nose with his red-hot tongs. The accession of Athelstan's brother, Edmund, recalled him to court, from which he was soon driven—most likely to East Anglia—only to be soon restored to the king's favour, and appointed Abbot of Glastonbury (945). Here he began a great work of reformation, and soon his abbey grew to be a great school and a centre of religious influence. At the same time he became the treasurer, and in harmony with the queen-mother Eadgifu, the chief adviser of the young king, whose death at Frome in 955 led to the accession of Edwy and the fall of Dunstan's power before the influence of the young queen Ælfgifu, her mother Æthelgifu, and the leaders of the West Saxon party. He took refuge in Flanders, where Arnulf I., by his mother grandson of Alfred, received him kindly. At Ghent he first saw the strict Benedictine discipline which he was to introduce into England. Two years later he was recalled by Edgar, who had become, through a rebellion of the Mercians and Northumbrians, king of the country north of the Thames, and created Bishop of Worcester, to which was added a little later the see of London. In 959 Edwy's death made Edgar king of the whole country. One of his first acts was to annul Brithelm's appointment to the see of Canterbury, and, by advice of the witan, to appoint Dunstan in his room. The wise measures that made Edgar's reign so peaceful and prosperous was in great part due to the counsels of Dunstan. It was his policy to weld the Danes and the English into one nation, and his wise and liberal measures to this end were rewarded by the gratitude of the Danes. It is significant that Cnut in 1017 ordered the universal observance of St Dunstan's mass-day. With Oswald, Archbishop of York, he solemnly crowned Edgar at Bath, on Whitsunday 973—a formal declaration of the unity of the kingdom. He was active in building churches, and sympathised heartily with the establishment of monastic life on the rigorous Benedictine rule. The secular clerks were turned out of the monasteries, but clerical celibacy was not made compulsory in any more direct manner than that a married priest lost the privilege of his order. Dunstan laboured to elevate the lives of the clergy, and make them the real teachers of the people in secular learning and skill in handicrafts, as well as in morals and religion. Himself a man of the severest purity of life, he was absolutely fearless in insisting upon the penances which he laid upon the great, but showed his wisdom in turning these into practical channels. He raised the social status of the clergy, and made obligatory the payment of tithes by landowners, while he did not entirely surrender the liberties of the church to Rome. Edgar's death in 975 opened up anew the struggle between the seculars and the monks, but Dunstan declared for Edward, elder son of the late king, and crowned him at Winchester. His triumph was complete, and the fall of the floor of the council-room at Calne (977), in which only his enemies were killed or injured, seemed to some like a divine judgment in his favour. On Edward's murder in 978, the two archbishops crowned Ethelred king, whose hostility put an end to the great churchman's political career. Dunstan spent his later years at Canterbury, busily employed in the affairs of the church, in study, in private prayer, and the services of the church, varied with the handicraft of his earlier days. The memory of his gentleness and patience long survived him. He died in 988, and was buried near the altar of his church. His day is 19th May. See Bishop Stubbs's *Memorials of St Dunstan* (1875) in the Rolls Series, a collection of six early biographies of the saint; also J. Armitage Robinson's *The Times of Saint Dunstan* (1923; Ford Lectures, Oxford, 1922).

Dunstanburgh Castle, a picturesque ruin on the basaltic sea-cliffs of the Northumbrian coast, 8 miles NE. of Alnwick. Crystals of quartz found here are called Dunstanburgh diamonds and amethysts.

Dunton, JOHN, bookseller, was born in 1659. Refusing to make the fourth in a direct line of clergymen, he was apprenticed to a London bookseller at fourteen, and managed to complete his time, and to acquire much varied knowledge, in spite of love, politics, and the thousand distractions incidental to a mind of such exceptional flightiness as his. He took a shop, married happily, made some lucky ventures, but was foolish enough to become security for the debts of some of his relatives, and had in consequence to fight a hard battle with financial troubles. He paid a visit to America, afterwards to Holland and Cologne,

settled somehow with his creditors, and kept shop for ten years with fair prosperity, his *Athenian Gazette* being for a while especially successful. In 1692 he succeeded to a cousin's property, and became a freeman of the Stationers' Company. He married a second time unhappily, and under the real and imaginary troubles of his later years, his mind seems to have crossed the line between crackbrained flightiness and sheer lunacy. His extraordinary book, *Life and Errors of John Dunton*, appeared in 1705. Thereafter he wrote numerous papers and pamphlets, and died in 1733

Dunwich, on the cliffs of the Suffolk coast, 4½ miles S. of Southwold, made the episcopal see of the Southfolk *c.* 630, became a large and important place. Its ancient buildings have been swept away by the sea; in 1350 more than 400 were washed away at once. The remaining fragment of the church tower was removed in 1923 to a safer site. Dunwich sent two members to parliament till 1832, and till 1883 was a municipal borough.

Duodecimal Scale (Lat. *duodecim*, 'twelve') is the name given to the division of unity into twelve equal parts, as when the foot is divided into 12 inches, and the inch into 12 lines; or the pound is divided into 12 ounces. This plan of counting has some advantages, as 12 admits of so many divisions into equal parts—viz. by 2, 3, 4, and 6. But the decimal scale, or division into ten equal parts, is now universally recognised as preferable, from its coinciding with our decimal system of notation.—DUODECIMALS, a method of calculating the area of a rectangle when the length and breadth are stated in feet and inches.

Duodenum, the first portion of the small intestine, next to the pyloric end of the stomach. See DIGESTION.

Dupanloup, FÉLIX ANTOINE PHILIBERT, Bishop of Orleans, was born at St Félix, near Annecy in Savoy, 3d January 1802. He received priest's orders in 1825, and, after acting as tutor to the young Orleans princes, was appointed in 1837 superior of the Little Seminary in Paris. Here he had an opportunity of carrying out still further his favourite views as to education; and he remained fond of teaching even after his appointment as Bishop of Orleans in 1849. During the reign of Louis-Philippe he strove earnestly in behalf of freedom of education, and to secure tolerance for the Jesuits. The publication of the papal Encyclical and *Syllabus* in 1864 called forth from him *La Convention du 15 Septembre et l'Encyclique du 8 Décembre*, a pamphlet of which 34 editions had to be issued within a few weeks. In this little book, the eloquent bishop defends the temporal authority of the pope. Nevertheless he received with great reserve the first intimations of the pope's intention to summon a council for the purpose of proclaiming the dogma of papal infallibility; and after his arrival at Rome, to take part in the deliberations of the council, he protested openly against the doctrine; and when he found that all opposition was in vain, he left the Holy City on the evening prior to the promulgation of the decree by the council. Yet, once the dogma was published, he submitted to the will of the church, and signified his acceptance of it. In 1871 the bishop was elected deputy for Orleans to the new National Assembly, the only bishop who sat in it. From this time onwards to the date of his death, at Lacombe, near Lancey (Isère), 11th October 1878, he struggled manfully against the attacks which were being constantly made upon the church both in the Assembly and outside of it. He became a senator in 1876, and in 1854 a member of the Academy, but resigned his fauteuil on the election of Littré. His writings are numerous. See the Lives by Lagrange (trans. by Lady Herbert, 1885) and by Faguet (1913).

Dupin, FRANÇOIS-PIERRE-CHARLES, BARON, was born in 1784, and served as an engineer under the Empire. In 1816–19 he made several visits to England and Ireland; the results of his investigations appeared in his chief work, *Voyages dans la Grande Bretagne* (6 vols. Paris, 1820–24). He was made a baron in 1824, a peer in 1837, and filled several posts, which he resigned in 1852. He died in 1873. His elder brother, André (1783–1865), was a statesman and lawyer, the author of several important works on legal subjects, and 4 vols. of memoirs (1855–61).

Dupleix, JOSEPH FRANÇOIS, the celebrated governor of the French Indies, was born 1st January 1697, at Landrecies. At the age of eighteen he was sent to sea on board an East Indiaman, and in 1720 his father, a farmer-general of taxes, who was a shareholder in the French East India Company, had him appointed to a seat in the Council at Pondicherry, where he combined admirable official work with the amassing of wealth by legitimate trade speculations. Ten years later he became superintendent at Chandernagore in Bengal. The remarkable success of his administration here led to his being appointed, in 1741, governor-general of all the French Indies, with the title of Nawab. He now successfully pursued that policy of patient skilful diplomacy among the Indian princes, which at one time made the Carnatic almost a French province. His ostentation, the increase and discipline of his army, and his improvements in the defences of Pondicherry had already begun to alarm the English Company, when war broke out in Europe between France and England (1742). La Bourdonnais, the governor of Bourbon and the Isle of France, having sailed with a powerful squadron to the Coromandel coast, took Madras, but, without authority, and in consideration of a bribe of £40,000 from the English Company, agreed to restore it to the English on payment of a ransom. This Dupleix refused to accede to, and violent disputes followed between the two governors, the result of which was that La Bourdonnais was recalled. Several brilliant engagements planned by Dupleix took place between the French garrison and the troops of the Nawab of the Carnatic, who endeavoured to take possession of Madras, but was precipitately forced to raise the siege. An attack on the English at Fort St David failed, but Dupleix's science and courage were eminently displayed in the defence of Pondicherry, which Admiral Boscawen in vain attacked for five weeks, with an apparently overwhelming force, but was forced to retire discomfited, although the defence was conducted by a civilian, unsupported by a single general of repute. The ambitious mind of Dupleix had long formed the project of founding a French empire in India on the ruins of the Mogul monarchy, and with this purpose he mixed ingeniously in all the intrigues of Southern and Central India, made himself master of the court of Hyderabad, and placed a creature of his own on the throne of the Carnatic, while he impressed the native imagination by adopting all the pomp and splendour of the Oriental. His military designs, however, able as they were, were frustrated by the energy and military genius of Clive and Lawrence; but the struggle continued until 1754, in which year Dupleix was recalled by Louis XV., who had patched up an agreement with England on the subject of the rival Indian companies, which was embodied in the futile Peace of Pondicherry, 1755. La Bourdonnais had actively laboured to disparage Dupleix, and the French Company had not seconded their governor's ambi-

tious schemes, and refused to reimburse him for the vast sums he had spent out of his private fortune in carrying on the war. He died in poverty and neglect in 1763. See Hamont, *Dupleix d'après sa Correspondance inédite;* Cultru, *Dupleix, ses plans politiques, sa disgrace* (1901); Alfred Martineau, *Dupleix et l'Inde française* (1920 *et seq.*); and Lives by Malleson (1890), Guérin (1908), and Biddulph (1910).

Duplicand, a double payment of feu-duty on certain occasions. See CASUALTIES OF SUPERIORITY, FEU.

Duplication. See DOUBLING THE CUBE.

Duplicidentata ('double-toothed'), a suborder of Rodentia (q.v.), distinguished from the Simplicidentata by the possession of a second pair of upper incisors. It includes the hares and rabbits, and the tailless hares or pikas.

Düppel, or DYBBÖL, a village of Danish Slesvig, 15 miles NE. of Flensburg. In 1849 it was stormed by the Germans, supporting the Sleswick-Holsteiners against the Danes; and in 1864, by the Prussians, after a month's bombardment.

Dupré, JULES, landscape-painter, was born at Nantes in 1812, and died at Paris 8th October 1889. His aim was to produce a *paysage intime* rather than a pretty picture, and was specially skilful in the management of the light and tone.

Dupuis, CHARLES FRANÇOIS, *savant*, was born in 1742, and already in 1766 was called to a chair of Rhetoric in Paris, when he was led to explain mythology by means of astronomy. A work on this subject appeared in 1781. He was now appointed professor of Eloquence in the Collège de France, member of the Académie des Inscriptions, and during the Revolution, a member of the Convention, next of the Council of Five Hundred, and afterwards of the legislative body, of which he became president. He died in 1809. His great work, *Origine de tous les Cultes, ou Religion Universelle* (1795, 10 vols.), was an extension of the memoir of 1781, and no doubt originated the famous commission afterwards appointed by Napoleon to explore Upper Egypt, which Dupuis had pointed out as the general source of southern mythology.

Dupuytren, GUILLAUME, BARON, a French surgeon, was born in 1777, and in 1812 was appointed professor of Clinical Surgery and surgeon-in-chief to the Hôtel-Dieu in Paris. He died in 1835. Keen in diagnosis, and firm of nerve, he invented many ingenious modes of operation and various surgical instruments.

Duquesne, a borough of Pennsylvania adjoining McKeesport, has steel-works and blast-furnaces; pop. 19,000.

Duquesne, ABRAHAM, MARQUIS, French naval officer, was born at Dieppe in 1610, and distinguished himself in 1637–43 in the war with Spain. During Louis XIV.'s minority he entered the Swedish service, and rose to the rank of vice-admiral. Returning to France, he reduced to submission Bordeaux, which had declared for the Fronde. He was successful in several engagements with De Ruyter and Van Tromp in 1672–73, and defeated the united fleets of Spain and Holland off Sicily in 1676, in an action in which De Ruyter fell. On the revocation of the Edict of Nantes, Duquesne was made the only Protestant excepted from the general decree of banishment. He died 2d February 1688. See Jal, *Duquesne* (1872); Laughton, *Studies in Naval History* (1887).

Dura Den, between Cupar and St Andrews, in Fife, a small glen through which runs a tributary of the Eden, famous for the numerous and beautifully preserved fossil fish entombed in its yellow sandstone (Upper Old Red Sandstone).

Dura Mater, the outermost membrane of the brain and spinal column, distinguished from the arachnoid and the pia mater. See BRAIN, NERVOUS SYSTEM.

Duramen, or HEART-WOOD, in Botany, the inner and fully ripened wood of dicotyledonous trees. The division is often very marked between the *duramen* and the *Alburnum* (q.v.), or sap-wood, the former being more dense and compact, and also frequently of a darker colour, as most notably in ebony. As timber it is much more valuable and durable than the alburnum; hence this distinction is as well known to the carpenter or cabinetmaker as to the botanist. See TIMBER, WOOD.

Durán, AGUSTÍN, Spanish poet and critic, born at Madrid in 1789, studied law at Seville, and became an advocate. He was employed in the education office, the board of press censorship, and the national library. He died in 1862. He collected and edited old ballads (*Romancero General*) and plays.

Duran, ÉMILE AUGUSTE CAROLUS (1837–1917), painter, was born at Lille. In 1853 he began to study in Paris; in 1861 he went to Rome; and afterwards spent some time in Spain, where his style was powerfully influenced by Velasquez. For 'L'Assassiné' (1866) he gained his first medal; and in 1878 he exhibited his design—'Gloria Mariæ Medicis'—for a ceiling in the Luxembourg. Duran, however, is most widely known by portraiture, which is distinguished by great vigour, force of colouring, and power of direct realism. Among his portraits may be named those of Émile Girardin and Pasteur, and an equestrian one of Mdlle. Croizette. He was also a most successful teacher.

Durance, an unnavigable river of SE. France, rises in the department of the Hautes-Alpes, and joins the Rhone 3 miles below Avignon, after a course of 235 miles. An aqueduct from it, 51 miles long, supplies Marseilles with water, and irrigates 25,000 acres, otherwise parched.

Durand, MADAME. See GRÉVILLE (HENRY).

Durandus, GULIELMUS (1237–96), born at Puimisson near Béziers, studied canon law at Bologna and Modena, and had held various offices under several popes, when in 1286 he became Bishop of Mende, still, however, remaining in Rome, where he died. His *Speculum Judiciale* (1271; first printed 1474) is his most famous work; of his *Rationale Divinorum Officiorum* (Mainz, 1459), book i. was translated by J. M. Neale and B. Webb as *The Symbolism of Churches* (1843), book iii. by T. H. Passmore as *The Sacred Vestments* (1899).

Durango (called also *Guadiana* and *Ciudad de Victoria*), a town of Mexico, on a dry plateau, 6700 feet above sea-level, 500 miles NW. of the city of Mexico. It is handsomely built, with a cathedral, a former Jesuit college, a theatre, and a mint, and has very rich deposits of iron ore and other minerals. Pop. 34,000.—The State of Durango (40,000 sq. m.; pop. 333,000), of which Durango is capital, consists of the mountain range of Sierra Madre in the west, and a dry plateau in the east. Several rivers drain to the Pacific, and the Nazas eastwards to an inland basin. Cattle and sheep are raised, and silver, iron, and other minerals got.

Durazzo (Serb *Drač*, Albanian *Dúrresi*), a port of Albania on the Adriatic, 50 miles S. of Scutari. It is a poor, decayed place, with 5000 inhabitants, and a ruined citadel; but the harbour, though sanding up, is the most important of Middle Albania.—Durazzo is the ancient *Epidamnos*, founded about 625 B.C. by Corcyræans and Corinthians. It became a great and populous city, but was much harassed by the party strifes which ultimately led to the Peloponnesian

War. Under the Romans it was called *Dyrrhachium* (whence its modern name), and became the principal landing-place for those sailing from Brundusium in Italy to Greece; and the great military road to the Hellespont began here. The town is memorable for the battles of Cæsar and Pompey in 48 B.C.; but it attained its highest consequence about the end of the 4th century A.D., when it became the capital of the Byzantine province of New Epirus. After being possessed successively by the Ostrogoths, the Bulgarians, the Normans, and the Venetians, and destroyed by an earthquake in 1273, it was conquered by the Turks in 1501. The Austrians took it in 1916, the Italians in 1918. It is the provisional capital.

Durban, or PORT NATAL, the seaport and largest town of Natal, is beautifully situated on the northern shore of a nearly land-locked tidal bay. Pop. (1866) 4991; (1891) 36,014; (1911) 69,187; (1921) 96,264, including some 48,500 natives, Indians, and other coloured persons. The climate, hot and rainy from November to March, is healthy for Europeans. Port Natal was named Durban after Sir Benjamin D'Urban, governor of the Cape, when Natal was declared British (1842).

In the heart of the town are public gardens, in which a new town-hall has been erected, with municipal offices, public library, museum, and art gallery. The law-courts are also new. Other conspicuous buildings include the post-office (old town-hall), market-house, and the railway terminus. Durban has a theatre, Botanic Gardens, a race-course, and several public parks. The Berea, a low range of hills overlooking the town, is a fashionable suburb with pretty villas and gardens. Municipal electric cars run along the main roads, and jinrickshas speed everywhere. An attractive marine beach has been laid out for holiday-makers. The town has efficient systems of lighting, drainage, and water-supply. Apart from shipping, Durban has few industries; it has dynamite-works, jam-factories, and a whaling-station. The Bluff, a bold, sheltering promontory at the southern entrance of the harbour, is fortified, and bears a lighthouse. North of the narrow entrance is the Point, with extensive quays, floating-dock, &c. Farther up are reclaimed lands with wharves, and a very large graving-dock (1920–24). The enclosed basin, over 7 square miles, is largely shoal water. For long Durban contended with a bar at the harbour-mouth; dredging and other devices at last brought success, and now vessels of deep draught can enter without difficulty. Coal, wool, hides, maize, sugar, and other South African products are exported; all Natal's imports, and much of the Transvaal's and Orange Free State's, enter *viâ* Durban. Railways run to the end of the Point and of the Bluff, north and south along the coast, and inland to Pietermaritzburg (70 miles), Johannesburg (483 miles), and Bloemfontein. See NATAL.

Durbar (Persian *darbár*, 'court,' 'audience'), a state reception of the Emperor or Governor-general of India or one of the native princes. Specially memorable are those of 1877, when Queen Victoria was proclaimed Empress of India, and of 1911, when George V. received homage in person.

Düren (Roman *Marcodurum*), an ancient town of Rheinland, on the Roer, 18 miles E. of Aix-la-Chapelle. It has manufactures of cloth, iron and steel, paper, sugar, carpets, and beer. Pop. 34,000, of whom about 3000 are Protestants.

Dürer, ALBRECHT, the most celebrated artist of Germany, was born at Nürnberg, 21st May 1471. His father, a devout and excellent man, was a goldsmith, and he carefully trained his son, and instructed him in his own craft. But the youth showed greater inclination for painting, and in very early years had already attained considerable artistic skill, as is proved by such drawings as the portrait of himself at the age of thirteen, now in the Albertina Collection, Vienna. He was accordingly apprenticed to Michael Wolgemut, the best painter in the town at the time, and the chief illustrator of the famous Nürnberg Chronicle. After serving his time under this master, Dürer started on his travels in 1490; and there is reason to believe that he found his way to Italy and visited Venice. On his return his father arranged a marriage for him with Agnes Frey, the daughter of a Nuremberg merchant. It has been constantly asserted that the union was an unhappy one, but Thausing, Dürer's most accurate biographer, has shown reason for believing that the letter of Pirkheimer, written two years after the painter's death, upon which this statement is founded, should be received with great caution. Dürer now established himself in his native town; and, largely aided by such assistants as Hans Leonhard Schäufelein, Hans von Kulmbach, and Hans Baldung, he executed many paintings, among which the triptych in the Gemälde Galerie, Dresden, and the fine Paumgartner altar-piece in the Pinakothek, Munich, may be named. In 1498 he published his first great series of designs on wood, the illustrations of the Apocalypse, which, it seems to be now generally admitted, were, like the rest of Dürer's work of the kind, cut upon the block by a professional engraver. The copper-plates of this period include 'The Prodigal Son,' assigned to 1500; the 'Shield of the Death's Head' (1503); the 'Shield with the Lion and Cock,' assigned to the same year, and in technique one of his most accomplished engravings; and the 'Adam and Eve' (1504). In 1504 he completed his 'Adoration of the Kings,' begun in tempera and finished in oils, now in the Tribune, Florence; and the elaborate copper-plate of 'St Eustachius' probably dates from the same time.

In 1505 Dürer visited Venice, with the view of arresting the piracy of his works by Marc Antonio, who had copied, line for line upon copper, certain of his woodcuts of the 'Life of the Virgin,' which had been executed previous to this date, though the completed work was not issued till 1511. Here he produced the 'Feast of the Rose-garlands,' now the property of Strahow monastery, Prague, of which he writes: 'I have also silenced the painters, who said I was a good engraver, but did not know how to manage colours. . . . There is not a better picture of the Virgin in the land.' On his return he painted his 'Adam and Eve' (1507), now in the Madrid Museum; and his 'Assumption of the Virgin,' a work executed with unusual care and elaboration, as is indicated by the painter's correspondence, and proved by the very numerous studies for its various parts which still exist. The central portion of this altar-piece, executed entirely by his own hand, was destroyed by fire in 1674. It was followed in 1511 by the All Saints' picture, styled 'The Adoration of the Trinity,' in the Vienna Gallery.

Dürer was much employed by the Emperor Maximilian I., of whom he executed several portraits, for whose prayer-book he designed a famous series of decorations, and in whose honour he drew the 'Triumphal Car' and the 'Triumphal Arch,' which were engraved on wood, the latter on ninety-two blocks, which when united form a surface 11 feet 3 inches by 10 feet wide—the largest known woodcut.

It was after the death of the emperor, and in order to recover sums due for his commissions, that the painter visited the Netherlands in 1520. His curious journal of the expedition has been preserved and published. At Antwerp he made the acquaintance of Erasmus, whose portrait he drew, and

afterwards engraved on copper, and he was present at the coronation of Charles V., who appointed him his court-painter; but among the swamps of Zealand he seems to have contracted a kind of low fever, and his health gradually failed, till he died at Nuremberg, 6th April 1528. During his later years the earnest and reverent-minded painter manifested great sympathy with the doctrines and progress of the Reformation; his journal in the Netherlands contains an impassioned outburst of grief, occasioned by the supposed death of Luther; and in 1526 he presented to the council of his native town a pair of companion panels, representing St John with St Peter, and St Paul with St Mark, inscribed with warning texts from Luther's translation of the Epistles.

Both upon technical and intellectual grounds Dürer ranks as the greatest of German artists; and his work is thoroughly national in character, fully expressive of all the homeliness and all the mysticism of the German nature. His paintings are distinguished by effective composition, careful manipulation, and forcible colouring; and that searching grasp of character and expression which renders his work in portraiture so valuable gives a sense of truth and reality to his subject-pictures also. His 'Four Apostles,' above referred to, and now at Munich, are interesting as exhibiting the final development of his pictorial style, being far broader in handling and larger in the disposition of the draperies than his earlier works. His masterly drawings and studies are very numerous, and are to be found in most public collections, those of the Albertina, in Vienna, and of the British Museum, London, being the richest. As an engraver on metal and a designer of woodcuts Dürer ranks even higher, and has certainly been more widely influential than as a painter. His work on copper and on wood is distinguished by the most unerring perception of the capabilities of his material, his metal-plates being executed with extreme finish and refinement, the burin being handled in a manner exceptionally free and painter-like; while his woodcuts are boldly drawn with a broad expressive line, such as could be easily followed by the engraver employed to cut the block. The most celebrated of his copper-plates, which number over 100, are those mentioned above; the 'Little Passion,' on copper (16 plates, 1508–13); 'St Jerome in his Study' (1514); and the 'Melancolia' (1514), and the 'Knight, Death, and the Devil' (1513)—two great imaginative designs, which are so filled with mysterious and poetic suggestiveness as to be susceptible of the most diverse interpretations. Dürer may also be regarded as the inventor of etching, as he produced several plates in which all the lines are bitten with acid, as well as others in which the process is used in preparation for work with the burin. His woodcuts are about 200 in number, including the 'Greater Passion,' 12 subjects; 'The Little Passion,' on wood, 37 subjects; 'The Apocalypse,' 16 subjects; and many single prints of religious, mythological, portrait, and heraldic designs. It has been asserted that Dürer executed several plastic works. The finest of these is the 'Birth of St John the Baptist,' a relief on soap-stone in the British Museum; but Thausing regards this and all similar works as spurious. Dürer was also author of various scientific writings, of which the *Instructions in Measurement* (1525), the *Treatise on Fortification* (1527), and the *Treatise on Human Proportion* (1528) are most important.

See Lives by W. B. Scott (1872), Mrs Heaton (1872), Thausing (trans. by Eaton, 1882), Barlow (1923); the French work of Ephrussi (1882); the German Life by A. von Eye (1882); Knackfuss, *Dürer und Holbein* (1895); and the monograph by Lionel Cust (1897). The standard editions of the prose writings are those by Jansen (*Alb. Duereri Opera*, 1603) and by Lange and Fulse (1893); an abridged English translation of them was published by Sir W. M. Conway in 1889. Reproductions of his metal engravings were published by Amand-Durand of Paris, and of his woodcuts of his 'Apocalypse' and 'Life of the Virgin,' by Van de Weijer of Utrecht. Thirty-three of the thirty-seven blocks of his 'Lesser Passion,' on wood, are preserved in the British Museum, and stereotype reproductions of these were issued in 1844 and succeeding years.

Duress, in English law, is the plea of a man who has obliged himself to pay or perform, or who has committed a misdemeanour, under compulsion by restraint of liberty, or threat of loss of life and limb. In such cases he may plead to be held free of the consequences.

D'Urfey, THOMAS, dramatist and song-writer, was born at Exeter in 1653. Of Huguenot descent he was boisterous in his Protestantism all his life. Shackerley Marmion was his remote kinsman; a nearer one was Honoré d'Urfé (1568–1625), author of the famous romance of *Astrée*. He early became a busy playwright, his comedies especially being popular. Among these were *The Fond Husband, or the Plotting Sisters* (1676); *Madame Fickle, or the Witty False One* (1677); and *Sir Burnaby Whig, or No Wit like a Woman's* (1681). In 1683 he brought out his *New Collection of Songs and Poems*, which was followed by a long series of songs in volumes and sheets, which were finally in 1719 collected into an edition in five volumes, as *Wit and Mirth, or Pills to Purge Melancholy*, supplemented by a sixth volume in 1720 (repr. 1872). Meanwhile D'Urfey had been busy with a long series of plays, for the morals of which he suffered like the rest from the heavy hand of Jeremy Collier. He never married; and though he was not particularly profligate, his fortunes had declined as his comedies ceased to please. Charles II. had done him the honour to lean upon his shoulder, but does not seem to have put anything in his pocket; the good Queen Anne had paid him fifty guineas for his singing to her at supper. Tom D'Urfey, as he was called by everybody, was very popular with his contemporaries, and seems to have been a cheerful, kindly, and fairly worthy fellow, convivial but not dissipated in his habits, loving and dutiful to his mother, if the evidence of pious verses may be believed. Benefits in his behalf were promoted by Addison and Steele, and the former thus pleaded in his behalf: 'He has made the world merry, and I hope they will make him easy, as long as he stays among us. This I will take upon me to say, they cannot do a kindness to a more diverting companion, or a more cheerful, honest, good-natured man.' D'Urfey died 26th February 1723. See Ebsworth's admirable article in volume xvi. (1888) of the *Dictionary of National Biography*.

Durga, the wife of Siva (q.v.).

Durham, a maritime county in the north-east of England, between Tyne and Tees. It has 32 miles of coast, generally low, but with some cliffs; area of land and water, 1012 sq. m., two-thirds being arable. The surface is hilly, and slopes to the east. In the west, which is waste but rich in minerals, are branches of the Pennine chain, rising in Kilhope Law, 2196 feet; Collier Law, 1678; and Pontop Pike, 1018. The two chief branches inclose the valley of the Wear, and send forth several parallel ranges, declining toward the coast, and inclosing many fertile tracts and sheltered valleys. The chief rivers are the Wear, Tyne, and Tees, navigable respectively for 12, 15, and 10 miles. The rocks are new red sandstone, magnesian limestone, millstone grit, carboniferous limestone, rich in lead; and coal-measures, forming the valuable Durham coalfield, 25 by 10 miles, with many

faults, and with about forty beds of coal, 3 to 10 feet thick. Basalt and greenstone trap dykes intersect the west part of Durham. The mineral products are coal, limestone, black marble, freestone, ironstone, firestone, slate, millstone, grindstone, iron pyrites, fluor-spar, zinc, barytes, and lead. The principal lead-mines are in Teesdale and Weardale. The production of lead, once important, has dwindled away; and the zinc mines have been given up. Large furnaces for the production of iron are in operation in various parts of the county. Durham has the largest coal production of any county in England, the number of persons employed above or below ground at the mines being over 150,000. The chief shipping ports are Stockton-on-Tees, South Shields, Sunderland, and Hartlepool. In the eastern districts it is intersected in all directions by railways. The soil is a clayey or dry loam. The chief crops are oats, wheat, barley, turnips, potatoes, and other green crops. The Teeswater or Holderness breed of cattle is famed for fattening, quantity of milk, and early maturity. The Durham horses are famed for draught and the saddle. Many sheep are pastured on the hills. There are manufactures of iron and steel, coke, alkalies and chemicals, and salt, and much shipbuilding at Jarrow, Sunderland, South Shields, Hartlepool, and Stockton. Coal is the chief export. Durham is one of the three counties palatine (see PALATINE) of England, the other two being Lancaster and Chester. It was the only county palatine in the hands of a subject, and belonged to the Bishop of Durham. By 6 and 7 Will. IV. c. 19, the palatine jurisdiction was separated from the bishopric, and vested in the crown. Till 1844 three wards adjoining Berwick formed a detached part of Durham; they were then incorporated with Northumberland. The county is divided into four wards. It is entirely in the diocese of Durham. Pop. (1801) 149,384; (1841) 307,963; (1881) 867,576; (1921) 1,478,506. The chief towns are Durham, the county town, Sunderland, Darlington, Gateshead, South Shields, Stockton, and Hartlepool. The county includes eleven parliamentary divisions, each returning one member; and the following parliamentary boroughs: Sunderland, returning two members, and Darlington, Gateshead, Hartlepool, South Shields, and Stockton, each returning one. Durham has some ancient barrows, and has afforded many Roman antiquities, as altars, urns, and coins. There are extensive remains of Roman stations at Lanchester, Binchester, and Ebchester. Durham formed part of the kingdom of Northumbria (547–827). Later it suffered severely from the incursions of the Scots. See county histories by R. Surtees (1816–40) and W. Fordyce (1855–57); Lapsley, *County Palatine* (1900); 'Victoria History' (1905 *et seq.*); Mawer, *Place-names of Northumberland and Durham* (1921); Vikar, *Durham Dialect* (1922).

Durham, a municipal (till 1918 parliamentary) borough, and ancient episcopal city, near the middle of Durham county, 12 miles S. of Newcastle, is built around a steep rocky hill 86 feet high, nearly encircled by the Wear. On the top of the hill are the cathedral and castle. Ancient walls partly enclose the hill, from which are fine views of the fertile wooded country around, and of the suburbs across the river. Its manufactures (mustard, carpets, and iron) have decayed. In the vicinity are coal-mines and coke-ovens. Pop. of municipal borough (1841) 14,151; (1921) 17,329. Once it sent two members to parliament, but from 1885 to 1918 only one. Durham arose about the year 995, when Bishop Aldune brought hither St Cuthbert's bones from Ripon, and built a church to enshrine them. On the site of this church, Bishop William de Carilepho, about 1093, began the present cathedral, one of the noblest specimens of Norman architecture in the kingdom, alike from situation and from structure, that massive pile—'half church of God, half castle 'gainst the Scot.' To the main structure various additions continued to be made up till 1500; and the whole has on various occasions undergone extensive renovation. Its extreme length is 510 feet; length of the transept, 175 feet; height of the central tower, 214 feet; and height of the two western towers, 138 feet. The cathedral contains many old monuments, and the tombs of St Cuthbert (q.v.) and of Bede. The castle, once the residence of the bishops of Durham, but now occupied by the university, was founded about 1072, by the Conqueror, in the Romanesque style, but it has received many alterations and additions. The dormitory of the monastery of Durham, now the new library of the cathedral, is one of the finest in England. The see extends over the county of Durham (Northumberland having been detached in 1882 to form the diocese of Newcastle); among the bishops of Durham have been Bek, Aungerville, Wolsey, Cosin, Butler, and Lightfoot. Two of the bridges over the Wear dated originally from the 12th century. Durham possesses seven parish churches, a town-hall, a miners' hall, large prison, grammar-school, diocesan training-colleges, and a school of art.

Durham Cathedral.

A college was founded in Oxford in 1290 by the prior and convent of Durham. It was abolished, however, at the dissolution of monastic houses in the reign of Henry VIII., and its endowments given to the dean and chapter of Durham. Under the Commonwealth, Cromwell instituted a college here, and endowed it with the sequestrated revenues of the dean and chapter, to whom, however,

these revenues again reverted at the Restoration, when Cromwell's college was suppressed. The present university of Durham was opened for students in 1833, under the provisions of an act of parliament, obtained by the dean and chapter during the previous year. A royal charter in 1837 empowered the university to bestow degrees. Licentiates in theology must be members of the Church of England; but otherwise subscription is not required from any member of the university. Among its colleges are University College, Hatfield's College, and the College of Medicine at Durham, and Armstrong College at Newcastle-on-Tyne.

Durham, JAMES, a Covenanting minister, was born at Easter Powrie, in Forfar, in 1622, studied at St Andrews, fought as captain in the Civil War, and became a preacher in 1647. He was chaplain to Charles II. in 1650–51, and minister in Glasgow till his death, 25th June 1658. He left numerous sermons and several expository works, but is best known for his *Clavis Cantici, or an Exposition of the Song of Solomon* (1668).

Durham, JOHN GEORGE LAMBTON, EARL OF, an English statesman, was born, the descendant of an ancient Durham family, in London on the 13th April 1792. Of decided liberal sympathies, he was in 1813 returned for the county of Durham, and though he did not speak on many questions, he took an active part in furthering all projects of a reforming tendency, even bringing forward in 1821 a scheme for parliamentary reform much more advanced than that of 1832. In 1828 he was raised to the peerage, with the title of Baron Durham of the city of Durham. Under the administration of Lord Grey (1830) he held the office of Lord Privy Seal, and was one of the four persons who drew up the Reform Bill, and supported it in the House of Lords. He was not in cordial relations with his colleagues, and resigning his office on the plea of ill-health in 1833, was made an earl. For a time he was ambassador at St Petersburg. In 1838 he was appointed Governor-general of Canada, where, owing to the revolt of the French in Lower Canada, the constitution had been suspended. Lord Durham's measures were statesman-like but dictatorial; and the House of Lords voted disapproval of some of his acts. Thereupon he took the extraordinary step of returning to England without either being recalled or obtaining the royal consent. His famous report on Canada (falsely attributed to Charles Buller; and edited in 1912 by Sir C. P. Lucas) anticipated many of the best features in the present Canadian constitution. He died at Cowes, 28th July 1840. See his *Life and Letters,* by Stuart J. Reid (1906).

Durham, SIMEON or SYMEON OF, historian, was a monk of Durham. His *Historia Ecclesiæ Dunelmensis* seems to have been written between 1104 and 1108; his *Historia Regum Anglorum et Dacorum* comes down to 1129. Other works have been attributed to him. Simeon, who became precentor of Durham, seems to have been dead in 1138. See his *Opera Omnia,* edited by Thomas Arnold (Rolls Series, 1882–85).

Durian, or DURION (*Durio zibethinus*), an Indian and Malayan fruit-tree of Malvaceous affinities, usually reckoned in the order Bombacaceæ. It is a lofty tree, with leaves resembling those of the cherry, and large bunches of pale-yellow flowers. The fruit is of the size of a man's head, roundish oblong, with a hard thick rind, covered with soft spines. The pulp is of a creamy consistence and delicious taste, but has a putrid smell which is at first very repulsive. Persons accustomed to it, however, universally regard the durian as one of the very finest fruits of the East. It contains ten or twelve seeds, as large as pigeons' eggs, which, when roasted, are not inferior to chestnuts. One tree yields about 200 durians in a year.

Dürkheim, a small town of Rhenish Bavaria, 6 miles SW. of Mannheim, at the base of the Hardt Mountains, with mineral wells and salt-works.

Durlach, an old town of Baden, on the Pfinz, at the base of the Thurmberg, 4 miles E. of Carlsruhe, manufactures linen, iron, sewing-machines, &c., and has fruit and grain markets; pop. 15,000.

Durostor, a Rumanian department in the Dobrudja.

Durra (*Sorghum*), a genus of grasses, which is also called Durra Millet and Indian Millet, or Sorgho Grass. The genus is closely allied to sugar-cane (*Saccharum*) and Beard-grass (*Andropogon*). The species are generally annual, tall, broad-leaved grasses, having strong culms filled with a juicy and saccharine pith, and large panicles. Several of them are cultivated as corn-plants, chiefly in Asia and Africa, particularly the common durra (*S. vulgare—Holcus Sorghum* of the older botanists), also called Joar and Jowaree in India. It grows 4 to 8 feet high, with thickly crowded panicles. It is a coarse, strong grass; its grain is round, a little larger than mustard seed. It is extensively cultivated in Asia Minor, India, the Sudan, and South Africa, and may perhaps be described as the principal corn-plant of Africa. It is also cultivated to a considerable extent in the south of Europe, sparingly in Italian Switzerland. In Germany the summer is not long and warm enough. The climate of Britain is still less suitable. Durra yields a very abundant produce, in this respect even rivalling maize, but the meal does not make good bread; it is excellent, however, prepared in other ways. The culms and leaves are excellent food for horses and cattle, as is the grain, which is useful also for brewing and distilling purposes. In Armenia it is grown as fodder, and yields as many as seven or eight crops.—The seeds of the Shaloo or Sugar-grass (*S. saccharatum*) are more pleasant to the taste than those of the common durra. It is cultivated in the warm parts of Asia and in Africa, and has a diffuse and very spreading panicle. The sweet pith of the culm is eaten, and is also of value as a source of sugar, for which it is successfully cultivated in the United States (see SUGAR).—KAFIR CORN (*S. caffrorum*) is largely cultivated in South Africa, both by Kafirs and by the colonists; by the latter chiefly for feeding horses.—*S. halepense* is a troublesome weed in North Italy, like couch-grass. Its sweet rhizomes furnish a local substitute for sarsaparilla.

Dürrenstein, a village of Lower Austria, is situated in a highly picturesque locality, on the left bank of the Danube, 45 miles WNW. of Vienna. In its ruined castle, Richard Cœur-de-Lion was confined by Leopold of Austria for three months.

Dursley, a town of Gloucestershire, amid picturesque scenery, near the Cotswold hills, 15 miles SW. of Gloucester by rail. Near it are quarries of Bath-stone.

Duruy, VICTOR, historian and educationist, was born in Paris, 11th September 1811. Destined for a designer in the Gobelins tapestry-works, he showed singular aptitude for learned studies, and, entering the École Normale in his nineteenth year, in 1833 became professor of History in the Collège Henri IV. From 1863 to 1869 he was Minister of Public Instruction, and as such carried out some important reforms, though his scheme for free and compulsory education was defeated by the clericals.

His numerous and important works, published between 1838 and 1879, include historical geographies of the Roman empire, of the middle ages, and of France, histories of France and Greece, and his *magnum opus*, the *Histoire des Romains* (trans. 6 vols. 1883–86). He was Grand Officer of the Legion of Honour (1867), and member of the Academy (1885), and died 25th November 1894. See Life by Lavisse (1895).

Dushan. See SERBIA.

Dussek (pronounced *Dushek*), JAN LADISLAW, composer and pianist, born 9th February 1761, at Czaslau in Bohemia, and became organist at Mechlin and Bergen-op-Zoom. At Amsterdam he met with much success, both as a teacher and performer, and here he produced his earliest works for the pianoforte; he afterwards resided at the Hague, and in Hamburg, Lithuania, Paris, Milan, and London (1788–1800), where he was very popular. In 1803–6 he lived as instructor and boon companion with Prince Louis Ferdinand of Prussia, whose death called forth the beautiful and pathetic 'Elégie Harmonique' (op. 61); in 1807 he entered the service of Prince Talleyrand, and thenceforward devoted most of his time to composition. He died at St Germain-en-Laye, 20th March 1812. To his contemporaries Dussek was the greatest of pianoforte specialists; there was a fascination in his style that raised him above even Clementi and Cramer. Of the seventy-seven numbered opus works, besides many without opus numbers, which he left behind, all, with few exceptions, were shortly forgotten.

Düsseldorf, the chief town of the populous district of Düsseldorf, in Rheinland, is situated on the right bank of the Rhine, at the influx of the Düssel, 24 miles NNW. of Cologne. It was formerly fortified, but its ramparts were converted into promenades in 1802, after the treaty of Lunéville. The streets, many of which are planted with rows of trees, are regular and spacious, while the eleven squares and the extensive garden-grounds in and near the town, are tastefully laid out and embellished with fountains and statues. Düsseldorf has recently considerably developed its trade and industries, but its chief importance is still as a centre of art. In the market-place rises a colossal equestrian statue of the Elector Johann Wilhelm, who founded a famous picture-gallery here in 1690, most of which, however, was removed to Munich in 1805. The Düsseldorf Academy was founded in 1767, reorganised in 1822, and attained great eminence during 1822–59, under the management of Cornelius and Schadow. Its reputation has again begun to revive. The present building, an imposing Renaissance edifice, with a façade 520 feet in length, was finished in 1879. The Art Hall (1881–1902) contains a gallery of modern paintings. Among the other principal buildings are the old electoral palace (1710–1846; burned 1872); the present palace, the residence of the governor of the province; the government house, the observatory, town-hall (1567), theatre, gymnasium, and public library (90,000 vols.). Of about forty churches the most remarkable are those of St Andrew, formerly the church of the Jesuits, a handsome and highly ornate structure completed in 1629, and St Lambert, dating from the 14th century. The Hofgarten is one of the finest public gardens in Germany. Adjoining it are the house and garden of the philosopher Jacobi, now the property of the famous 'Malkasten' club of artists. The iron and cotton industries are very important, employing thousands of hands. Düsseldorf has also manufactures of pianofortes, paper, soap, beer, chemicals, tobacco, chocolate, glass, &c., besides mills of all kinds, and photographic, lithographic, printing, and other institutions. Its rapidly growing commercial and industrial importance is fostered by its situation on the Rhine and at the junction of several railways. Düsseldorf is also an important educational centre. Pop. (1875) 80,750; (1885) 115,190; (1900) 213,767; (1910) 358,728; (1919) 407,338. Made a town by the Duke of Berg in 1288, it became the capital of the duchy in 1385; and in 1609 passed to the Palatinate. In 1806 it became the capital of the duchy of Berg, which was revived for a brief period by Napoleon, and in 1815 was united to Prussia. It was made a free port in 1829. The brothers Jacobi, Heine, Varnhagen von Ense, and the painters Cornelius and Peter von Hess, were born at Düsseldorf.

Dust is present in the atmosphere from various causes. The existence of dust in the air of a room or in a liquid is proved by the fact that we can trace the course of a beam of light through the air or the liquid by means of its partial reflection from suspended motes. The dust in the atmosphere is carried up in part from the earth's surface by currents of air, and in part by evaporation. A great part of it is due to volcanic action, and part also, the so-called 'cosmic dust,' has a meteoric origin (see METEORS). The blue colour of the sky is due to the reflection of light from particles of dust, possibly even from particles of air. Aitken showed that no condensation of moisture in the air (as in rain, mist, fog; see FOG) could occur without nuclei such as dust particles. He also devised an apparatus for counting the number of dust particles in a given sample of air or gas.

Dust-brand. See SMUT.

Dusty-foot. See PIEPOWDER COURT.

Dutch is an English form corresponding to the German *Deutsch* (old *Diutisk*, 'belonging to the people'), which by them is used specifically for German, and in a wider sense is applied to both High German (*Hochdeutsch*) and Low German (*Niederdeutsch*), of which Plattdeutsch (q.v.) is a variety, or still more widely for Germanic or Teutonic (see TEUTONS). *Teutones* is from the same root. Formerly *Dutch* and *Dutchland* were used in English for 'German' and 'Germany,' what is now called 'Dutch' being then 'Low Dutch'; but 'Dutch' has been long restricted in its reference to Holland and the things thereto pertaining. The people of Holland (who call themselves *Nederlandsch*) use their forms *Duitsch*, *Nederduitsch*, as the Germans do *Deutsch*, *Niederdeutsch*. For Dutch Language and Literature, see HOLLAND.

Dutch Liquid is an oily substance obtained by mixing chlorine and olefiant gases, which combine together and yield Dutch liquid, with the formula $C_2H_4Cl_2$. It has a specific gravity of 1·271 (water = 1·000), boils at 185° (85° C), is not miscible with water, but readily dissolves in ether and alcohol. It produces Anæsthesia (q.v.), just as Chloroform (q.v.) does; but the great difficulty of preparing Dutch liquid in commercial quantities retards its employment as an anæsthetic.

Dutch Metal, sometimes called *Dutch gold* or *Dutch leaf*, is an alloy of copper and zinc. In other words, it is a kind of brass containing a large percentage of copper. It is made in the same manner as gold-leaf, and is said not to exceed $\frac{1}{52000}$ inch in thickness. Dutch leaf dissolves in strong nitric acid; true gold-leaf does not. The former is also easily tarnished. Ordinary Dutch metal is yellow, but a white kind is made, and both are used for coffin furniture.

Dutch Rushes. See HORSETAILS.

Dutens, LOUIS, a French writer, was born at Tours, 15th January 1730. A Protestant, he came to England about 1750, went with the English

ambassador to the court of Turin as his secretary, and afterwards remained as *chargé-d'affaires*. He held a pension, in 1766 was presented to the rich living of Elsdon, in Northumberland, and was likewise made Historiographer Royal of Great Britain. He died 23d May 1812. He undertook the first comprehensive edition of Leibnitz's works (6 vols. Geneva, 1768), and wrote books on the history of discoveries, English politics, theology, numismatics, &c., and poems. See his *Mémoires* (1806; trans.). —His nephew, JOSEPH MICHEL DUTENS (1765–1848), wrote on political economy.

Duty. See CUSTOMS, EXCISE, TAX; ETHICS.

Duval, CLAUDE, highwayman, was born at Domfront, Normandy, in 1643, and came to England at the Restoration, in the train of the Duke of Richmond. Taking soon to the road, he robbed many gentlemen of their purses, and ladies of their hearts, till, having been captured while drunk, he was hanged at Tyburn on 21st January 1670, and was buried in Covent Garden church.

Dvina. See DWINA.

Dvinsk. See DÜNABURG.

Dvořák (pronounced *Dvorzhak*), ANTONIN, the Bohemian composer, was born at Mühlhausen, near Kralup in the Prague district, on the 8th September 1841. He had more difficulties to overcome in his pursuit of education than the majority even of music's least favoured sons. His father was a butcher, and could ill afford to allow his son to indulge the tastes which a few lessons from a local musician had deeply implanted in the boy. At a great sacrifice, however, he sent his son in 1857 to Prague, which was thereafter the headquarters of his uneventful life. In 1873, after years of the dullest hack-work in café orchestras and as a church organist, he composed a hymn for chorus and organ which attracted attention. Attention begat ever-increasing interest, until two years afterwards the Austrian government conferred on him a *staats-stipendium* or annual allowance from the treasury. Brahms introduced his compositions to the musical public in Vienna; but the work which won for him the ear of all Europe was his *Stabat Mater*, which speedily became a favourite, especially in England, where it was first performed by the London Musical Society in 1883. This work rises above the strong influences of national feeling so generally found in Dvorák's writings into a more cosmopolitan atmosphere, and challenges comparison with the most universally accepted settings of the Latin hymn. Other compositions are songs, &c., very spontaneous and delicate (*Seven Gypsy Songs*, op. 55), and pianoforte compositions (*Dumka* or Elegy, *Furiante* or Bohemian Dances, *Slav Dances*), in all of which he has made very large use of national melodies and dance rhythms; also chamber music of great beauty (*E flat Quartette*, op. 51). His most ambitious work is orchestral (*Symphony in D*, &c.) and choral. *The Spectre's Bride* (cantata written for the Birmingham Festival of 1885) is comparatively short. The *Stabat Mater* commands the admiration of all earnest musicians. *St Ludmila* (an oratorio written for the Leeds Festival, 1886) is long and dreary. His opera, *Der Bauer*, was unlucky; *Der Jacobin* (1889) was better received; *Der Teufel und die wilde Käthe* was the work of 1899. In 1892–95 he was director of the New York Conservatory of Music; after 1895 he settled in Prague. In the symphonies, *From the New World* and *In Nature*, he utilised negro melodies. He died 1st May 1904.

Dvorák deliberately turned to folk-song and national dance as a fountain of originality; and musical Europe, so long accustomed to Teutonic inspiration, gladly heard the new rhythms and strange harmonic effects of the Slav races. The characteristics of Dvorák's compositions are, first, the strong Czech element which pervades them, and displays itself in characteristic rhythmical effects and relations of tonalities, peculiar and indistinct to Western ears; secondly, the economical and often extremely clever use of small thematic material; and thirdly, notwithstanding this economy, his lavish use of rich and fresh melody, as if it were as easy to write a new melody as to repeat an old.

Dwale, an old name for deadly nightshade. See BELLADONNA.

Dwarf (A.S. *dweorg*, *dwerg*, or *dweorh*; cf. Icel. *dvergr*, Ger. *zwerg*) is a term applied to any organised being, but especially to the human species, whose height is much less than the average height of their race. The word is often restricted to those cases where there has been a uniform and general arrest of growth, except perhaps in the nervous system, which is often fully developed in dwarfs. See DEFORMITIES.

The ancients believed not only in dwarfs, but in nations of them. Aristotle declared that the report of trustworthy witnesses testified to the existence of a minute race of men, with minute horses, living in caves which are washed by the waters of the Nile; and Pliny gives details as to their habits and geographical position. There were also, according to later writers, pygmies (Gr. *pyx*, 'the fist') in Thule and beyond the Ganges. Greek fancy delighted to paint their Lilliputian dimensions: they cut down every corn-ear with axes; when Hercules came into their country, they climbed by help of ladders up to his goblet, to drink from it.

Of dwarf races of man, the most notable are the Bushmen (q.v.), 4 feet 7 inches high; the Akkas (q.v.) in Central Africa, about 4 feet 10 inches high, with whom Emin's men identified the hordes of forest dwarfs ('a venomous, cowardly, and thievish race, and very expert with their arrows') by whom Stanley's march in 1888 was so harassed; the Obongos on the Gabun, and the still smaller Batwas, 4 feet 3 inches (see AFRICA); a tribe called M'Kabba, near Lake Ngami, reported as only 4 feet 1 inch; the Tapiro pygmies in Dutch New Guinea, 4 feet 9 inches; also the Andaman Islanders (under 5 feet), the Aetas in the Philippines, the Malayan Samangs, the Javan Kalangs. The Lapps, Ainus, and Veddas are somewhat taller.

Dwarfs play a large part in the mythology of the ancient Germanic nations. They had their own kings, and dwelt in caves and rocky cavities in the interior of the earth, wherein are priceless treasures, metal, and wondrous works of art. It is they who forge for the gods their armour, who gave Odin his spear, and Thor his hammer Miölnir. Some of the attributes of the dwarfs are supposed to have been derived from an actual race of small stature—the Lapps, who occupied part of the Scandinavian peninsula before the immigration of the Gothic Scandinavian peoples (see SCANDINAVIAN MYTHOLOGY, and Grimm's *Deutsche Mythologie*). British tradition tells of a 'Tom Thumb' at King Arthur's court; and Gulliver's Lilliputians are amongst the most familiarly known of all dwarfs.

Dwarfs were not unfrequently retained as court favourites or toys down until the 18th century; more recently they have been popular as curiosities exhibited in shows. Of ancient dwarfs, Philetas of Cos, tutor of Ptolemy Philadelphus, was said to have worn weights in his pockets to keep him from being blown away, and a niece of Augustus had two dwarfs said to have been only 2 feet 4 inches. Gibson and his wife, dwarfs of Queen Henrietta Maria, had a united height of 7 feet 2 inches. Jeffery Hudson (called Sir Geoffrey, and known to

us from *Peveril of the Peak*) was 3 feet 9 inches. 'Bébé,' dwarf of King Stanislaus of Poland, was only 23 inches in height, and died aged ninety in Paris in 1858. Count Borowlaski, a Pole of birth and accomplishments, was at thirty years of age but 3 feet 3 inches in height; he died in England in 1837. Charles Sherwood Stratton (1838–83), the American dwarf known as General Tom Thumb, was exhibited in England by Barnum in 1844. In 1863, when 31 inches in height, he married Lavinia Warren, aged twenty-one, and 32 inches in height. They, with their child and a dwarf called Commodore Nutt, visited England in 1864. The so-called 'Aztecs,' and Flynn, a New Yorker called General Mite, and only 21 inches high, are among dwarfs who have been exhibited in England. Many jockeys restrict their stature and are practically dwarfs. Unlike giants, who are usually feeble in body and mind, ill-proportioned and short-lived, many dwarfs are strong, well-proportioned, active, and intelligent. Some have spoken four or more languages. See E. J. Wood's *Giants and Dwarfs* (1868), and Tyson's *Pygmies of the Ancients* (1699; reprinted 1896); and for causes, &c., *Dwarfism* (1912), by Rischbieth and Amy Barrington.

Dwarfed Trees, growing in flower-pots, are a characteristic ornament in Chinese and Japanese houses and gardens, and the production of them is an art which has been carried to great perfection. It depends on the prevention of an abundant flow of sap, so that whilst the tree is kept living and healthful, vegetation does not go on with its natural activity. The trees are planted in shallow and narrow flower-pots; care is taken that their roots never pass into the ground beneath; they are very sparingly supplied with water; their strongest and leading shoots are pinched off, and their branches are bent and twisted in various ways. A very extraordinary dwarfing is the result of these and other such processes; and the dwarfed trees not unfrequently abound in flowers and fruit.

Dwarka, a maritime town of Guzerat, India, on the west side of the peninsula of Kathiawar, in the dominion of Baroda, 235 miles SW. of Ahmedabad. On an eminence overhanging the seashore stands a great temple of Krishna, visited annually by 10,000 pilgrims.

Dwight, Dr Timothy, a well-known American theologian, was born at Northampton, in Massachusetts, May 14, 1752, grandson of Jonathan Edwards; he studied at Yale College, and was licensed to preach in 1777. During the War of Independence, he was for some time a chaplain in the Continental army. In 1783 he became minister of Greenfield Hill, in Connecticut, where he also conducted an academy for twelve years with distinguished success. The College of New Jersey conferred on him the degree of S.T.D. in 1787, and Harvard that of LL.D. in 1810; in 1795 he was elected president of Yale College and professor of Divinity. He died January 11, 1817. His principal work is his *Theology Explained and Defended in a series of 173 Sermons* (5 vols. Middletown, Conn. 1818), which has gone through a great number of editions both in America and in England. Among his other writings may be mentioned *The Conquest of Canaan* (1785), an ambitious epic poem, and *Travels in New England and New York* (4 vols. 1821), reckoned by Southey the most important of his works.—A grandson, a second Timothy Dwight, born in 1828, was in 1886–99 president of Yale University, and was a member of the American committee for the revision of the English version of the Bible.

Dwina, the name of two important rivers of Russia.—(1) The Northern Dwina has its origin in the confluence of the Suchona and the Jug, two streams rising in the south of the government of Vologda, and uniting in 60° 46′ N. lat., 46° 20′ E. long. The Dwina flows generally north-west through a flat country, to the Gulf of Archangel, which it enters by three principal mouths, of which only the easternmost is useful for navigation. The length of the Dwina is about 450 miles (with the Suchona, 760); its basin embraces over 140,000 sq. m. Its chief tributaries are, on the left, the Vaga and Emza, and on the right the Pinega and the Vytchegda, the last having a course of some 625 miles, 500 being navigable. The volume of water poured down by this main tributary increases the breadth of the Dwina from about one-third to nearly two-thirds of a mile; near Archangel it widens to over four miles. The river is free from ice from May to October, and is a valuable channel of inland trade. Its waters also are rich in fish.—(2) The Western Dwina (Ger. *Düna*) rises in the government of Tver, not far from the sources of the Volga and the Dnieper, and flows at first WSW. in a course almost parallel to the latter. Below Vitebsk it turns WNW., crosses Lettland, and enters the Gulf of Riga. About 580 miles long, it is navigable from the confluence of the Mezha downwards, although the numerous shallows and rapids greatly impede traffic. Its basin is estimated at 32,850 sq. m.; its average depth of 26 feet at Riga is increased to about 40, and its breadth of 1400–2400 feet is extended in some places to a mile during the heavy spring floods which overflow wide tracts of the low-lying lands on either bank. The Western Dwina is connected with the Dnieper by the Beresina Canal, and by other canal systems with the Caspian, the Neva and Gulf of Finland, &c.

Dwinsk. See Dünaburg.

Dyaks, or Dayaks, is the Malay name for the race who constitute the bulk of the aboriginal population of Borneo, divided into innumerable tribes, differing pretty widely in language, customs, and degrees of savageness. Physically they closely resemble the Malays, to whom they are doubtless akin, but are somewhat taller; they are intelligent, hospitable, and unsuspicious, and greatly excel the Malays in truthfulness and honesty. Many of the dialects spoken by them are little known; but they seem all to fall into some five great geographical groups. The coast tribes have adopted many Malay words, and some have completely adopted the Malay speech. Even the most uncivilised tribes have many ingenious arts and industries, weave cloth, make excellent steel weapons, and erect most serviceable suspension-bridges with bamboo poles and withes. Their chief weapon is the Blowpipe (q.v.), not the bow. The barbarous custom of systematic 'head-hunting' is dying out, though the heads of enemies are still cherished trophies of the warrior. The Sea-Dyaks were long famous as untamable pirates. See Borneo.

Dyce, Alexander, an assiduous English critic, was born at Edinburgh, 30th June 1798. He spent part of his boyhood at Aberdeen, and had his education at the Edinburgh High School, and Exeter College, Oxford, where he graduated B.A. in 1819. He took orders, but soon abandoned the clerical calling to settle in London as a busy man of letters. His name will never be forgotten for the rare combination of learning, patience, and sagacity in his great editions of the dramatists, Peele (1828–39), Webster (1830; new ed. 1857), Greene (1831; in one vol. with Peele, 1858), Shirley (a completion of Gifford's ed. 1833), Middleton (1840), Beaumont and Fletcher (1843–46), Marlowe (1850; new ed. 1861), and Ford (a revised ed. of Gifford's, 1869). His edition of Shakespeare (9 vols. 1857; new ed. 1864–67) is not yet superseded. Besides these he edited between 1831 and 1835 the poems of Shake-

speare, Pope, Akenside, and Beattie, for Pickering's Aldine Edition of the Poets. Other works were his edition of Richard Bentley's works (1836–38), of Skelton's works (1843), and his *Recollections of the Table-talk of Samuel Rogers* (1856). He edited for the Camden, Percy, and Shakespeare societies, and was one of the severest assailants of Payne Collier's Shakespeare vagaries, an act of duty which ended an old friendship. Dyce died 15th May 1869, bequeathing his fine library to South Kensington Museum.

Dyce, WILLIAM, R.A., painter, was born at Aberdeen in 1806, and at 16 graduated M.A. of Marischal College. After acquiring the rudiments of his art-education he went in 1825 to Rome, where he developed a tendency towards early Italian or pre-Raphaelite art. In 1830 he settled in Edinburgh, where, besides painting portraits, he contributed largely to the exhibitions. In 1837 he was appointed master of the 'Trustees' Academy;' and eighteen months later he left for London, where he held various appointments in connection with the New School of Design at Somerset House. In 1844 he was appointed professor of Fine Arts in King's College, London. He was one of the artists selected to decorate the Palace of Westminster and the House of Lords, and at Osborne House several works in fresco were executed by him. Dyce was elected an A.R.A. in 1844, an R.A. in 1848. The following are some of the works he exhibited in the Royal Academy: 'King Joash shooting the Arrow of Deliverance,' a 'Madonna and Child' (1846), a 'Meeting of Jacob and Rachel' (1850), 'Christabel' (1855), 'The Good Shepherd' (1856), 'Neptune assigning to Britannia the Empire of the Sea'—a study for a fresco at Osborne (1857), 'St John leading Home his Adopted Mother,' 'The Man of Sorrows' (1860), and 'George Herbert at Bemerton' (1861). Dyce was a man of singularly wide culture, and an accomplished musician. In 1842–43 he published a sumptuous edition of the Prayer-book, with a dissertation on *Plain-chaunt*, and its use in the English service. He died at Streatham, 14th February 1864.

Dyck, SIR ANTHONY VAN. See VAN DYCK.

Dyea, a village of southern Alaska, on the Chilkoot Inlet, once important as the starting-point of the Chilkoot Pass route to Klondike and the Upper Yukon, superseded by the railway from Skagway to Whitehorse.

Dyeing is the art of imparting colours to textile and other materials, such as cotton, silk, wool, and leather. It has been practised among Eastern nations from time immemorial; and in the Old Testament we read of the purple-dyed vestments of the high-priests, of linen cloths dyed blue, purple, and scarlet, and of rams' skins dyed red. The famous Tyrian purple, obtained from one or two species of shell-fish, is believed to have been discovered by an inhabitant of Tyre fifteen hundred years B.C.; afterwards this purple became the badge of royalty, and cloth dyed with it commanded a princely price. Purple of various shades was dyed not only at Tyre, but at Tarsus, Alexandria, and other places on the shores of the Mediterranean, though other colours were, of course, employed. The Egyptians, Greeks, and Romans practised the art of dyeing. There is an ancient Roman dyer's workshop with its apparatus to be seen among the ruins of Pompeii. Gradually the art became more and more widespread as civilisation advanced. In earlier times dyeing was much more extensively followed as a domestic art than it is at present, but in some outlying parts of Europe, and even in the Highlands of Scotland, the colours imparted to home-made fabrics are still to some extent obtained from native vegetable dyes. The dyeing of indigo, madder, and several other vegetable and animal dyestuffs was practised thousands of years ago. In the Middle Ages the Italians were famous for their dyeing, and, as they were at that time the great maritime nation, they introduced large numbers of new dyes from the East. The discovery of America caused another incursion of new dyes, such as logwood, cochineal, &c. As these imported dyes competed with the native products, very stringent laws were passed to prevent their use. It is only within the last hundred years that the art of dyeing has been put on a scientific basis. Before that time it was almost entirely empirical, and all sorts of substances were added to the dye-baths with the supposed effect of improving the dyeing. Some of the old receipts contain as many as thirty ingredients. The starting-point for the modern practice of dyeing is the year 1856, in which the first artificial coal-tar dyestuff was prepared by Sir W. H. Perkin. This dye, known as Mauve, was for a large number of years used for printing the lilac-coloured one penny stamps. Since that date the number of coal-tar dyes has increased enormously, and they can now be counted by thousands, and hundreds of new ones are added every year. One result of this is that the natural dyes have been very largely replaced by the artificial products, as the latter usually give much brighter shades, and are more easily applied.

DYESTUFFS AND MORDANTS.—Until the year 1856, when Perkin discovered the first coal-tar dyestuff, the dyes employed in practice were, with few exceptions, of natural origin. As already mentioned, these have been largely driven out of use by the artificial products. There are various methods of classifying the various dyestuffs. The really scientific method is to divide them into classes according to their chemical constitution; but this is not convenient for practical purposes, and it is better to classify them into groups according to the methods employed in their application to the various textile fibres. In former days they were divided into natural and artificial dyes, but since many of the natural dyes can now be prepared artificially, and it has also been found that there is no essential difference in chemical constitution between the two classes, this method of division is really of little use. Another method still employed is to divide them into substantive dyes—those which can dye the fibres direct—and adjective dyes—those which require the use of other substances in order to fix them on the fibres in a satisfactory manner.

The substances employed in order to fix the adjective dyes on the fibre are known as 'mordants,' and the terms substantive and adjective dyes have been replaced almost completely by the newer terms direct and mordant dyes. The mordants in general use are either acid or basic in their properties. The chief acid mordants are tannic acid and various fatty acids, whilst the basic mordants are mainly metallic compounds, chiefly of the metals chromium, aluminium, and iron. The acid mordants are employed for fixing dyes of a basic character—e.g. the basic dyes; whilst the basic mordants are used to fix dyes of an acid character, such as the main class of mordant dyes. For practical purposes the dyestuffs now in use may be divided into the following nine classes: (1) Direct Cotton Dyes; (2) Basic Dyes; (3) Acid Dyes; (4) Mordant Dyes; (5) Sulphur Dyes; (6) Vat Dyes; (7) Insoluble Azo Dyes; (8) Oxidation Dyes; (9) Mineral Dyes. It must be understood that these classes of dyes are not all sharply defined from one another, as there are many dyes which seem to occupy an intermediate position between different classes.

The question as to what chemical or physical structure a substance must have in order that it

may be able to dye has given rise to countless theories, but has not yet been solved in a satisfactory manner. A discussion of the various suggested explanations would be beyond the scope of this article; but it may be stated that the general opinion seems to be that the dyeing of vegetable fibres is largely a matter of physical attraction, whilst the dyeing of animal fibres is more in the nature of a chemical action between the dyestuff and the fibre. When we note the great differences in structure and chemical composition between the two classes of fibres, it is easy to see that no simple theory is likely to explain the dyeing of all fibres. The natural wood dyes come into the market in the form of wood chips or raspings, or else in the shape of liquid or solid extracts obtained by extracting the colouring matter by boiling the wood with water. Most of the artificial dyes come as powders, some as pastes, and a few as solutions in various liquids. The more important methods of applying the various classes of dyes to the different textile fibres will now be considered.

1. Direct Cotton Dyes.—These are sometimes called congo dyes or substantive cotton dyes. As their name indicates, they have the power to dye cotton without the use of a mordant. With few exceptions, they belong to the class known as azo dyestuffs, and are prepared by the 'diazo' reaction (see below). The first of this class was discovered by Bottiger in 1884, and named by him Congo Red. It has the formula,

$$\begin{matrix} C_6H_4-N:N-C_{10}H_5(NH_2)SO_3Na \\ | \\ C_6H_4-N:N-C_{10}H_5(NH_2)SO_3Na, \end{matrix}$$

and is prepared by diazotising benzidene and coupling the product with naphthionic acid. Cotton is dyed by simply heating it in a solution of the dye, an addition of common salt or Glauber's salt being usually made in order to force more dye on to the cotton by diminishing the solvent action of the water. In many cases the dyeings obtained in this manner can be improved in fastness to light, washing, &c. by various methods of after-treatment. The three most important methods are: (1) treatment with metallic salts; (2) diazotising and developing; (3) coupling with diazo solutions. The first method is only applicable to certain of the dyestuffs, and consists in treating the dyed cotton for a short time in a hot solution of a metallic salt, such as copper sulphate or potassium bichromate. The second method is only suitable for dyes which contain one or more 'amido' (NH_2) groups. The dyed material is treated with a solution of nitrous acid (sodium nitrite and acid), in order to convert the dye into the diazo compound, and, after rinsing, the cotton is soaked in a cold solution of some suitable developer—e.g. beta naphthol. The reaction which takes place is similar to that occurring in the manufacture of the azo dyes and also in the dyeing of para red (see below), the original dye being converted into a new one on the fibre. These new dyes are usually darker in shade and faster than the original untreated dyeings.

Direct Cotton Dyes on Wool and Silk.—Many of these colours are well suited for dyeing wool or silk, and the dyeings so obtained are usually faster than those obtained on cotton with the same colours. Wool is dyed from a neutral bath, to which Glauber's salt is added. To exhaust the dye-bath better a small addition of acetic acid is frequently made. Many of the dyeings on wool can be rendered faster by after-treatment with metallic salts, as in dyeing cotton. Silk is dyed in the same manner as wool.

2. Basic Dyes.—These dyes, as their name indicates, are of a basic character; that is to say, they combine with acids to form salts. They can be divided chemically into a large number of sub-classes, but practically all contain one or more amido groups, the hydrogen atoms of which are frequently replaced by organic radicles—e.g. CH_3, C_2H_5, &c. One of the oldest and most important of this class is magenta, which consists of a mixture of two closely related dyestuffs, one of which is pararosaniline, and is given the formula:

$$\begin{matrix} & & C_6H_4NH_2 \\ & \diagup & \\ C & - & C_6H_4NH_2 \\ & \diagdown\!\!\diagdown & \\ & & C_6H_4=NH_2Cl. \end{matrix}$$

Although cotton absorbs these dyes to some extent if heated in their solutions, it is more a stain than a dye, and the colour can be almost completely removed by washing. In order to get satisfactory dyeings with these colours on cotton the latter must first be mordanted (see above). The mordant usually employed is Tannin or Tannic Acid (q.v.), as this substance has the property of combining with basic dyes to form colour-lakes. The cotton is first soaked in a warm solution of tannin, of which it absorbs a portion, the amount of which depends on a number of factors, and the absorbed tannic acid (which would be removed by washing) is 'fixed' by passing the tanned cotton through a solution of some metallic salt—e.g. tartar emetic—by which the soluble tannic acid is converted into an insoluble metallic tannate. After washing with water, the mordanted cotton is dyed with the basic dyestuff from a heated bath, the final product on the fibre consisting of the double tannate of the metal and the dyestuff. Wool and silk can be dyed direct with basic dyes by simply heating them in the dye solutions. A little acetic acid is frequently added to the dye-baths to prevent the precipitation of the dye by any alkaline salts in the water.

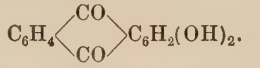
3. Acid Dyes.—These dyes are acidic in properties, and form salts with bases, usually owing to the presence of hydroxyl (OH) or sulphonic (SO_3H) groups. Like the basic dyestuffs, the acid dyes can be divided into a number of sub-classes. Probably the most important of these classes is that of the azo dyes. These are formed by similar reactions to those employed in the preparation of para red (see below), but, unlike the latter, contain one or more sulphonic group which renders them capable of forming salts with alkalies, which salts are soluble in water. As an example, the dyestuff Orange 2 may be taken. This has the formula:

$$(SO_3Na)C_6H_4-N:N-C_6H_4-N(CH_3)_2.$$

For cotton, these dyes are of little importance, as, with few exceptions, they cannot be fixed sufficiently fast upon the fibre; they form, however, the most important class of dyestuffs for wool. Although some of them will dye wool direct from a neutral bath, most of them give much better results if an acid —e.g. sulphuric—be added to the dye-bath. This liberates the 'free colour acid' from the dye, which is usually a sodium salt of a sulphonic acid, and these free acids are more strongly attracted by the wool fibre than their alkaline salts. Glauber's salt is usually added to the dye-bath in order to moderate the action of the sulphuric acid, and so give more 'even' dyeings. The dyeing is carried out at or near the boil. Silk is dyed with these colours in the same manner as wool. A number of the acid dyes have a particular chemical structure, owing to which they are able to combine with metallic salts—e.g. bichrome—to give colour-lakes. These lakes are usually insoluble, and the dyeings obtained with them are much faster than the direct dyeings. The dyeing is done as usual, and the metallic salt is added to the exhausted dye-bath,

and the boiling continued for some time. Such dyes are frequently known as acid mordant, or chrome dyes. The after-treated colours are in some cases quite different in shade from the original dyeings.

4. MORDANT DYES.—The basic dyes are really mordant dyes so far as cotton is concerned, but the name mordant dye is usually restricted in practice to those dyes which require the use of a mordant, whatever the fibre to which they are being applied. Many of these are hardly attracted at all from their solutions by the textile fibres, and even if they are taken up, the colours obtained are usually worthless and not fast. Many of them scarcely show any colour at all until they are combined with a suitable mordant to form a colour-lake. The mordants employed in practice are mainly metallic salts, and the same dyestuff will frequently give different coloured dyeings according to the particular metallic mordant with which it is combined. Dyes which show this property are sometimes called 'polygenetic dyes,' to distinguish them from the 'monogenetic dyes,' which give practically the same shade with different mordants. Most of the natural dyestuffs belong to the class of mordant dyes. The dyestuff alizarin may be taken as typical of the mordant colours. It has the formula given below, being a di-hydroxy anthraquinone:



It owes its mordant dyeing properties to the presence of the hydroxyl groups adjacent to a CO ('carbonyl') group. As most of the natural dyestuffs are dyed by similar methods to the artificial products, a brief description may be given here of the natural dyes still in use on the large scale. The natural dyes have lost greatly in importance since the discovery of the coal-tar colours, owing to the variety and purity of the shades given by the latter, and also to the greater ease and certainty with which they can be applied. The old idea as to the want of fastness of 'aniline dyes' no longer holds good as a general rule, as many of them give much faster shades than the natural dyes.

Natural Dyes.—The most important of the natural mordant dyes is Logwood (q.v.), which has never been completely replaced in black dyeing. It is a very cheap dyestuff, and gives a fine, bloomy black, which cannot be obtained with the artificial dyes at so low a price. It is dyed on wool, either on a chrome mordant or else with a mixed mordant of copper and iron. In pale shades it gives a blue on a chrome mordant, and a blue is also sometimes dyed on an alum mordant, but is not so fast as the chrome colour. It is dyed on cotton, with an iron mordant for blacks, but it has been largely replaced for this purpose by aniline black and the sulphur blacks. The most important of the remaining natural dyes are the following: Brazil-wood (q.v.), peach-wood, lima-wood, and sapan-wood; these are known as soft red-woods, and are chiefly the woods of various South American trees. They are dyed on the usual mordants, and give shades varying from red to violet, according to the particular mordant employed. Barwood and Camwood (q.v.) are hard red-woods, and give reddish-brown shades with the usual mordants. They are frequently used to 'bottom' woollen cloth before dyeing it with indigo. Fustic (q.v.), sometimes called 'old fustic' to distinguish it from another dyestuff, 'young fustic,' is the most important natural yellow dye, and gives shades varying from a yellow to an olive, according to the mordant. It is largely used along with logwood and other dyes, both natural and artificial. Madder (q.v.) has been practically driven out of the market by the artificial alizarin, madder itself owing its dyeing properties to the presence of about ½ per cent. of alizarin and allied dyestuffs. Quercitron bark, the bark from the *Quercus tinctoria*, gives similar shades to fustic. Weld, the stalks of *Reseda luteola*, gives bright yellow to olive shades. Persian berries, the fruit of the *Rhamnus infectorius*, give yellow to brown shades, and are used in dyeing and printing. The most important dyestuff of animal origin is Cochineal (q.v.), which gives fine scarlet shades on a tin mordant. On alum crimson shades are obtained. Kermes and lac dye (see LAC) are also produced by various insects. They give somewhat similar but duller shades than those obtained with cochineal. They are little used in Britain.

The following natural dyes are not mordant dyestuffs in the true sense of the word, but are mentioned here for convenience: Archil (q.v.) and Cudbear (q.v.). These are produced from various species of lichens. They are dyed on wool direct from an acid, neutral, or alkaline bath, and are used to a considerable extent for red shades. Turmeric (q.v.), the root of *Curcuma tinctoria*, can be dyed direct on cotton, wool, or silk, and gives yellow shades. Catechu (q.v.) or cutch is the evaporated extract from various species of Acacia, and is largely employed for the production of fast brown shades on cotton. It is dyed on cotton with the addition of a little copper sulphate, and the dyeings are after-treated with bichrome solution in order to develop the colour fully. It consists of various bodies of a tannin nature, which appear to be oxidised to brown substances during the dyeing. It is largely used in the 'barking' of fishing-nets, in order to render them more durable. Other natural dyes of less importance are woad, young fustic, Annatto (q.v.), and Safflower (q.v.).

Mordant Dyes on Cotton.—Before cotton can be dyed with these colours it must be mordanted. The mordants employed are salts of alum, iron, chromium, and tin. If cotton be treated with solutions of neutral salts of the above metals, it only absorbs traces of the metals; but if easily dissociated acid or basic salts be used, the cotton can take up considerable quantities of the metals, which become fixed on the fibre in the form of basic salts, usually hydroxides. The acetates of alum and iron are largely employed, the cotton being impregnated with their solutions and then aged (see CALICO-PRINTING). During this process acetic acid is lost, and the mordants are fixed in the form of hydrates or basic salts. With the exception of alizarin, which is dyed on a very large scale on an alum mordant for the production of Turkey-red, and logwood, which is used in dyeing blacks on cotton, the other mordant dyes are of minor importance in cotton-dyeing, owing to difficulties in their application, and also to the expense of the process.

Turkey-red is a very bright and permanent colour on cotton; it was obtained till recently from madder, but now almost entirely from alizarin, by a special process. An oil mordant, as it is termed, is employed in combination with the fibre. Formerly a coarse olive-oil was made into an emulsion with a weak solution of crude pearl-ashes, through which the cloth was passed, then wrung out and hung up in a stove. The oil absorbs oxygen, and thickens into a varnish containing free fatty acids. The operation was repeated six or eight times. A Turkey-red oil is now sold which is chiefly the oleic acid of castor-oil in combination with ammonia, and of this oil the cloth requires only one or two applications. The oiled cloth is mordanted with alumina as usual, and then passed into the dye-bath, which is gradually raised to boiling. The bath is charged with alizarin,

and sumach or some other tannin substance is usually added in order to give a faster colour. The shade is finally brightened by boiling the dyed material in soap solution, to which chloride of tin is frequently added.

In dyeing logwood black on cotton the latter is first soaked in a tannin solution, and then in an iron liquor, so as to fix the iron mordant on the cotton in the form of tannate of iron. The cotton is finally dyed up with logwood.

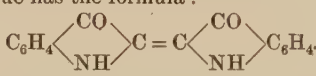
Mordant Dyes on Wool.—The mordant dyes are very largely employed in the dyeing of fast shades on wool which cannot be obtained with the ordinary acid dyes. The mordants used for cotton are not suitable for wool, but the mordanting of the latter fibre is a much simpler process than the mordanting of cotton. The most important mordants for wool are bichromates of potash or soda, alum or aluminium sulphate, and, to a much less extent, sulphates of copper and iron and chlorides of tin. Bichrome is used for by far the greater number of mordant dyes on wool. Wool is mordanted by simply heating it to boiling in a solution of bichrome, to which additions of various 'assistants'—e.g. sulphuric acid, cream of tartar, oxalic acid, &c.—are frequently added to help the mordanting. After boiling for an hour or so, the wool is well rinsed with water, and then dyed in a fresh bath with the required mordant dyestuff. The dyeing is started at a moderate temperature, which is gradually raised to boiling. The other mordants are applied by similar methods, usually with the addition of tartar or oxalic acid.

Besides the above method of dyeing these colours, many of them may be dyed direct by the following methods. The wool is first dyed with the dye, and is then after-treated with the necessary mordant in the same manner as in the dyeing of the acid mordant dyes (see above). A third method which can be used for some dyes is to add both the dye and the mordant to the bath at the same time, so that they are both absorbed by the wool on heating. In this method some acid, such as acetic acid, is frequently added to the bath to prevent the premature formation of the colour-lake in the dye-bath.

Mordant Dyes on Silk.—Silk is usually mordanted by soaking it in strong, cold solutions of various salts, followed by a fixing operation. The dyeing is performed as in the case of wool.

5. Sulphur Dyes.—These dyes are with few exceptions insoluble in water, but can be dissolved in solutions of sodium sulphide, which apparently converts them into soluble reduction products. Cotton is dyed direct by these solutions, and on exposure to the air the soluble colour is in most cases oxidised back to the original insoluble form. The colour is boiled up with sodium sulphide and soda carbonate in order to dissolve it, and an addition of common salt is usually made in order to exhaust the dye-bath better. The dyeing is usually done at the boil, after which the cotton is rinsed and dried, but in some cases the dyed material must be submitted to an oxidising operation before rinsing to fully develop the colour. These colours are, as a class, extremely fast to light, washing, &c., but not to bleaching solution. Owing to the alkalinity of the dye-bath the above process is not suitable for dyeing wool or silk, but the latter are sometimes dyed with these colours by special processes. Very little is known as to the chemical constitution of these dyes, but they all appear to contain sulphur as an essential constituent.

6. Vat Dyes.—The most important member of this class is Indigo (q.v.). Indigo is a product of the vegetable kingdom, and is produced from a number of plants chiefly belonging to the Indigofera family, especially *I. tinctoria* and *I. arrecta*, which are cultivated in India, Java, and other tropical countries. Indigo is not present as such in the plant, but the latter contains a glucoside, 'indican,' which is decomposed by fermentation in the process of manufacture into indoxyl and a kind of sugar. This indoxyl on oxidation yields indigo. When ready, the plant is cut down, tied into bundles, and placed in large tanks of water to steep for some hours. A vigorous fermentation soon arises, which decomposes the indican and liberates the indoxyl, which dissolves in the water. The solution containing the indoxyl and other soluble matters is then run off into beating-tanks, in which it is beaten either with mechanical beaters or else by hand, in order to bring it into intimate contact with the air, and so oxidise the indoxyl to indigo, which sinks to the bottom, and is collected, boiled with water, strained on canvas filters, pressed in presses, cut up into small blocks, and dried gradually in the air. The product obtained in this manner is not the pure dyestuff, and usually contains only about 62 per cent., or even less, of the real indigo blue dyestuff, or 'indigotin,' as it is called, the remainder consisting of indigo red, or 'indirubin,' indigo browns, indigo glutin, &c. The part which these so-called impurities play in the dyeing operation is a matter of considerable controversy, but they are sometimes stated to give richer dyeings than the pure indigotin. At the present day indigotin is very largely manufactured artificially from naphthalene and other coal-tar products. During the last few years a large number of new vat dyes have been placed on the market, some of which are derivatives of indigo, whilst others only resemble it in the method of their application. Indigotin or indigo blue has the formula:

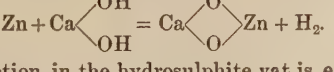


The vat dyes are all insoluble in water, but can be converted by reducing agents into leuco compounds, which are soluble in alkalies. The textile fibres absorb these leuco bodies from their solutions, and on exposing the dyed materials to the air the soluble leuco dyes are oxidised back to the original insoluble dyestuffs upon the fibre. The solutions employed to reduce these dyes are known as 'vats,' and the name 'vat dyes' is used to designate the whole class.

A great number of different vats are employed for reducing indigo, but only a few of these are of much importance. The chief vats used for cotton-dyeing are: (1) the copperas vat; (2) the zinc-lime vat; (3) the hydrosulphite vat. In the first the finely ground indigo is mixed with a warm solution of sulphate of iron, and lime is added. The copperas is converted by the lime into ferrous hydrate, which oxidises, at the expense of the water, to ferric hydrate, liberating hydrogen, which reduces the indigo blue into its leuco compound, which is named indigo white, and dissolves in the alkaline solution. The reduction of the indigo is illustrated by the following equation:

$$C_{14}H_{10}N_2O_2 + H_2 = C_{14}H_{12}N_2O_2.$$

In the zinc-lime vat the copperas is replaced by zinc-dust, and the reaction is:



The reaction in the hydrosulphite vat is expressed by the following equation:

Indigo Blue. Hydrosulphite. Indigo White.

$$C_{14}H_{10}N_2O_2 + Na_2S_2O_4 + 2NaOH = C_{16}H_{12}N_2O_2 + 2Na_2SO_3.$$

The reduction is usually carried out at a temperature of about 50° C. in a strong vat, which is then added to the necessary quantity of water in the dye-vat proper. Cotton is dyed cold, being entered into the solution of indigo and worked below the surface for some time; it is then lifted, squeezed, and exposed to the air in order to oxidise the leuco indigo which has been absorbed by the fibre. This constitutes one 'dip,' but if a darker shade is required a second or more dips are given. In dyeing wool with vat dyes great care must be taken to avoid the fibre being injured by the alkaline liquors. The chief vats for wool-dyeing are: (1) the fermentation vat; (2) the hydrosulphite vat. In the first of these the reduction is effected by means of hydrogen produced by certain ferments. The vat contains indigo, lime, and a number of fermentable substances, such as bran, sugar, woad, madder, &c. The vat is heated, and a strong fermentation soon commences, which after a time reduces the indigo. The fermentation vat requires great experience in order to work it properly, but is still largely employed in wool-dyeing. The dyeing is carried out hot, and a longer immersion is needed than in the case of cotton; like the latter the dyed material must be exposed to the air after dyeing. The hydrosulphite vat is also suitable for wool, and is prepared as for cotton except that less alkali is taken. Instead of using hydrosulphite ready prepared, the dyer frequently prepares it himself in the vat from zinc-dust and sodium bisulphite. Most of the other vat dyes can be dyed on cotton by similar methods to those used for indigo, but in some cases hot baths must be employed. The hydrosulphite vat is most used. Many of these dyes are also suitable for wool.

7. Insoluble Azo Dyes.—This is a very small class of dyestuffs, but includes the very important one known as paranitraniline red, or para red. Being insoluble in water, these dyes cannot be applied by the usual methods, but must be actually prepared on the fibre itself. Their use is restricted to the dyeing of vegetable fibres, as the alkaline liquids employed would injure animal fibres. In dyeing para red, the cotton is first impregnated with a solution of beta naphthol in caustic soda, carefully squeezed and dried, and then passed through a solution prepared by diazotising paranitraniline with sodium nitrite and acid. Combination takes place between the diazo compound and the naphthol, and the dyestuff is formed upon the fibre. It is usual to add some fatty substance, such as Turkey-red oil, to the naphthol prepare in order to give brighter and faster colours. As this chemical reaction is typical of the manufacture of all the azo dyes, the equations are given in full below.

$$C_6H_4(NO_2)-NH_2HCl+HNO_2=$$
$$C_6H_4(NO_2)-N:N-Cl+H_2O.$$

The diazo chloride thus formed then unites with the sodium salt of the naphthol, ($C_{10}H_7ONa$), to form the dyestuff thus:

$$C_6H_4(NO_2)-N:N-Cl+C_{10}H_7ONa=$$
$$NaCl+C_6H_4(NO_2)-N:N-C_{10}H_6OH,$$

which is the insoluble para red.

By replacing the paranitraniline in the above reaction by other amido compounds different colours can be produced; e.g. if the diazo chloride of alpha naphthylamine be coupled with beta naphthol in the same manner as given above, a fine claret colour is obtained, which is known as naphthylamine claret, or Bordeaux, and is very largely employed in calico-printing. Para red is a very fast dye, and on account of its much lower cost has to a considerable extent replaced Turkey-red in the dyeing of red shades on cotton yarn and pieces. Besides the two dyes given above, there are a considerable number of other dyes of the same class, but they are of much less importance than the two named, and although used to some extent in printing, are seldom employed in dyeing.

8. Oxidation Dyes.—The most important colour of this class is aniline black. This dye, which has been in use for the last fifty years, is insoluble in water and other ordinary solvents, and requires to be manufactured on the fibre itself by a special process. It is an oxidation product of aniline, but although a great deal of work has been done on it, its chemical constitution is not yet quite clear. There are various processes employed in practice, one of which, called the single-bath black, is described below. The dye-bath is prepared with aniline dissolved in hydrochloric acid, so as to form the soluble hydrochloride, water and bichromate of soda or potash, together with more acid, in order to liberate chromic acid from the bichromate. The cotton is entered and worked for some time in the cold bath, in order to become thoroughly impregnated with the mixture; the temperature is then gradually raised to near the boiling-point. The cotton first becomes green, owing to the formation of an intermediate oxidation product known as emeraldine, which on further oxidation is converted into the black. Aniline black is a very fast dye, and is dyed on an enormous scale. The other dyes of the same class are of much less practical importance. Aniline black is not dyed on wool.

9. Mineral Dyes.—These are of minor importance, and are practically only applied to cotton. The most important are iron buff, Prussian blue, and chrome yellow. Iron buff is dyed by padding the cotton in a solution of 'nitrate of iron,' and then passing it through a solution of soda or lime water. The colour is produced by the deposition of ferric hydroxide on the fibre. Chrome yellow can be dyed by padding the cotton in a solution of a lead salt, and then passing the cotton through a solution of a bichromate, in order to form the insoluble yellow lead chromate on the fibre.

Dyeing of other Vegetable Fibres.—Linen and other vegetable fibres are dyed by similar methods to those used for cotton.

Union Dyeing.—Owing partly to the high price of wool, a very large amount of cloth is now manufactured from mixtures of cotton and wool. Because of the different dyeing properties of these fibres, special methods have to be employed in dyeing such materials. A method formerly much used was first to mordant the piece with tannin, which was chiefly absorbed by the cotton, and then to dye with basic dyes, which dyed both the wool and the mordanted cotton. Another method is to dye the piece first in the ordinary manner with an acid dye, which mainly dyes the wool, and then to dye the cotton in the piece with a direct cotton dye at a moderate temperature, or else to dye the cotton with a basic dye after first mordanting it with tannin. By a suitable choice of dyes two-coloured effects can be produced by this method. If faster dyeings are required, mordant dyes can be used for the wool and sulphur dyes for the cotton. The above methods all require two or more dyeing operations, and they have been largely replaced in recent years by the use of the direct cotton dyes, many of which dye both wool and cotton in approximately the same shade. Any difference in shade is corrected by the addition of suitable dyes to the bath. Materials consisting of wool and silk or cotton and silk are dyed by modifications of the above processes.

Machinery used in Dyeing.—The textile fibres are dyed in all the various stages of their manufacture—e.g. loose or raw material; yarn and woven pieces. The material is dyed in the loose form when a very thorough through dyeing of the

individual fibres is required, or when two or more different coloured materials have to be spun together into a mixed yarn. As the material so dyed has to pass through all the subsequent manufacturing operations, the dye must be very fast, as otherwise it would be more or less removed by the severe treatment to which it is subjected. Yarn-dyeing is chiefly employed when different coloured yarns are required for weaving into multicoloured fabrics. Dyeing in the piece is practically limited to cases where only one colour is required on the material, but if the cloth consists of more than one textile fibre—e.g. a mixture of cotton and wool—two-coloured effects can often be obtained even in the piece. The usual method of dyeing loose material is in large hemispherical copper pans, which are sometimes heated directly over the fire, but more often by means of steam jackets or coils. The material is worked about in the dye-liquor by means of poles, in order to obtain even dyeings, but this method causes considerable felting or knotting of the fibres and loss in the later operations of combing, &c. To avoid this, open-pan dyeing has been largely replaced by machine-dyeing, in which the loose material is packed in closed holders, and the dye-liquor is forced through either by means of a pump or else by air-pressure. As the material remains stationary, there is no risk of felting. Yarn is usually dyed in the hank-form in rectangular wooden vessels heated by steam-pipes, the hanks being suspended from sticks which lie across the top of the vat. The hanks are turned every few minutes by hand, in order to alter their point of support and obtain even dyeings. As the hand-work is very heavy, a number of machines have been designed to effect this mechanically. Yarn is sometimes dyed in the form of warp ready for the loom, the bundle of warp-threads being carried through the dye-liquor by means of guiding-rollers until the dyeing is completed. Of recent years 'cop dyeing' has come largely into use for cotton. The cops are placed on perforated spindles, and the dye-liquor is forced through them by pressure. This method avoids the loss caused by reeling into hanks, dyeing, and winding back on to the cops for the weaving process. Cotton pieces are mostly dyed in the 'jigger,' which is a dye-vat having a rectangular top and a V-shaped vertical section. The pieces are beamed on a roller placed at one side of the vat, and pass down over guide-rollers fixed at the lower part of the V-shaped portion, and then up to another beaming-roller placed at the opposite side of the vat to the first. The lower part of the vat contains the dye solution, and the pieces, which may be several hundred yards in length, are run backwards and forwards through the liquor from one beaming-roller to the other. Wool pieces are usually dyed on winch-machines, as they would not stand the strain in the jigger. The winch-machine consists essentially of a dye-vat heated with steam coils, over which is placed a winch or reel. A number of pieces are joined together and thrown over the reel, the loose ends being sewn together so as to form an endless band. The reel is revolved by power, and the pieces circulated through the dye-liquor until sufficiently dyed.

In dyeing with mordant colours, the mordanting is usually carried out in similar machines to those used for the dyeing. The dyeing material is frequently well rinsed with water in the same machine in which it has been dyed, but yarn is usually washed on special washing-machines. After washing, the wet material is well squeezed or hydro-extracted, according to its state of manufacture, and is then dried, commonly by hot air. Piece goods as a rule require stretching after dyeing to counteract the shrinkage caused by the heat and liquids. The dried material has finally to pass through a number of finishing operations in order to render it fit for the market, but a discussion of these would be beyond the scope of this article.

Consult Knecht, Rawson, and Loewenthal, *A Manual of Dyeing* (1916); Cain and Thorpe, *The Synthetic Dyestuffs;* J. Hubner, *The Bleaching and Dyeing of Vegetable Fibrous Materials;* Green, *The Organic Colouring Matters* (1908); *Journal of Society of Dyers and Colourists; The Dyer and Calico Printer; Die Farber-Zeitung; Revue Générale des Matières colorantes;* Matthews, *Laboratory Manual of Dyeing and Textile Chemistry* (1909); Dreaper, *The Chemistry and Physics of Dyeing* (1906).

Dyer, Sir Edward, poet, courtier, and diplomatist, was born at Sharpham Park, Somersetshire (Fielding's birthplace) about 1545. He seems to have studied at Oxford, but took no degree. After some time spent in travelling on the Continent, Leicester sought to advance him at court as a rival to Sir Christopher Hatton in Elizabeth's favour, which he more than once lost and regained. Court life seems to have been irksome to him, for he 'would not stoop to fawn.' In 1584 and 1589 he went on diplomatic missions to the Low Countries and to Denmark, and in 1586 was commissioned to inquire into crown lands illegally alienated. He was knighted in 1596, and made chancellor of the Order of the Garter; and in 1607 he died. He was said to be addicted to alchemy, 'esteemed by some a rosicrucian, and a great devotee of Dr Joh. Dee and Edw. Kelly.' Dyer was a friend of Edmund Spenser, Sir Philip Sidney, and Fulke Greville. Sidney bequeathed his books to be divided between him and Greville. Among his contemporaries his reputation was high as a poet, especially an elegiac poet; but little has come down bearing his name, and of that little it was long difficult to know what was truly his. Poems ascribed to him in one collection were elsewhere recognised as the work of Lodge or Breton; but in 1872–76 Dr Grosart did his best to identify and edit (in the 'Fuller Worthies Library' *Miscellany*, iv.) all Dyer's extant work—a dozen pieces in all. 'My Mind to me a Kingdom is,' set to music by William Byrd in his *Psalms, Sonnets, and Songs* (1588), is almost certainly his, and on it rests his claim to immortality.

Dyer, George, antiquary and scholar, well known to readers of Charles Lamb, was born in London, 15th March 1755, and educated first at Christ's Hospital, and afterwards at Emmanuel College, Cambridge, which he entered in 1774. He took his degree of B.A. in 1778. During the next fourteen years he was variously engaged, chiefly at Cambridge, as tutor and usher, but he finally settled in London in 1792. Here he devoted himself principally to literature, and produced, among many works of less note, the *History of the University and Colleges of Cambridge* (1814), and *Privileges of the University of Cambridge* (1824). He also contributed largely to the *New Monthly* and *Gentleman's Magazine*, made indexes, and corrected for the press. He contributed 'all that was original' to Valpy's classics, 141 volumes (1809–31), but became blind when his work was done. The incident of his walking into the New River and being nearly drowned is chronicled by Charles Lamb in his essay 'Amicus Redivivus.' He died in Clifford's Inn, 2d March 1841. Dyer was a man of remarkable straightforwardness and honesty of character, qualities which are everywhere discernible in his works. He was destitute of humour, slovenly in dress and in his home surroundings. 'For integrity and single-heartedness,' Lamb ranked him 'among the best patterns of his species.' He was also a poet, although now forgotten, and never famous.

Dyer, John, an English poet, was born about 1700, near Llandilo, in Carmarthenshire, and

educated at Westminster. On the death of his father, a solicitor, he abandoned law, and took to art, rambling over South Wales and the English country near. In 1727 he published his poem of *Grongar Hill*, remarkable for simplicity, warmth of feeling, and exquisite descriptions of natural scenery, which it was much more a merit for a man to see then than now. He next travelled in Italy, returned in bad health to publish a second poem, the *Ruins of Rome* (1740), took orders, and became vicar of Catthorpe in Leicestershire in 1741, which he exchanged later for the Lincolnshire livings of Belchford, Coningsby, and Kirkby-on-Bain. He died in 1758. The year before his death he published *The Fleece*, an unpretentious didactic poem, which had the honour to be praised by Wordsworth in a sonnet. His poems were edited by Edward Thomas in 1903.

Dyer, THOMAS HENRY, an industrious archæologist and historian, born in London, 4th May 1804. In early life he was engaged in the West India trade, but he ultimately devoted himself to literature, and qualified himself as an authority on classical antiquities by extensive travel on the Continent and prolonged study of the topography and antiquities of Rome, Pompeii, and Athens. In 1865 he was made LL.D. by the university of St Andrews. His works are a *Life of Calvin* (1850), *History of Modern Europe* (4 vols. 1861–64; revised and continued by Hassall, 1901–2); *History of the City of Rome* (1865), *History of the Kings of Rome* (1867), *Ruins of Pompeii* (1866; 2d ed., substantially a new work, entitled *Pompeii: its History, Buildings, and Antiquities*, 1868), and *Ancient Athens* (1873), besides articles in the *Classical Museum* and Smith's *Dictionaries of Biography and Geography*. He died at Bath, 30th January 1888.

Dyer, SIR WILLIAM TURNER THISELTON, botanist, born at Westminster, 28th July 1843, studied at Oxford, was professor at Cirencester and in the Royal College of Science in Ireland, and director of Kew Gardens (1885–1905). He edited a number of floras.

Dyer's Alkanet, Dyer's Bugloss (*Anchusa tinctoria*). See ALKANET.

Dyer's Broom, Dyer's Greenweed (*Genista tinctoria*). See BROOM.

Dyer's Rocket, Dyer's Weld, Dyer's Yellowweed (*Reseda luteola*). See WELD.

Dyer's Weed, a name given to various plants which have yielded dye-stuffs, especially Weld (q.v.), Woad (q.v.), and dyer's broom (see BROOM).

Dyfed. See PEMBROKESHIRE.

Dying Declaration. See DECLARATION.

Dyke, or DIKE, an artificial mound along the bank of a river or seashore, erected for the purpose of preventing inundation; but *dyke* is also used in the sense of *ditch*, another form of the same word (Old English *dic;* modern Scots *dyke*, a boundary wall of stone or turf; cognate with German *teich*, a pond). Dykes or embankments, in some form or another, are in use in most low-lying countries, as in the English Fen Country and along the Lower Mississippi (q.v.). But the classical land of dykes is Holland, where as early as 10 B.C. the Roman commander Drusus made embankments. Beside the river-dykes, and those which help to keep the *polders* (see POLDER) drained, the kingdom of the Netherlands possesses, where the shores are not defended by sand-dunes, many hundreds of miles of sea-dykes, erected and maintained at enormous cost. One, the West Kappel dyke, is 12,648 feet long, and 23 feet high, with a seaward slope of 300 feet; it is protected by piles and stone-work, and has a road and a railway on its top. Great destruction has been brought about by the bursting of dykes in Holland; sometimes the Dutch dykes have been deliberately broken down for military purposes, as when in 1574 the Prince of Orange raised the siege of Leyden by breaking down the dykes, flooding the country, and drowning many of the besieging Spaniards. Modern illustrations of the fearful damage caused by the bursting of dykes are those which destroyed Szegedin, in Hungary, in 1879, and the flooding of a vast area in China by the inundation of the Hoang-ho in 1887. For various kinds of embankments, see CANAL, RAILWAY, LEVÉE, WATER-WORKS, HAARLEM, BEDFORD LEVEL.

Dykes and **Veins.** Igneous rocks which rise in even-sided, more or less vertical, wall-like sheets are called dykes, from the common Scots word for a wall (see the article above). The term vein is applied to the more irregular, winding, branching, and generally smaller intrusions. Dykes and veins are of common occurrence in the cones of existing volcanoes, where they appear to have been injected chiefly from below. Occasionally, however, the rents occupied by dykes would seem to have been filled from above by an overflowing stream of lava. The crystalline rocks of which dykes are composed are of various kinds. In Scotland, where dykes are abundantly developed, the rock is chiefly some variety of basalt-rock. These basalt-dykes vary in thickness from a foot or less up to 100 feet and more, and in length from apparently only a few yards up to many miles. Sometimes they cut across rocks which have yielded more readily than themselves to the denuding agents, and hence they form prominent features in a landscape, stretching like great wall-like ramparts across low-lying undulating tracts; when, on the other hand, they traverse strata which are less readily eroded than themselves, they frequently form deep trench-like hollows. Sometimes they have come up along lines of faults; but more frequently they appear simply to occupy great rents which are not accompanied by any vertical displacement of strata. They generally run in approximately straight or gently undulating lines; but occasionally they follow a more zigzag course. The rock of a dyke is usually jointed at right angles to its direction, and now and again this jointing gives rise to fine prismatic columns. In the centre of the dyke the rock is more markedly crystalline than towards the sides, where it is often compact, and its point of junction with the walls of the rent in which it lies are not infrequently coated with a skin of volcanic glass. Vesicular cavities frequently appear in the centre of a dyke, and finer pores are often distributed through the rock near the sides. As a rule, the strata are not much affected at their junction with a dyke—the alteration seldom extending beyond a foot or two. When the dyke, however, is very thick, say 100 feet or so, the adjoining rocks are often considerably baked—limestones being rendered crystalline, while coals are converted into a kind of coke, shales are porcelainised, and sandstones changed into quartzite. Sometimes, too, the strata are much smashed and jumbled, and their fragments enclosed in the marginal areas of the intrusive rock.

In regions where fissure-eruptions have taken place, the dykes are often branching and irregularly ramifying—the rocks being traversed by a perfect network of dykes and veins, anastomosing with and crossing each other at all angles. Good examples occur in the western islands of Scotland, the Faröe Islands, and Iceland. Veins are frequently very numerous in the neighbourhood of great masses of granite, from which, indeed, they proceed. It is remarkable that the rock of such veins is frequently finer grained than the granite from which it comes, and often passes into quartz-

porphyry or Felsite (q.v.). Granite itself is also very commonly traversed by peculiar dykes and veins, some of which are more coarsely crystalline, while others are finer grained, than the granite itself. These veins are so closely welded into the granite, their crystals indenting the surrounding rock, that it is obvious they were formed at a time when the granite was only partially consolidated. It seems probable that they were injected before the granite had quite solidified. They are known as 'contemporaneous' or 'segregation' veins; but their precise mode of formation is still very obscure. Occasionally dykes of fragmental matter occur, as in the Sidlaw Hills, the hills of Ayrshire, and the Cheviots in Scotland. They have been observed also in the Canary Islands. Such dykes vary in width from a foot or two up to many yards. They seem only to occur in association with other volcanic rocks, and generally to indicate the proximity of some volcanic vent. The fragmental materials are angular, and form a breccia or agglomerate of volcanic rocks alone, or of these and various derivative rocks; hence they are termed *agglomerate dykes*. See IGNEOUS ROCKS.

Dykes, JOHN BACCHUS, composer, was born at Hull, 10th March 1823, graduated at Cambridge, was ordained in 1847, and was appointed precentor of Durham cathedral in 1849. In 1861 he received the degree of Mus. Doc. from the university of Durham, and in 1862 was presented to the vicarage of St Oswald's in that city. An earnest High Churchman, he became involved in a controversy with Dr Baring, his diocesan. He died 22d January 1876. Dr Dykes was a joint-editor of *Hymns Ancient and Modern*, and composed, besides many services and anthems, a number of hymn-tunes, most of which are to be found in all English collections. Among these are 'Lead, Kindly Light,' 'Nearer, my God, to Thee,' and 'Jesus, Lover of my Soul.' See Life by Fowler (1897).

Dymoke, the name of a Lincolnshire family who exercised the offices of Champion (q.v.) and Standard-bearer of England from the coronation of Richard II. to that of George IV., after which the champion's ceremony was dropped, though the standard-bearer continued to play his part. These offices passed in 1875 to a collateral branch of the family. See Samuel Lodge, *Scrivelsby, the Home of the Champions; with some Account of the Marmion and Dymoke Families* (1893).

Dympna, SAINT, an Irish princess doubtfully referred to the 7th or the 9th century, is said to have fled to Gheel in Belgium from the incestuous passion of her father, who followed her thither and slew her. She is patroness of the insane.

Dynamics is the science which treats of *matter* and *motion*. The term *Mechanics* (q.v.) has been, and still is, much employed to denote this science, but its use in this way is not justifiable. *Kinematics*, the science of *motion*—i.e. of *space* and *time*—does not take account of *what* moves, nor of what *cause* produces the motion. In dynamics, the nature of the moving body and the cause of its motion are both considered. The whole science is based upon Newton's Laws of Motion, which are as follows: (1) Every body continues in its state of rest or of uniform motion in a straight line, except in so far as it is compelled by force to change that state; (2) change of momentum is proportional to force, and takes place in the straight line in which the force acts; (3) to every action there is always an equal and contrary reaction. Definitions of the principal terms used in the science are given below.

The *mass* of a body—i.e. the quantity of matter which it contains—is proportional to its volume and density conjointly, the *density* being the quantity of matter contained in unit volume. If V be the velocity of a moving body, the mass of which is M, the quantity MV is termed its *momentum;* and similarly, if A be the acceleration of velocity, MA is called the *acceleration of momentum*. The quantity $\frac{1}{2}MV^2$ (which represents the work done on a body of mass M, originally at rest, in order to produce in it the speed V) is called the *kinetic energy* of the body.

Force is defined as any cause which alters a body's state of rest or of uniform motion in a straight line. A force is measured (in accordance with Newton's second law) by the momentum which it produces in unit time—i.e. by the quantity MA. It is completely specified when its place of application, its direction, and its magnitude are given. Hence (and since every force produces its own change of momentum in a body quite independently of the action of other forces) forces are compounded and resolved in the same way as accelerations and velocities (see VELOCITY). A force does *work* when it moves a body in the direction in which it acts, and the work done is measured by the product of the force into the distance through which it moves the body, or, as has been already remarked, by the kinetic energy produced. A pair of equal and oppositely directed forces acting so as to rotate a body about an axis is termed a *couple*, and the product of either of the forces into the distance between their lines of action is called the *moment* of the couple.

In many cases of motion the moving body, though of finite dimensions, may be treated as if it were a mere material particle. Thus there is the dynamics of a particle. This subject is further subdivided into *statics* and *kinetics* of a particle according as the particle is or is not in equilibrium under the forces. The condition for equilibrium is that the sum of the resolved parts of the forces in *any* direction is zero; but, because of the tri-dimensional character of space, it is sufficient to show that the sums of the resolved parts in any three non-coplanar directions are zero. When motion occurs, three cases arise according as the motion of the particle (1) is limited to a given curve, (2) is limited to a given surface, or (3) is unlimited. Simple examples are those of particles (1) falling under the action of gravity, or sliding under gravity on a smooth or rough surface; (2) projected at any inclination under gravity, or revolving around an attracting centre (in both these cases the surface to which the motion is confined is a plane). In all these cases, in accordance with the second law of motion, the resultant of the forces acting on the particle is equal to the acceleration of momentum; and whenever two or more particles mutually influence each other, the third law is required, in addition, completely to determine the motion. When two smooth spheres impinge upon one another, and remain in contact, their common speed is that of their Centre of Inertia (q.v.) before impact. If they separate again, the centre of inertia retains its previous motion, while the relative speed of separation is always a definite fraction (less than unity) of the relative speed of approach. Thus the motions are determinate.

A moving body, though it cannot always be considered to be a mere particle, may often be regarded as rigid. We have thus the statics and kinetics of a rigid solid. The three necessary conditions for equilibrium of a particle are here insufficient, as the body may rotate. The other conditions are that the sums of the moments of the forces about any three non-coplanar axes shall vanish. When the rigid body moves under the action of forces, it is sufficient to know the motion of the centre of mass (which is a case of kinetics of a particle),

and the *moments of inertia* of the body about three non-coplanar axes through the centre of mass. The moment of inertia about any axis is the sum of the products of the mass of each particle of the body into the square of its least distance from the axis. When a body rotates about an axis, it is always possible to find a distance such that, if the whole mass of the body were condensed at that distance from the axis, its moment of inertia would be the same as that of the actual body. This distance is called the *radius of gyration*. The quantity MAR^2, where R is this radius, A is the angular acceleration, and M is the mass, is the rate of increase of moment of momentum; and, by the second law, this is equal to the moment of the resultant couple about the axis of rotation.

The case of equilibrium of a flexible cord or chain is readily treated by means of the consideration that the difference of the horizontal parts of the tension at each end of any link is zero, while the difference of the vertical parts is equal to the weight of the link; and at least one case of motion of a flexible cord can be treated by an elementary statical method (see WAVE). The subject of dynamics of an elastic solid is of great complexity. For a slight discussion of the more elementary parts, see ELASTICITY and RIGIDITY.

Dynamite and other 'High' Explosives. As early as 1534 mention appears in a work termed *Büchsenmeysterei*, printed at Frankfort-on-the-Main, of an explosive liquid formed by a mixture of six parts of nitric acid, two parts of sulphuric acid, three parts of liquid ammonia, and two parts of oleum benedictum—a crude tar-oil. Next there is a description of aurum fulminans, or fulminating gold, in *Pepys's Diary*, under the date November 11, 1663, as a powerful explosive; while Berthollet, in 1786, discovered potassium chlorate ($KClO_3$), and endeavoured, until a disastrous explosion occurred, to use it to form a gunpowder. In 1800 Howard investigated the fulminates, and was severely injured while doing so. The articles on Gun-cotton and Nitro-glycerine give further details of the progress in the discovery of explosives. The wonderful results obtainable by detonation of nitro-glycerine and gun-cotton, as compared with the explosion of gunpowder, gave an immense impetus to research into the nitration of many organic substances, with the result that the number of explosive compounds and mixtures known is now very great, and grows annually.

The meaning of the term detonation has been explained under Gun-cotton, but it will be well to touch briefly here on the fundamental difference between an explosive *mixture*, such as gunpowder containing no ingredient which is itself detonatable, and an explosive *compound*, such as nitro-glycerine, and the other nitro-compounds which will be dealt with in this article. This difference is due to the very intimate and regular contact of the constituent atoms of the molecule of an explosive compound and the comparative coarseness of the most carefully made mechanical mixture. The explosive combination of the various elements of the compound can therefore take place enormously faster than can be the case with the constituents of a mixture such as gunpowder, which is quite incapable of detonation. If, however, the potassium nitrate of gunpowder be replaced by potassium chlorate (which can be detonated by itself, though with difficulty), a detonating explosive is produced. The violence of this and other detonating *mixtures* of a similar character will, however, be affected by the intimacy of the mixture of the ingredients. Detonating explosives are termed 'high' explosives, and are of course only used for disruptive purposes. Their special feature is the rapidity with which the wave of detonation will traverse them. This varies considerably with the density of the charge and the initial detonating impulse. In the most favourable circumstances all the detonating compounds which are usually employed have velocities of detonation of over 20,000 feet per second. No compound or mixture would rank as a high explosive which has a lower velocity of detonation than about 6000 feet per second. Too much must not be made of this feature, however; the heat and volume of gas produced on detonation are the measures of an explosive's power. Velocity of detonation enables that power to be exerted with the utmost rapidity and violence.

The number of organic bodies capable of nitration to produce explosives is very large, but, as the result of experiments, the majority have been rejected as too expensive, as requiring too much purification, as giving too sensitive compounds, or as requiring an undue amount of nitration to obtain the best results. As a consequence, the nitro-compounds in practical use are not very numerous, though the number of explosives, with various fancy names, formed by mixing them together (with or without the admixture of non-explosive materials) is considerable—some sixty or more being mentioned in the Annual Reports of H.M. Inspectors of Explosives as actually manufactured or sold in the British Isles. To mention the more important of the nitro-compounds, there are, of the cellulose class, gun-cotton (soluble and insoluble); and of the glycerine class, nitro-glycerine. The cellulose and glycerine classes, it may be remarked, are sometimes classed together as alcohols, owing to the similar formation of their nitrates (see GUN-COTTON and NITRO-GLYCERINE), as compared with the true nitro-substitution products about to be mentioned. These latter are obtained from the so-called aromatic hydrocarbons, benzene (C_6H_6), toluene (C_7H_8), and naphthalene ($C_{10}H_8$), and the derivatives of the first two by hydroxyl (OH) substitution, phenol (C_6H_5OH), and cresol (C_7H_7OH), to mention only some of the more important.

These compounds when treated with mixtures of nitric and sulphuric acids produce nitro, dinitro, trinitro, and in some cases tetranitro compounds. As in the case of gun-cotton and nitro-glycerine, the sulphuric acid does no more than take up the water formed by the chemical reaction, and so maintains the strength of the nitric acid. The action of the nitric acid (HNO_3) on these hydrocarbons is usually explained by assuming that one or more of the hydrogen (H) atoms in the hydrocarbon is replaced by the nitryl group (NO_2), with the formation of water (H_2O), in combination with the hydroxyl (HO) of the nitric acid, which last can be written $(OH)NO_2$ instead of HNO_3. Thus in the case of benzene (C_6H_6) we have the formation of nitro-benzene ($C_6H_5NO_2$) as follows:

$$C_6H_6+(OH)NO_2=C_6H_5(NO_2)+H_2O,$$

and for dinitro-benzene $\{C_6H_4(NO_2)_2\}$:

$$C_6H_6+2(OH)NO_2=C_6H_4(NO_2)_2+2H_2O.$$

Trinitro-benzene, $C_6H_3(NO_2)_3$, can be similarly formed by a large excess of mixed acids. It is not much used.

The specially important compounds of this group are dinitro-benzene, already mentioned, trinitro-toluene, $C_7H_5(NO_2)_3$, and trinitro-phenol (picric acid), $C_6H_2(NO_2)_3OH$. All the nitro-substitution compounds above mentioned are deficient in the oxygen needed for the complete combustion of their carbon (C), and on detonation by themselves give off dense black smoke. They are therefore usually mixed with some oxidising substance when used for explosives. They are very inert, and need powerful detonators to produce detonation. Unless strongly confined they will not explode on ignition.

A highly important compound also is ammonium nitrate (NH_4NO_3). This compound, itself a mild explosive when detonated, is very largely used mixed with other more powerful explosives—firstly, as a reservoir of available oxygen to ensure that the actively poisonous gas carbon monoxide (CO) shall be converted, as far as possible, to the less objectionable carbon dioxide (CO_2), which, while it does not support life, is not actively poisonous if inhaled; secondly, to cool down the gases of explosion (as its decomposition absorbs heat), and thus produce a 'permitted explosive,' which is one which passes the British Home Office test, prior to use in fiery mines, of not causing, by its detonation, an explosive mixture of coal-gas and air to explode. Ammonium nitrate is a constituent of some 70 per cent. of these permitted explosives. As it is highly deliquescent, the mixtures in which it is used must be contained in waterproofed cartridges. A mixture of tri-nitro-toluene with ammonium nitrate in proportions varying from 60 to 20 per cent. of the former to 40 to 80 per cent. of the latter, is now the high explosive largely used for shell and bomb filling in the British service. The mixture is termed 'Amatol.' Usually the mixture with 20 per cent. of tri-nitro-toluene is used, and is described as 'Amatol 80/20.' When closed up in a shell its hygroscopicity is unobjectionable. With 50 to 60 per cent. of tri-nitro-toluene, and heated up above the melting-point of the latter, and kept well mixed, the mixture can be poured into shell, as can be done with tri-nitro-toluene alone (see below); but with less than about 50 per cent. of tri-nitro-toluene the mixture is put into the shell as a powder, and consolidated by suitable means to a density of about 1·45. The mixture of the two ingredients can be effected by milling cold under rolls, or by mixing with stirrers at a temperature of about 100° C. For mines ammonium perchlorate (NH_4ClO_4), mixed with a combustible such as wood-meal, was used largely in the war of 1914–18. This is a powerful high explosive. Explosives with potassium and ammonium perchlorate bases, mixed with nitro-compounds, or with a combustible only, are used to a considerable extent on the Continent.

Nitro-glycerine, gun-cotton, and the other explosives mentioned, except Picric Acid (q.v.), which is usually employed by itself, may be, and are, mixed together to form special explosives, but the following substances are often used in the mixtures, viz. barium, potassium, and sodium nitrates, as absorbents of nitro-glycerine, instead of the absolutely inert kieselguhr (see below); and when this is done, charcoal, wood-pulp, or wood-meal is added for combustion by the oxygen they contain. See GUNPOWDER.

The composition of some characteristic specially named explosives will now be given.

Dynamite.—Nitro-glycerine 75 per cent., kieselguhr 25 per cent. Kieselguhr is a silicious earth formed chiefly of the minute silicious cells originally containing Diatoms (q.v.), a group of plants found in water, especially in cold climates. The cells, being porous, absorb the nitro-glycerine. Although the parent of all high explosives, this form of dynamite has been superseded by the more powerful forms mentioned below.

Blasting-Gelatine.—Nitro-glycerine 93 per cent., nitro-cotton 7 per cent. This is probably the most powerful explosive in existence. The nitro-glycerine is absorbed by the soluble gun-cotton, and forms with it a substance somewhat like india-rubber.

Gelignite.—Nitro-glycerine 60 per cent., nitro-cotton 4 per cent., potassium nitrate 27 per cent., wood-pulp 9 per cent.

Monobel.—Nitro-glycerine 10 per cent., ammonium nitrate 80 per cent., charcoal 9 per cent., moisture 1 per cent.

Bellite.—Ammonium nitrate 85 per cent., di-nitro-benzene 15 per cent.

Faversham Powder No. 2.—Nitrate of ammonium 90 per cent., tri-nitro-toluene 9 per cent., moisture 1 per cent.

Roburite.—Ammonium nitrate 86 per cent., chloro-di-nitro-benzene ($C_6H_3Cl(NO_2)_2$) 14 per cent. This is di-nitro-benzene, with one atom of chlorine (Cl), replacing one atom of hydrogen.

Ammonite.—Ammonium nitrate 88 per cent., di-nitro-napthalene 12 per cent.

Of the above, dynamite, blasting-gelatine, and gelignite are not 'permitted' explosives; the remainder are.

Mention has been made of picric acid as being used by itself for explosive purposes. This is specially the case for the filling of shell, for which purpose its property of becoming thoroughly liquid at 251° F. (122° C.) renders it very suitable, as in that condition it can be poured into the interior of the shell. For shell-filling tri-nitro-toluene is also well suited, as it melts at the lower temperature of 177° F. (81° C.), and has none of the objectionable chemical activity of picric acid leading to the formation of dangerous picrates. On the other hand, it is slightly less powerful, and needs a more powerful detonator to start detonation.

Compared with blasting-gunpowder, the cost of high explosives is much greater, their prices varying from about two to three times more than that of blasting-gunpowder; but on the other hand, according to their compositions, they are from two to three times as powerful (see GUN-COTTON).

See *Treatise on Service Explosives* (Official, 1907); *Manufacture of Explosives: Twenty Years' Progress*, by Guttman (London: Whittaker & Co., 1909); *Nitro Explosives*, by Sandford (London: Crosby, Lockwood, & Son, 1906); *Explosives*, by Marshall (London: J. & A. Churchill, 1917).

Dynamo-electric Machines are machines for generating electric currents by means of the relative movement of conductors and magnets. Faraday discovered in 1831 that an electric current is induced in a conductor when it is moved across the pole of a magnet, so that it cuts the lines of magnetic force, or (more generally) whenever the number of these lines which passes through the circuit of the conductor is in any way varied. If, for example, a coil of wire, the ends of which are connected so that the whole forms a closed circuit, be suddenly withdrawn from the pole of a magnet, a transient electric current is induced in it, while the lines of magnetic force which proceed from the pole are ceasing to be present within the coil. If the coil be replaced, a current will again be induced, but in the contrary direction. Similarly, a transient current is induced if the coil be held at rest while the magnet is drawn away; or, again, if the coil be turned round so that the direction of the lines of force through it becomes reversed, in which case the effect will be twice as great as before. Any movement which causes an alteration to take place in the amount of magnetic induction through the coil produces a transient current, the electromotive force of which is proportional to the rate at which this alteration takes place. The whole amount of electricity produced is the same whether the movement be fast or slow. When the movement is slow, the current lasts longer in proportion as its strength is less. To produce the movement requires an exertion of mechanical work, which finds its equivalent in the energy of the induced current.

Faraday's discovery was immediately followed by the invention of numerous forms of magneto-electric machines, as they were then called, in most of which a steel horseshoe magnet was made to

rotate over a pair of coils wound on a fixed armature, or the armature and coils were made to rotate while the magnet was held fixed. Fig. 1 is an example of one of these early forms, in which the armature, BB, with the bobbins, C, D, which consist of coils wound upon iron cores fixed to the armature, revolves in front of the magnet poles, N, S. In every half-revolution the lines of magnetic force through the bobbins have their direction reversed, and a series of transient currents are consequently produced in the coils. These pass to the external part of the circuit through the spring brushes, H, K, which make contact with a revolving collector, consisting of insulated metallic rings on the axle, to which the ends, *m*, *n*, of the coils are attached. If *m* were always in contact with H, and *n* with K, it is obvious that each successive transient current would take the direction opposite to its predecessor —the direction of the current would alternate at every half-revolution. On the other hand, it is easy, by splitting the rings, to arrange the collector so that H is in contact with *m* for half a revolution, and then with *n* for the other half, while K is in contact first with *n*, and then with *m*, with the effect that the successive currents all have the same direction in the external portion of the circuit. The collector is then called a commutator. A simple form of commutator is shown in fig. 2.

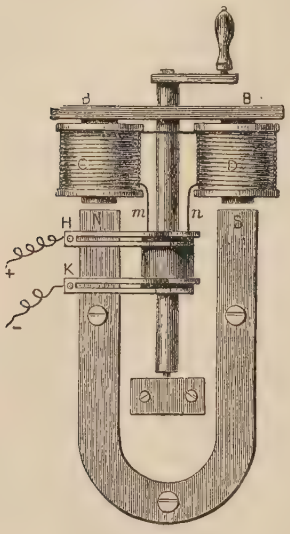


Fig. 1.

Fig. 2.

An ideally simple form of dynamo is represented diagrammatically in fig. 3, which represents a conductor consisting of a single loop of wire revolving in the magnetic field between the poles of a magnet, NS, so that at every half-revolution the lines of force have their direction of passing through the loop reversed, and a series of transient currents is consequently induced in the loop. Here, again, a commutator is required if the currents are to have one continuous direction in the external portion of the circuit. In the position sketched (by full lines), the side, *a*, of the rectangular loop is cutting the lines of force in one direction, and the side, *b*, is cutting them in the other, and both these movements are contributing to produce electromotive force in one direction round the loop; the other two sides (i.e. the front and the back) of the loop do not cut lines of force, and therefore do not contribute to the production of electromotive force. As the loop approaches the vertical position (shown by dotted lines), the component motion of the sides across the lines of magnetic force becomes reduced, and the electromotive force diminishes, till, at the vertical position, it disappears entirely, for there the sides of the loop are moving (at the instant) along the lines of force. After that they begin to cut the lines of force again, but in the reverse direction, and an electromotive force opposite to the last begins to act, which reaches its maximum when the coil is again horizontal. The same variations are repeated as the coil turns through the remaining half of its revolution. The strength of the current follows similar fluctuations, being determined by the electromotive force and by the resistance of the circuit, including the resistance of the revolving loop itself.

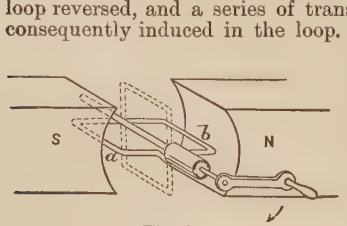


Fig. 3.

The effect of the revolving conductor in producing electromotive force may be increased (1) by increasing the speed of rotation; (2) by forming the loop with more than one turn of wire so as to make a coil, the whole effect is then the sum of the effects due to the individual turns; (3) by strengthening the magnetic field. One very important method of doing this is to furnish the revolving coil with an iron core, the effect of which is to increase the magnetic induction through the loop, across the space from pole to pole, by providing an easier path for the lines of magnetic force to cross this gap. In early dynamos the armature (as the revolving-piece is called) frequently consisted of a coil of many turns wound on an iron core, in the manner illustrated by fig. 4, which shows in section the simple shuttle-wound armature introduced by Siemens in 1856. The ends of the coil were brought to a commutator like that of fig. 2, and the effect was to produce currents which were uniform in direction. They were, however, very far from uniform in strength, varying from zero to a maximum twice in every revolution of the shaft.

Fig. 4.

In the early dynamos permanent steel magnets were used to produce the field in which the armature moved, but it was soon recognised that electro-magnets might be employed instead, and in 1863 Mr Wilde introduced a machine with large electro-magnets, which were excited by a small auxiliary armature revolving between the poles of a permanent magnet. Before this it had been proposed in machines with permanent magnets to supplement the magnetism when the machine was in action, by having coils wound upon the magnets, and by allowing the current produced in the machine itself to pass through these coils. It was not till 1867, however, that it became known that steel magnets were wholly unnecessary, and that dynamos with electro-magnets might be made entirely self-exciting. Even when the cores of the electro-magnets are of soft iron, there is enough residual magnetism to initiate a feeble current; this develops more magnetism, which in its turn develops more current, and so the process goes on until full magnetisation is reached. The principle of self-excitation was enunciated independently, and almost simultaneously, by Wheatstone, Werner Siemens, and S. A. Varley; it is now made use of in all except the smallest machines. The term 'dynamo-electric' was at first applied to distinguish those machines which were self-exciting from 'magneto-electric' machines, which had permanent magnets to give the field; but this distinction is no longer maintained, and the name 'dynamo' is now used in the wider sense defined above.

An extremely important step in the development of the dynamo was taken in 1870 by Gramme, who

introduced a form of armature which, for the first time, gave a current not merely continuous in direction, but also sensibly uniform in strength. The Gramme ring armature is shown diagrammatically in fig. 5. It consists of a ring-shaped iron core, revolving in the magnetic field, and having a series of coils, A, B, C, &c., wound upon it. These are joined to one another in a continuous series, and also to the insulated segments of a commutator, *a*, *b*, *c*, which revolves with the ring, and from which the current is taken by brushes, H, K. Consider now the action of the field in producing electromotive force in any one of the coils, such as A. Near the place in which it is sketched, the coil A is moving in a direction parallel, or nearly parallel, to the lines of force, and, therefore, is having little or no electromotive force induced in it. But by the time the ring has made half a revolution, the same coil will have the lines of force within it reversed. Between these two positions, therefore, there must have been a generation of electromotive force, and this will in fact be going on most actively half-way between the two places. The coil C is at present the most active contributor of electromotive force, but B and D, the coils lying in front of and behind it, are also contributing a share, and the whole electromotive force between A and E, so far as that side of the ring is concerned, will be the sum of the several effects due to all the coils from A to E. A little consideration will show that the same action is going on on the other side of the ring, so that if the brushes be applied at *a* and *e* they will take off to the external portion of the circuit a current, half of which is contributed by one side, and half by the other side of the ring, the two sides acting like two groups of battery cells arranged in parallel and of equal resistance and equal electromotive force. The whole electromotive force in the armature is the same as that produced by the coils on one side alone, but the internal resistance is halved by the division of the current between the two sides. In actual Gramme armatures, the number of coils on the ring is very much greater than the number shown in the sketch, and each brush is made wide enough where it presses on the commutator to touch two of the segments at once. Hence the current is never interrupted, and the fluctuations in its strength, which occur as one segment passes out of contact and another comes in, may be made almost indefinitely small. As each coil passes, it is for the instant short-circuited through the brush, and this would give rise to a waste of energy in the coil and to sparking at the brushes, were it not that the brushes are set to bear on the commutator at the points where the development of electromotive force in the corresponding pair of coils is a minimum. These neutral points, as they are called, are not exactly midway between S and N, but are in advance of that position in consequence of the magnetic field within the ring being distorted through the action of the currents in the armature coils. Hence the brushes require to have what is called 'lead,' and this lead has in general to be adjusted whenever the output of the machine is considerably varied, more lead being needed if it happen that the armature current is increased while the field magnets remain of constant, or nearly constant, strength. As it often happens, especially in the case of a dynamo supplying power for traction purposes, that the demand for current is liable to severe fluctuations, it is obviously a great advantage to have a machine which will work sparklessly at all loads without the necessity of altering the adjustment of the brushes. Various expedients have been introduced with this end in view, chief among which are (1) carbon brushes, the high resistance of which checks the rush of current in the short-circuited coils; (2) small auxiliary poles, called 'interpoles,' midway between the main poles, excited by series coils, which supply a reversing field equivalent to giving lead to the brushes appropriate to every load; (3) compensating series windings, arranged to neutralise the distorting effect of the armature current.

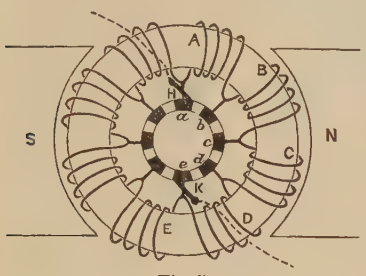


Fig. 5.

A small practical Gramme dynamo of an early form is shown in fig. 6. In this example two field-

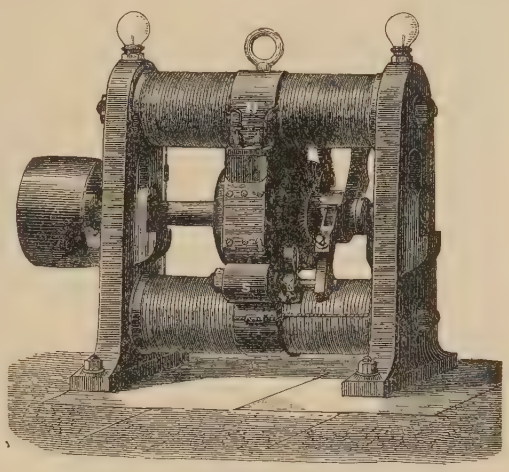


Fig. 6.

magnets conspire to produce a north pole at N, and two others to produce a south pole at S. The commutator is a series of copper bars mounted on an insulating hub fixed to the shaft, and separated from one another by thin strips of mica or other insulating material; these bars have radial projections, which are soldered to the junctions of successive armature coils. Each brush consists of a flat bundle of copper wires pressed lightly against

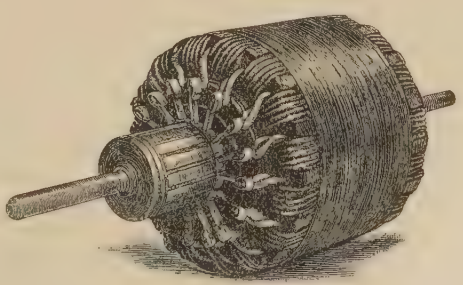


Fig. 7.

the commutator by a spring. The core of the armature is a ring made up of many turns of soft iron wire, on which insulated copper wire is wound to form the coils. It is essential that the core of the armature should not be solid, for in that case currents would be developed in the substance of

the moving iron itself to such an extent as very seriously to impair the efficiency of the machine. Hence the core of dynamo armatures is always subdivided, by being made up either of wire, or more usually of thin plates more or less carefully insulated from one another. Fig. 7 shows the armature of a small Gramme dynamo, removed from its place between the pole-pieces.

Two years after the introduction of the ring armature by Gramme, it was shown by Von Hefner Alteneck that the Siemens armature (fig. 4) might be modified so that it also should give continuous currents of practically constant strength. In the original Siemens armature there was but one coil, all wound parallel to one plane, and the current fluctuated from nothing to a maximum in every half-revolution. In the modified form the coil is divided into many parts, which are wound over the same core, but in a series of different planes, the plane of each successive coil being a little inclined to the plane of the coil before it. The coils are all joined in series, and their junctions are connected to the bars of a commutator just as in the Gramme ring. The Siemens-Alteneck or drum armature may, in fact, be compared to a Gramme armature, in which the coils, instead of being wound on successive portions of a ring, are all wound on one piece of core, preserving, however, the angular position they would have in the ring. Their action depends on their angular motion, and is therefore the same in both cases. As the drum revolves, that coil which is passing the neutral plane (viz. the plane perpendicular to the lines of force) is for the moment inoperative, and the brushes are set to touch those bars of the commutator that are connected with it. The other coils are more or less operative, the most active contributor of electromotive force being that one which is for the moment perpendicular to the neutral plane. The electrical effects in drum and in ring armatures are the same. Nearly all modern continuous current dynamos have drum armatures of the kind shown in fig. 8, mainly on account of the convenient

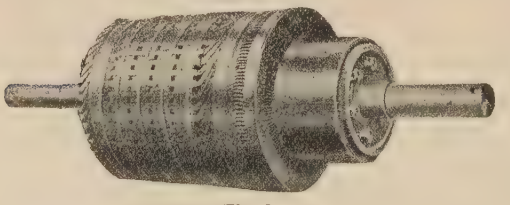


Fig. 8.

mechanical construction which can then be adopted. The core consists of a large number of discs of annealed sheet-steel with slots punched out at regular intervals round the periphery. At intervals of every two or three inches, air-ducts some half-inch wide are left between the plates through which the rotation causes air to circulate. These ducts are useless so far as the transmission of magnetic lines is concerned, but are invaluable for keeping the armature cool. The winding consists of a number of precisely similar coils of insulated copper wire, braid, or strip wound on a former, and then taped and varnished. Some idea of the peculiar shape of these coils will be gathered from fig. 9. They are inserted two-deep in each slot in such a way that each coil has one straight limb at the bottom of a slot, and the other straight limb at the top of a slot a certain number of slots in advance of the first slot. The coils are kept in place by wire bound round the periphery, or by wooden wedges driven into grooves at the tops of the slots, and the free ends of the coils are soldered to lugs attached to each commutator segment. The commutator segments are of hard-drawn copper, and are insulated from each other by prepared mica of the same hardness as the copper, so that the surface under the brushes wears down evenly. The segments are held in place by V clamping-rings insulated with mica. The bolts for drawing these together can be seen spaced at intervals round the shaft.

An important element in the classification of dynamos is the manner in which magnetism is

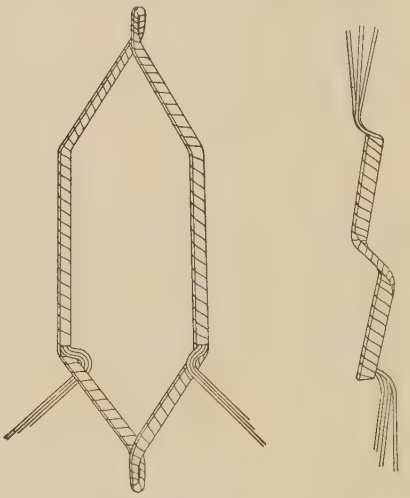


Fig. 9.

induced in the field-magnets. These may of course be excited from an independent source of electricity; but when the machine is self-exciting, there are three important alternative methods. In the early machines the coils on the field-magnets were connected in series with the external part of the circuit, and consequently the whole current produced by the machine passed through both. This arrangement is distinguished as *series winding*, and is shown diagrammatically in fig. 10. It was first pointed out by Wheatstone, in 1867, that the magnet coils, instead of being put in series with the external conductor, might be arranged as a

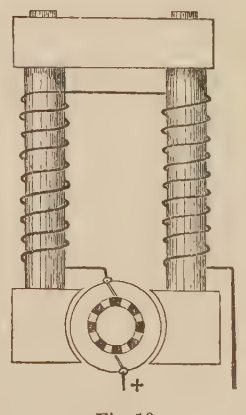


Fig. 10.

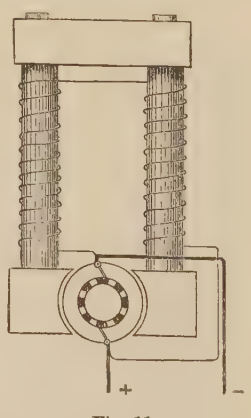


Fig. 11.

shunt to it, thereby forming an alternative path through which a portion only of the current would pass. In this arrangement, which is called *shunt winding* (fig. 11), the magnet coils consist of many turns of comparatively fine wire, so that they may not divert an excessive quantity of current from

the external circuit. Finally, in *compound winding* (fig. 12) the two previous methods are combined. The field-magnets are wound with two coils; one of these (which is short and thick) is connected in series with the external circuit, and the other (which is long and fine) is connected as a shunt to it. This plan appears to have been first used by Varley in 1876, and afterwards by Brush, who pointed out that it, along with simple shunt winding, has the advantage of maintaining the magnetic field even when the external circuit is interrupted. It has, however, when properly applied, another and more important merit, as will appear below.

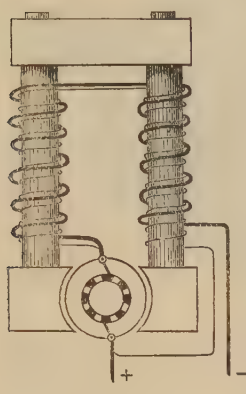


Fig. 12.

In a series-wound dynamo the magnets do not become excited if the external circuit is open, and become only feebly excited when the external resistance is high. Let the external resistance be reduced, while the armature is forced to turn at the same speed. The current will now increase, producing a stronger magnetic field; the electromotive force is therefore greater than before. A curve drawn to show the relation between the current and the difference of potential between the terminals of the machine (which is a little short of the full electromotive force, in consequence of the resistance of that part of the circuit which is within the machine itself) will in its early portion rise fast as the current increases, in consequence of the rapid augmentation of the magnetic field. Such a curve is called the characteristic curve of the machine, and is shown at AA in fig. 13. If we continue to increase the current by further reducing the external resistance, the magnets tend to become saturated, and finally even have their magnetism somewhat weakened on account of the influence of the currents in the armature coils. Further, the loss of potential, through internal resistance, becomes more considerable. The difference of potential between the terminals accordingly passes a maximum, and becomes considerably reduced when the current is much augmented, as appears in fig. 13. The characteristic curve for a shunt-wound dynamo is shown at BB in the same figure. Here the strength of the magnetic field is nearly constant, but decreases a little when the machine is giving much current, partly because the current in the shunt circuit is then somewhat reduced, and partly because the current in the armature coils tends to oppose the magnetisation. Hence the potential falls off as the current increases. This fall will, however, be slight if the resistance of the armature is very low and if the field-magnets are very strong, and under these conditions a shunt-wound dynamo will give a nearly constant difference of potential whether much or little current be taken from it, provided, of course, that the speed remain unchanged. To make the difference of potential more exactly constant, it is necessary that the magnetic field should become stronger when the machine is giving much current, and compound winding achieves this. A compound-wound dynamo may be regarded as a shunt machine in which the action of the shunt winding is supplemented by that of a series coil on the magnets. When the machine is running on open circuit, the shunt coil alone is operative; as the current taken from the machine is increased, the series coil produces a larger and larger supplementary effect on the magnets, and by choosing a proper number of series windings, their effect may be made to neutralise with great exactness the droop in the characteristic curve which would occur if the shunt coil were the only source of magnetism. Compound machines wound for constant potential give a nearly straight horizontal line for their characteristic; CC in fig. 13 is an actual example. By making the series coil more influential, so that the potential at the terminals rises slightly as the current increases, the machine may be compound-wound to give constant potential at the ends of long leading-wires by which the current is conducted to a distance.

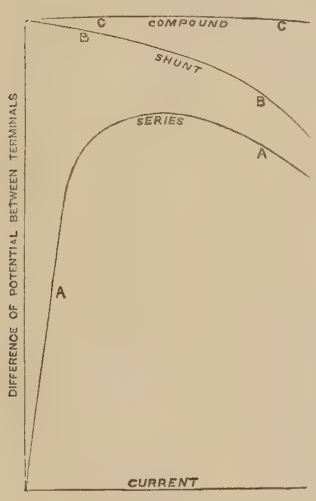


Fig. 13.

Series-wound dynamos were at one time largely employed for electric lighting by arc lamps. Shunt machines are the most suitable for charging storage batteries and for electro-plating.

Fig. 14 illustrates the front and rear of a Westinghouse generator (with shaft removed) for coupling

Fig. 14.

direct to a reciprocating engine, which gives a good idea of the modern way of constructing such machines. The rear view shows that the magnetic circuit consists of eight poles projecting inwards from a circular yoke. The series winding, consisting of a few turns of flat copper strip wound on edge, is seen enveloping the poles next to the yoke. The large rectangular coils at the tips of the poles, consisting of a large number of turns of comparatively fine wire, constitute the shunt winding. Turning to the front view, we notice a ring carrying the eight brush-arms, which may be rocked through a small angle by means of the hand-wheel provided for the purpose. The brushes consist of rectangular blocks of carbon set normal to the surface of the commutator, and kept lightly pressing upon it by springs, the strength of which can be adjusted. Just as the polarity of the magnets is alternately north and south, so the polarity of the brush-arms is alternately positive and negative. Cross connections are provided which join up electrically each group of brushes of the same polarity, and flexible leads bring the current from each group to a terminal block fixed

at the side of the machine. It will be noticed that the armature spider on which the laminations are carried is hollowed out so that air may freely enter, to be afterwards whirled through the air-ducts in the armature core, of which mention has already been made.

The rise of the steam-turbine to its present important position as a prime mover has exercised a profound influence on dynamo construction, and has necessitated the development of a distinct class of electric generator to suit the very high speed of rotation. Two difficulties have to be overcome: (1) to make the armature and commutator strong enough to resist the enormous centrifugal forces to which these are subjected; (2) to prevent sparking at the commutator due to the very rapid rate at which the current has to be reversed in the armature coils, and the large difference of potential existing between adjacent commutator segments.

In recent years, due to the expansion that has taken place in the area over which central stations distribute electricity, the *alternating current dynamo* or 'alternator' has more and more taken the place of the direct current dynamo for converting the mechanical energy of the prime mover into electrical energy. This is because there is difficulty in getting any machine with a commutator to work satisfactorily when the potential difference between the brushes exceeds, say, 1000 volts, and because with alternating currents the

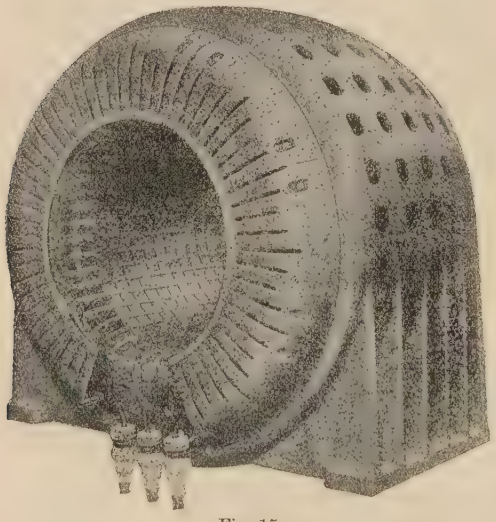


Fig. 15.

static transformer (see article on Electric Light) affords such an easy and efficient means of raising or lowering the pressure.

In early forms of alternating dynamo the armature usually consisted of a group of coils, joined in parallel or series, attached to a disc which revolves in the space between a corresponding group of pairs of magnet poles, so that rapidly alternating transient currents are induced as the coils pass the successive poles, and these currents pass to the external circuit through a simple collector which is not a commutator.

Figs. 15 and 16 show the stator and rotor of a three-phase alternator, designed for coupling direct to a steam-turbine. It will be seen that in this case, as is now usual in large machines, the armature is situated outside and is fixed, and a high pressure is induced in the windings by four field-magnet poles, which rotate within them at a speed of some 1500 revolutions per minute. The current for exciting the magnets is here obtained from a small low-tension continuous current dynamo fixed at the far end of the shaft, and is led into the field-winding by means of a couple of collector rings

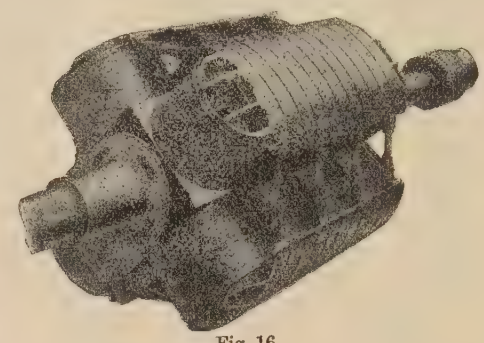


Fig. 16.

(not shown in fig. 16). Interesting mechanical features of the rotor are the very massive end-brackets and diagonal struts necessary to prevent the field-winding bulging under the high centrifugal forces to which it is subjected. The elaborate provision made for ventilating both stator and rotor should also be noticed. The so-called salient pole construction of fig. 16 is now largely confined to rotors of 6 poles or more driven by water turbines. When the prime mover is a steam turbine it is important in the interests of economy of steam to employ the highest possible speed. Now the field system cannot have less than 2 poles, which for a standard frequency of 50 cycles per second means a speed of 3000 r.p.m. This plan is found practicable up to outputs of 20,000 k.v.a. For still larger units recourse is had to a 4-pole design turning at 1500 r.p.m. In these large high-speed turbo-alternators the revolving field is of the non-salient or cylindrical type—i.e. the magnetising coils are embedded in slots somewhat after the fashion of a d.c. armature, except that the slots are grouped between the pole centres instead of being evenly spaced all round the circumference. In alternate current dynamos, the relation between the strength of the current and electromotive force induced in the moving coils depends not merely on the resistance of the circuit, but also on its coefficient of self-induction, which has the effect of making the maximum of strength in each transient current lag behind the maximum of electromotive force. It was shown experimentally and theoretically, by Adams and Hopkinson, that in consequence of self-induction two similar alternate current machines driven independently, but started at the same speed, and connected in parallel, will control one another, so that the phases of the currents will continue to agree, and in alternating current generating stations it is usual to find several machines running in parallel in this way.

Dynamos, of whatever type, may be regarded as machines for converting energy from a mechanical into an electrical form, and from this point of view a matter of prime importance is what is called the efficiency of the machine, which is the ratio of the electrical power the dynamo gives off, available for use outside the machine, to the power used to drive the machine. The electrical energy given off falls short of the mechanical energy absorbed, in consequence of (1) mechanical friction; (2) the generation of eddy currents, to be prevented as much as possible by laminating the iron core of the armature; (3) magnetic friction or 'hysteresis,' by which every reversal of magnetism in the iron causes dissipation of energy, apart from the production

of eddy currents; (4) the energy consumed in maintaining the magnetic field; and (5) the heating of the armature in consequence of the resistance of its own coils. The aggregate effect of these sources of loss is that some 85 to 95 per cent. of the driving-power (according to the size of the machine) is available as electric energy in the external circuit. The efficiency of high-pressure turbo-alternators is remarkably high, often exceeding 97 per cent. in the larger sizes.

The Dynamo as a Motor.—Just as a conductor when made to move across the lines of magnetic force has a current generated in it, so when a current is made to pass along a conductor placed in a magnetic field, the conductor tends to move across the field in the direction which would reduce the current by inducing an opposing electromotive force. Even before Faraday's discovery of the induction of current in a conductor by its movement in a magnetic field, he had shown (in 1821) that the reverse process was possible, and soon afterwards various forms of magneto-electric engines were devised by Barlow and Sturgeon, and later by Ritchie, Henry, Dal Negro, Joule, and others, which employed electric currents to do mechanical work on a small scale. In 1838 Jacobi constructed an electric motor of sufficient power to propel a small boat, using a group of electro-magnets, which revolved on a disc between opposite groups of other electro-magnets, which were fixed. Some time before the application of the ring-armature to dynamos by Gramme, it had been used in a motor by Pacinotti, and the principle had been explicitly stated that any electric motor might be used to produce currents, but it was not until Gramme's time that the full significance of this principle was generally recognised. The action of the dynamo is in fact reversible; the same machine which converts mechanical into electrical energy will serve the opposite function equally well. Power may therefore be conveyed to any distance by using a dynamo to produce currents, conducting these to the distant spot, and utilising them there to produce mechanical effect by means of another dynamo acting as a motor.

Just as there are series, shunt, and compound wound dynamos, so there are series, shunt, and compound wound motors, each of which possesses its own sphere of usefulness. With a constant electromotive force applied at the terminals, a shunt-wound motor tends to rotate at a nearly constant speed at all loads, which makes it suitable for driving machine tools, textile machinery, and the like, where a constant speed of rotation is required. In series and compound wound motors, on the other hand, the speed under similar circumstances falls off when the load increases, which fact renders them suitable for traction purposes, cranes, &c., where it is advantageous that a heavy load should be overcome at a reduced speed. The powerful torque which these last-mentioned motors exert at starting also renders them specially valuable for all classes of work in which the motor has to be frequently started with the load on.

The factors controlling the current passing through the winding of a motor are (1) the impressed electromotive force, (2) the resistance of the winding, (3) the opposing or so-called 'back electromotive force' induced in the conductors in virtue of the rate at which they are cutting magnetic lines of force. When the armature is at rest item (3) is zero, and consequently an abnormally large current tends to flow when the current is first switched on. To prevent this rush of current at starting, an external resistance has to be introduced, which is cut out slowly as the speed (and consequently the back electromotive force) rises.

Alternate current dynamos form fairly efficient motors when driven by alternate currents; they require to be started in synchronism with the impulses received from the generating machine, but once started they tend to remain in synchronism.

The motor which is most extensively used with polyphase currents, however, is of a totally different type, called the *induction motor*. Its development dates from the discovery of the possibility of producing rotating waves of magnetic flux by means of polyphase currents, made by Ferraris (1885) and by Tesla (1888), in such a manner that a continuous

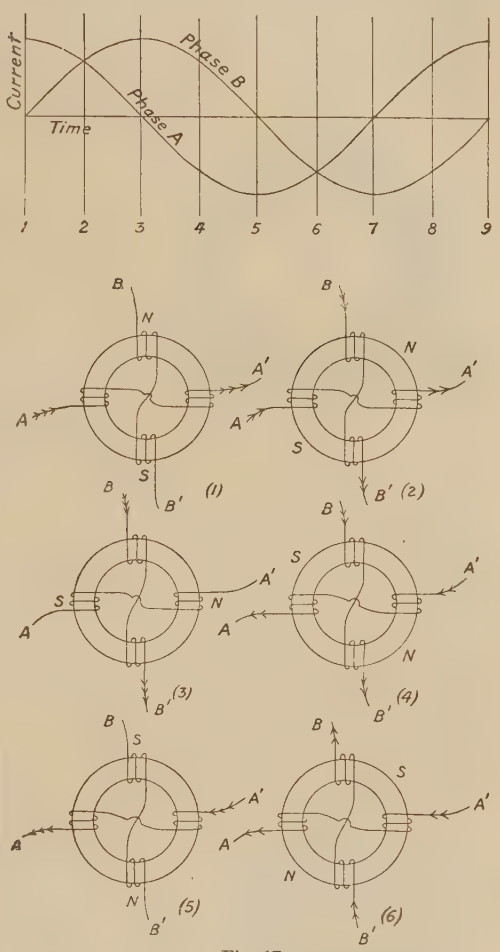


Fig. 17.

turning effect is produced between a stationary winding, called the stator, and a rotating member, called the rotor.

An elementary conception of the so-called 'rotating field' produced can be obtained by tracing step by step the magnetic field induced in a soft iron ring (fig. 17), when two coils (AA′ and BB′), whose axes are at right angles, are traversed by alternating currents differing by a right angle in phase. The two sine curves at the top of the same figure, marked phase A and phase B respectively, have been drawn to represent these two currents throughout a complete cycle. At the instant which we will designate (1) the current in phase A has its maximum positive value, flowing in the direction indicated by the arrow-heads. The induced magnetic field will be such that a north pole is produced at the top and a south pole at the bottom, as indicated by the letters N and S. The current

in phase B, being zero at the moment, is without magnetic effect. At the instant (3) the current in phase A has vanished, but now the current in phase B has risen to its maximum positive value, and consequently the new axis of magnetism is horizontal with poles as indicated by the letters N and S. Returning now to the intermediate instant (2), a reduced current is seen to be flowing in at A and out at A′ as at instant (1), simultaneously with a reduced current flowing in at B and out at B′ as at instant (3). The resultant magnetic effect is evidently to induce north and south poles at positions intermediate between corresponding positions of these poles at instants (1) and (3). Enough has now been said to make it clear that the magnetism travels round gradually through a quadrant between the instants (1) and (3); and, as indicated in the figure, it travels through another quadrant between the instants (3) and (5), completing a revolution in the time taken for either phase of the supply current to make a complete period. A precisely similar effect is obtainable when the iron ring carries three coils traversed by three-phase currents.

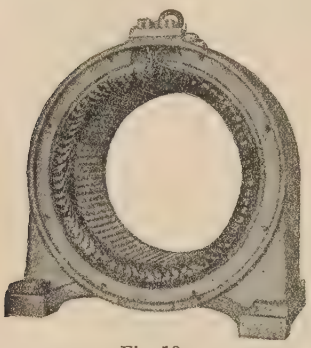


Fig. 18.

In actual induction motors the soft iron ring is replaced by an assemblage of annular punchings mounted in a hollow cylindrical frame (see fig. 18). The winding is situated in slots punched at regular intervals round the internal periphery of the laminations. The rotor (fig. 19) consists in this case of a core built up of sheet-steel punchings, and threaded all round the periphery by a number of stout copper bars riveted back and front to heavy end rings of copper or brass. From the resemblance of the construction, this type of rotor is called a 'squirrel cage.'

When current is first switched on to the stator winding, large currents are induced in the bars of the rotor in the same way as currents are induced in the secondary winding of a transformer (see ELECTRIC LIGHTING) by the passage of an alternating current in the primary. The electro-magnetic effect between the current in the copper bars of the rotor and the rotating field of the stator causes the rotor to revolve in the same direction as the field until a speed is attained only slightly less than that of the rotating field itself. An attractive feature of this type of motor is the absence of commutator, brushes, and all rubbing contacts. As regards efficiency, there is practically no difference between that of an induction motor and of a continuous current motor of the same output. A disadvantage of the squirrel-cage type is that if the rotor is designed to have a good efficiency at full load, a large current is taken at starting, and, in spite of this, the turning moment or 'torque' produced may be insufficient to start the motor.

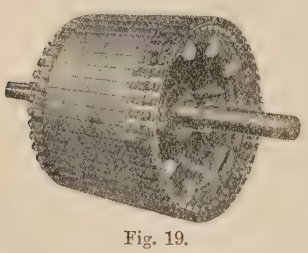


Fig. 19.

In such cases it is necessary to make the motor drive through some form of clutch by means of which the rotor is enabled to attain full speed before the load is thrown on. A satisfactory method of controlling the speed is also difficult to secure.

A good starting torque and an easy means of controlling the speed can be obtained by employing a 'wound' rotor with slip rings, but this means introducing rubbing contacts, and the performance at reduced speeds is uneconomical.

Induction motors can also be made which will operate on single-phase circuits, but in this case the magnetic field does not rotate, but only pulsates, so that it requires some special device to make the motor self-starting. In fact, the turning effect in a single-phase, two-phase, and three-phase induction motor is analogous to the turning moment experienced by the shaft of an engine operated by a single crank, two cranks at right angles, and three cranks at 120° respectively.

Returning for a moment to the consideration of the continuous-current series motor, a little consideration will suffice to show that this motor may also be operated by a single-phase alternating current, for at each reversal the direction of the current is changed both in the armature and the field, and consequently the turning moment experienced by the armature is always in the same direction. Working on these lines, the Westinghouse Company have produced a single-phase series motor which has been successfully applied for traction purposes; and the Oerlikon Company and Messrs Siemens have also brought out series motors with commutating poles.

Another type of motor for single-phase alternating current, also using a commutator, is the 'repulsion motor' originally invented by Professor Elihu Thomson in 1887. An improved compensated motor of this type has been adopted by the Southern Railway for propelling the trains on the electrified sections of their system (see ELECTRIC RAILWAY).

See ELECTRIC LIGHT, ELECTRIC RAILWAY, TRAMWAYS; and for the utilisation of water-power, ALUMINIUM, FOYERS, NIAGARA. On the theory of dynamos, see papers by J. Hopkinson (*Proc. Inst. Mech. Eng.* 1879–80), in which were explained the construction and uses of curves, such as those of fig. 13 (afterwards called characteristic curves by Deprez); by J. and E. Hopkinson (*Phil. Trans.* 1886), in which it was shown how the strength of the field and the performance generally of a dynamo might be predicted by calculation of the induction in the magnetic circuit of the machine. See articles in *Proc. Inst. Elect. Eng.*, *The Electrician*, &c.; C. C. Hawkins, *Dynamo Electric Machinery;* H. M. Hobart, *Electric Motors;* Miles Walker, *Specification and Design of Dynamo Electric Machinery;* E. Hausman, *Dynamo Electric Machinery;* A. T. Dover, *Electric Motors and Control Systems;* W. J. Maccall, *Continuous Current Electrical Engineering;* also *Alternating Current Electrical Engineering* by the same author; J. F. C. Snell, *Power House Design.*

Dynamom'eter, originally an instrument for measuring force, such as the pull exerted by a horse in drawing a cart; but the name is now usually given to instruments for measuring power. A friction brake, for example, applied to a drum on the shaft of a steam-engine, may be arranged so that it measures the rate at which the engine is doing work on the brake: the device then forms an *absorption dynamometer.* There are also various *transmission dynamometers* which measure the power conveyed by a belt or by a shaft without absorbing it.

Dyne. See FORCE.

Dyotheletism. See CHRIST.

Dyrrhachium. See DURAZZO.

Dysart, an old-fashioned seaport of Fife, on the Firth of Forth, 2½ miles NE. of Kirkcaldy. It owes

its name (Lat. *desertum*, 'a solitude') to St Serf's cave near Dysart House, Lord Rosslyn's seat; was a thriving place prior to the Union; and now has some textile manufactures and collieries. James V. made it a royal burgh, and with Kirkcaldy, Burntisland, Kinghorn, and Buckhaven, Methil, and Innerleven, it returns one member to parliament. Pop. of royal burgh (1851) 1610; (1891) 3022; (1921) 4598.

Dyscrasia (Gr. *dys-*, 'difficult,' and *krasis*, 'a mixture'), a pathological term much used by some authorities to indicate an altered condition of the blood and fluids of the system, leading to constitutional diseases, as dropsy, cancer, delirium tremens, &c. See CACHEXIA and DIATHESIS.

Dysentery (Gr. *dys-*, 'difficult,' and *enteron*, 'the intestine') is the name applied to disease characterised by pain in the abdomen, frequent and painful efforts to evacuate the contents of the lower bowel, resulting in the passage of small but usually bloody and slimy stools, and produced by severe inflammation of the large intestine. Till a few years ago, it was believed to be one definite disease; it is now known that the conditions above described may be produced by many different causes, so that under one name numerous distinct diseases are included. Far the most important of these are *bacillary* and *amœbic* dysentery, produced by the presence in the intestines of a bacillus and an amœba respectively.

Dysenteric diseases are much more prevalent in tropical than in temperate countries, but are apt to appear even in the latter under bad hygienic conditions (bad drainage and water-supply, overcrowding, unsatisfactory feeding, &c.), and therefore especially in time of war.

Dysentery may begin suddenly and severely, sometimes with a rapidly fatal issue, or gradually and insidiously; it may be readily curable, or it may become chronic and persist for years; it may occur in isolated cases, usually of a mild type, or may give rise to extensive and fatal epidemics. The most important complication is abscess of the liver, which is frequent in amœbic dysentery, and very rarely met with in Great Britain, except in those who have contracted it in the tropics. At the commencement of an attack the patient should be kept in bed on a light and very sparing diet, and a dose of castor oil and laudanum should be administered. Further treatment ought to be determined by the causation of the disease; but this cannot always be made out, even on microscopic examination of the stools. In amœbic dysentery, ipecacuan, or its active principle, emetine, is far the most effective drug; in bacillary dysentery the sulphates of sodium and magnesium in repeated doses are most useful. It is important, therefore, that medical supervision should be obtained, whenever possible, at the onset of the disease; and hardly less important that it should be continued till the case is cured, as recurrences and complications frequently occur.

Dysodil, a yellow or grayish laminated bituminous mineral, often found with lignite. It burns vividly, and diffuses an odour of asafœtida.

Dyspepsia. See INDIGESTION.

Dysphonia. See THROAT (AFFECTIONS OF THE).

Dyspnœa. See ASTHMA, RESPIRATION.

Dysuria (Gr. *dys-*, 'difficult,' and *ouron*, 'urine'), a difficulty of passing urine, may depend on a variety of causes. See URINE.

Dytiscus, or DYTICUS (Gr. *dytēs*, 'a diver'), a genus of water-beetles, including the large British species, *D. marginalis*. See WATER-BEETLE.

Dyveké ('the little dove'), called by the Latin chroniclers *Columbula*, the famous mistress of Christian II. of Denmark. Born at Amsterdam in 1488, she was but nineteen when she first met her lover at Bergen, where her mother had settled as an innkeeper. She followed him to Denmark, where her mother acquired such political influence as to become hated by the nobles. Dyveke, who herself took no interest in affairs, died suddenly in 1517, almost certainly from poison. Christian avenged his favourite's death by executing a young noble, Torben Oxe, whom he suspected at least of having himself aspired to her favour. The unhappy fate of Dyveke has been the subject of dramas in Danish or in German by Samsöe (1796), H. Marggraff (1839), and Rièkhoff (1843); and of romances by L. Schlefer, Tromlitz, Carsten Hauch, and Ida Frick. See Münch's *Biographisch-historische Studien* (1836).

Dyvour, in the old legal language of Scotland, was a bankrupt who under various acts from 1606 to 1696 was until discharged compelled to wear a hideous and conspicuous costume. Thus an act of 1688 prescribes as the dyvour's habit 'a bonnet, partly of a brown and partly of a yellow colour, with uppermost hose, or stockings, on his legs, half brown and half yellow coloured, conform to a pattern delivered to the magistrates of Edinburgh.' The barbarous usage had fallen into desuetude long ere the dyvour's habit was abolished by law in 1836.

Dziggetai (*Equus hemionus*), a species of wild ass, more horse-like than the others. It is probably the hemionus ('half-ass') of Herodotus and Pliny. It inhabits the elevated steppes of Tatary, extending into the south of Siberia and to the borders of India. The Dziggetai lives in small herds, sometimes of several males and several females, sometimes of a single male with about twenty females and foals. The Mongols and Tungûs hunt it eagerly on account of its flesh, but its fleetness, watchfulness, and power of endurance often secure its safety. It has been partly domesticated, but does not seem to breed in captivity. It is also known by the names of Kiang, Khur, and Goor. See ASS.

Dzungaria. See ZUNGARIA.

E

the fifth letter of our alphabet, descends from the fifth letter of the ancient Semitic alphabet, which expressed the sound of our *h*. Its form in the 9th century B.C. was 𐤄, afterwards 𐡄; in the Aramaic type of Semitic writing it was turned on its side, and developed into the Syriac ܗ, ܐ, and the Hebrew ה. The Semitic name of the letter, *hē* (preserved in Hebrew and Syriac), appears to have no meaning, but to have been arbitrarily invented to denote the sound. Some scholars have conjectured that the character was a modification of the eighth letter, 𐤇 (see H), which expressed a cognate sound; but this is very doubtful. The Greeks adopted the letter in the form 𐌄, which when the direction of the writing was reversed became E. (Some other forms occur in early inscriptions, but the original type ultimately prevailed.) Although the Greeks had the sound *h* in their language, they apprehended it rather as an affection of the vowel than as a separable consonant; hence the name *hē* naturally suggested the use of E as the needed sign for the mid-front vowel. In most parts of Greece it stood for the narrow variety of this vowel (=French *é* in *été*). This sound was normally short; when by exception it was pronounced long, it was in the 4th century B.C. written EI. Hence, according to ancient testimony, the alphabetic name of E in classical Greek was *ei*. Its name in late Greek, *epsilon*, literally 'bare' or 'simple' *e*, was (according to the now prevailing view) intended to distinguish the letter from the digraph *ai*, which had come to have the same sound. In modern Greek the letter when accented is sounded as *e* in *there*, when unaccented as *e* in *then*.

The Romans adopted the usual Greek form E, which is general in inscriptions, though Ⅱ (the origin of which is obscure) is occasionally found. In writing on parchment, the nature of the material favours the development of the rounded form ϵ, whence (through the intermediate form 𐑈) our modern printed e is derived, as well as the many widely divergent forms found in mediæval manuscripts. The various forms now in use, script and printed, are of obvious origin, except the small German written ℓ, which represents an older ℓ, the middle stroke being adapted for junction with the following letter.

In Latin, E expressed a vowel sound differing from that of I (=English *i* in *machine*, *pin*) in being produced with a lower position of the tongue. This description, which includes many varieties of articulation, represents the normal value of the letter in all modern languages except English, where the ordinary long sound of E (used as its alphabetic name) is now identical with the Continental sound of I. The ordinary English short E (as in *bed*) and the long E in *there*, &c., retain the original sound. Italian and French grammarians have long applied the terms 'close' and 'open' to different varieties of the vowel; in French, when the quality is not indicated by position, the close E is written *é*, and the open E, *è*, or *ê*; in Italian the distinction is not shown in writing. In Middle English the vowel represented by E had, when long, two distinct qualities; Chaucer never rhymes a word like *meten*, to meet (close E), with one like *eten*, to eat (open E). In French and English (and in German, Dutch, and the Scandinavian languages) E, in addition to its original use, was early employed to denote the obscure vowel derived from various unaccented vowels in the older language. In English during the 14th century this vowel came to be dropped in pronunciation at the end of words, but the spelling remained unaltered. A mute E thus became part of English orthography, and until the 17th century it was often added arbitrarily at the end of words. In modern spelling it is retained chiefly when it serves a phonetic purpose, as to mark a preceding vowel as long (compare *mane*, *man*), or to indicate the 'soft' sound of C and G. An unfortunate exception exists in such phonetically misleading spellings as *give*, *have*, which have been retained owing to reluctance to use V as a final. Other exceptions, of various origin, are seen in *one*, *done*, *come*, *exquisite*, &c. Modern French has a mute E of similar origin, but it is still pronounced in singing, and is counted in the scansion of verse. In English, as in some other languages, E forms part of vowel digraphs, as *ea*, *ei*, *eo*, *eu*, *ew*, *ey*, *ae*, *ie*, *oe*, which express simple sounds, and have mostly more than one phonetic value.

For E, the third note of the natural diatonic scale, see MUSIC, SCALE, KEY; and for *e*, the radix of Napierian logarithms, see LOGARITHMS.

Eadgar, Eadmund. See EDGAR, EDMUND.

Eadie, JOHN (1810–76), United Presbyterian minister and lecturer on exegesis in Glasgow, born at Alva, wrote encyclopædias and commentaries. See Life by J. Brown (1878).

Eadmer, a learned monk of Canterbury about the end of the 11th century, the devoted friend of Archbishop Anselm, to whom he had been sent by Pope Urban. There also he remained in the same favour with St Anselm's successor, Archbishop Ralph, until 1120, when at the request of King Alexander I. he went to Scotland to become Bishop of St Andrews. There was already a controversy between Canterbury and York for jurisdiction over the see of St Andrews; while that see asserted its independence of either. Eadmer claimed to be consecrated by the Archbishop of Canterbury, but the Scottish king naturally refused to recognise this right, and accordingly the monk returned to Canterbury, whence eighteen months later he sent his renunciation of all claims to the bishopric. He died, it is supposed, in 1124. He tells us that from his childhood he was a diligent observer of contemporary events, especially in church affairs; and this habit has given more than usual interest to his writings, which show no little literary dexterity in their clearness and selection merely of such historical details as are really significant. The most valuable are his *Historia Novorum*, first printed by Selden in 1623, and his *Vita Anselmi*, first pub-

lished at Antwerp in 1551. Both were edited (1884) in the 'Rolls' series by Martin Rule. His lives of St Dunstan, and St Bregwin of Canterbury, and of St Oswald of York, were printed by Wharton in the second part of his *Anglia Sacra* (1691).

Eagle, a name given to many birds of prey in the order Accipitres, family Falconidæ, and sub-family Aquilinæ. The Golden Eagle, the White-tailed Eagle, and the Bald-Eagle are characteristic examples. Eagles, which are nearly related to buzzards and vultures, are thoroughly carnivorous birds, of cosmopolitan distribution. They hunt by day, and usually rest and nest in more or less inaccessible rocky places. The strong bill is not toothed as in the falcons; the bony shield over the eye is prominent; the legs and feet are heavy; the claws are long, curved, and very strong; the soles of the toes bear large callosities.

(1) The genus Aquila includes the Golden Eagle, the Imperial Eagle, and other species. The bill is large and high, with the upper part much bent, and with notched margins; the powerful wings reach to the end of the tail, and are rounded off; the tail is of medium size, broad, and straight; the leg-feathers extend down to the toes. Representatives of this noble genus are found in all parts of the world except the neotropical and Australian regions. The powers of vision and flight are well known; the power of 'renewing youth' is mythical.

The Golden Eagle (*A. chrysaëtus*) is a large and magnificent bird. The predominant colour is dark, tawny brown, but the back of the head and neck are more tawny and look golden in the sunlight. The young birds have tails of a brighter colour. The adult female measures about 3 feet in length; the male is rather less both in length of body and

The Golden Eagle (*Aquila chrysaëtus*), Adult Male.
From E. T. Booth's *Birds of the British Islands* (Porter, London, 1881).

wing. The golden eagles have their homes in remote rocky regions, but often wander far in search of booty. They prey upon numerous mammals and birds, but are rarely willing to run any great risks in so doing. Rabbits, hares, lambs, and even young deer; ducks, plovers, ptarmigan, and the like, are seized and torn up, or carried home to the eyry. They have been known to drive roe deer over the rocks, and even to attack a pony, but at the same time they do not disdain carrion. The nest, usually upon a rocky ledge, is large and roughly made. There are most commonly two eggs. Though a strong and majestic bird, it cannot be credited with much bravery. The occasional cry is loud and shrill, but with some hoarseness. The golden eagle has increased considerably in the north of Scotland since the protection of deer-forests has secured the necessary wildness, and since an appreciation of its nobility has increased among land-owners and sportsmen. The species is widely distributed in Europe, Asia, and North America. Allied species are the Imperial Eagle (*A. imperialis*) in south-eastern Europe, western Asia, and North Africa; and the Screaming Eagle (*A. nævia*), with similar distribution, but commoner in the north of Europe than either of the above species.

(2) *Other Genera.*—The Crested Eagles (Spizaëtus and Morphnus), the former in tropical parts of both hemispheres, the latter in South and Central America, are in some species distinguished by tufts of feathers on the back of the head. The Harrier-eagles (Circaëtus) of Europe, North Africa, and western Asia are usually included with the hawks. The European species (*C. gallicus*) is known as Jean-le-Blanc. The White-tailed or Sea Eagles (Haliaëtus) are absent only in South America. One species (*H. albicilla*) is, like the golden eagle, a British species, becoming as usual increasingly rare (see ERNE). Its analogue in America is the Bald-eagle (*H. leucocephalus*), which extends from the north to California and Mexico. The Fishing Eagle, Osprey (q.v.), or Fish-hawk (*Pandion haliaëtus*) is an almost cosmopolitan bird, requiring a family (Pandionidæ) for itself. It nests on high trees, and is remarkable for the backward grasping adaptation of the outermost toe. The Harpy-eagle of South America (*Thrasaëtus harpyia*) is extremely fierce and strong, but does not take the initiative in attacking man. There are several eagles in Australia, such as the black *Uroaëtus audax*.

While undoubtedly doing much damage to useful birds and quadrupeds, the eagles must be allowed some share in the credit of keeping down 'vermin.' In one case at least, the prey consists in part of serpents. Eagles seem to be long-lived birds, but precise information is far to seek; there is good evidence of a Sea-eagle attaining to fourscore years, and Brehm speaks of a Golden Eagle that was more than a centenarian.

In Mythology, the eagle usually represents the sun; its beak, its talons, or the whole bird itself, the lightning and the sunbeam. The great mythical eagle of India, the Garuda, is the bearer of the god Vishnu, victorious by his brightness over all demons. In the Scandinavian mythology, the eagle is a gloomy figure assumed by demons of darkness, or by Odin himself, concealed in gloomy night or in wind-swept cloud. The storm-giant Hräswelgr sits in the form of an eagle at the extremity of heaven, and blows blasts of wind over all peoples; and on the great tree Yggdrasil sits an eagle observing everything that happens. When Zeus was preparing for his struggle with the Titans, the eagle brought him a thunderbolt, whereupon the god took the bird for his emblem. He holds the bolts of Zeus in his talons, inspires heroes with courage, and also carries out the tyrannous behests of Zeus, as in tearing at the heart of Prometheus, and carrying off Ganymede from the earth. As an emblem of the immortal gods he becomes also a symbol of abstract immortality and of the human soul ascending after death. From the analogy of the heavenly authority of Zeus, the eagle also became the symbol of earthly power. Ptolemy Soter made it the emblem of the Egyptian kingdom. In the Roman story, an eagle was the herald to Tarquinius of his royal power, and it was one of the most important insignia of the republic, was also assumed by the emperors, and adopted into medieval heraldry after the time of Charlemagne. In the apotheosis of the Roman emperors,

an eagle ascending from a funeral pyre symbolised their reception among the gods. Even in Christian symbolism the eagle has preserved to the present day its significance as the symbol of St John the Evangelist in the lecterns of churches.

As a standard of war the eagle seems first to have been used by the Persians, but the most famous eagles of antiquity were those that so often carried the Romans on to victory. These were made of silver or bronze and with outstretched wings, and were carried before the legions upon long poles, just as the great Napoleon's armies after 1804 carried gilded eagles with outstretched wings in place of banners.

The German imperial eagle was originally one-headed, and was first adopted by Charlemagne as a symbol of his empire after his coronation at Rome in 800. We find it already on the imperial banner in the time of the Emperor Otto II. When it came to be armorially depicted, its blazon was or, an eagle displayed sable, beaked and membered gules. The eagle is occasionally figured as two-headed towards the end of the 13th century, and is so represented on coins of Ludwig the Bavarian in 1325. Two-headed eagles are found in Sumerian and Hittite symbols. The eagle of the Holy Roman Empire was first crowned in the 15th century; somewhat later the sword, sceptre, and orb came to be borne in its claws; and on the breast of the eagle were the personal arms of the emperor. In the arms of the later German empire (fig. 1) an eagle (with one head) displayed sable, beaked and membered gules, sustained on its breast a shield containing the arms of Prussia—viz. argent, an eagle displayed sable, crowned, armed, and membered or, and charged on the breast with the arms of Hohenzollern—viz. quarterly argent and sable, with which was entwined the collar of the order of the Black Eagle. On the

Fig. 1.—German Empire.

Fig. 2.—Austrian Empire.

head of the imperial eagle rested the imperial crown, from which fell down on both sides golden fillets embellished with arabesques. The republic dropped the crown and the shield with its arms, and closed the plumage. The Prussian eagle is the original imperial eagle granted as a special mark of honour to the Teutonic knights by the Emperor Frederick II., and retained by them after the double-headed eagle had become the imperial emblem. The Austrian empire preserved the double-headed eagle (fig. 2) of the earlier German empire. This also was modified at the revolution, but the crown was retained. Russia assumed in 1472 the double-headed eagle under Ivan III. to signify that the tsar sprang from the Greek emperors, who had borne it as a symbol since the partition of the Roman empire. The Russian arms (fig. 3) differ from the Austrian in the eagle's holding only a sceptre in its dexter claw, and being charged with a shield gules, bearing a figure of St George and the dragon. The shield was encircled with the collar of the Russian order of St Andrew, and the wings of the eagle were charged with groups of small shields representing the provinces of the empire. A white crowned eagle in a red field is the shield of Poland (kingdom and republic); and the United States of America have adopted a dark-brown eagle with outspread wings, having in one of its talons a bundle of arrows, in the other an olive-branch, bearing on its breast a shield whose upper part is blue and under part silver, and crossed by six red vertical bars (fig. 4). In its beak it holds a band with the inscription *E pluribus unum*, surmounted by thirteen stars, the original number of states. In France, the eagle was assumed as his imperial symbol by Napoleon I. (fig. 5), was set aside at his fall,

Fig. 3.—Russian Empire.

Fig. 4.—The Seal of the United States.

Fig. 5.—French Empire.

restored by Napoleon III. in 1852, and once more abolished by the republic in 1870. The arms of the French empire may be blazoned azure, an eagle rising and respecting to the sinister, grasping in both his claws a thunderbolt all or.

Eagle, a gold coin of the United States of America, of the value of ten dollars, or over forty-one shillings sterling. The double-eagle is a gold twenty-dollar piece. See DOLLAR.

Eagle, BLACK and RED, Prussian orders. See ORDERS.

Eagle-hawk, a name applied to several eagles of comparatively small size, belonging to the genera Spizaëtus and Morphnus. They are natives of warm climates, and are often very beautiful in form and colour. Some species are adorned with well-developed crests extending backwards from the

Eagle-hawk (*Morphnus guianensis*).

crown of the head. Hence they are sometimes called *Crested Eagles*. The crest is well seen in a species of Morphnus from Guiana. See EAGLE.

Eaglehawk, a mining town of Victoria, Australia, 4½ miles from Bendigo, and 106 NW. of Melbourne, with both of which it is connected by rail. Much gold has been found here in the quartz lodes with which this hilly district abounds.

Eaglehawk and Crow. See TOTEMISM.

Eagle-owl (*Bubo*), a genus of large owls. The familiar disc of feathers round the ear is incomplete above, there is a large free tuft on each side, and the feathers on the legs extend down to the toes. The members of the genus are widely distributed, occurring in most parts of the world except Australia. The largest eagle-owl (*B. maximus*) has a wide range in Europe and Asia. It is a large and powerful bird, said sometimes to cope with the golden eagle, and to prey upon young deer; in length it may measure over two feet; the colour is rusty yellow, varied with brown and black; its voracity is excessive, and has made it an Ishmaelite among birds.

Eagle-owl (*Bubo maximus*).

The loud weird cry has given origin to the German name *Uhu*, and has been the basis of many evil omens and superstitious terrors. Its favourite haunts are desolate and wooded rocky regions. The eagle-owl of America (*B. virginianus*), the Virginian Horned Owl, is somewhat smaller, but very bold and powerful. It carries off with ease almost any inhabitant of the poultry-yard. It is found in almost all parts of America. See OWL.

Eagre. See BORE.

Ealing, a parliamentary and municipal borough in Middlesex, 5¾ miles W. of Paddington by rail. It is the birthplace of Huxley. Pop. 68,000. Brentford (q.v.) is in this parish.

Ear. The apparatus of hearing, as it exists in man and the mammalia, is composed of three parts —the external ear, the middle ear or tympanum, and the internal ear or labyrinth.

The *external ear* consists of two portions, the *auricle* or *pinna* (the part popularly recognised as the ear), and the *auditory canal* or *external acoustic meatus*.

In man the auricle, on its outer or more exposed surface, presents various eminences and depressions, resulting from the form of its cartilaginous framework. These have received special anatomical names, to which it is unnecessary to advert further than to mention that the deep capacious central space to which several grooves converge is termed the *concha*, and that the lowest and pendulous portion of the ear is termed the *lobe*. The cartilage forming the basis of the external ear consists of one principal piece, in which there are several fissures, which are filled up by fibrous membrane. Several muscles are described as passing from one part of the auricle to another, but they are so little developed in man that they do not require notice; there are additionally three muscles—the *musculus auricularis superior*, the *m. auricularis anterior*, and the *m. auricularis posterior*, which pass from adjacent parts of the scalp to the ear, and which, though more developed than the previous group, are of little or no real importance in man (at least in his civilised state), but are of considerable use in many mammals. They are rudimentary, and usually functionless.

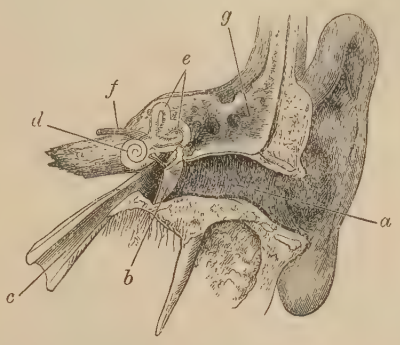


Fig. 1.—Sectional view of the external, middle, and internal Ear, showing the interior of the External Acoustic Meatus, Tympanic Cavity, and Auditory Tube (or Eustachian Tube):

a, the external acoustic meatus; *b*, the tympanum; *c*, the auditory tube leading to the pharynx; *d*, the cochlea; and *e*, the semicircular canals and vestibule, seen on their exterior by the removal of the surrounding bony tissue; *f*, auditory nerve; *g*, temporal bone.

The external acoustic meatus passes from the concha inwards, and a little forwards, for rather more than an inch. It is narrower at the middle than at either extremity, and on this account there is often considerable difficulty in extracting foreign bodies that have been inserted into it. The membrane of the tympanum which terminates it is placed obliquely, in consequence of the lower surface of the meatus being longer than the upper. The canal is partly cartilaginous and partly osseous, the osseous portion consisting in the fœtus of a ring of bone, across which the membrane is stretched, and in many animals remaining persistently as a separate bone. The orifice of the meatus is concealed by a pointed process, which projects from the facial direction over it like a valve, and which is called the *tragus*, probably from being sometimes covered with bristly hair like that of a goat (*tragos*); and it is further defended by an abundance of ceruminous glands, which furnish an adhesive, yellow, and bitter secretion, the cerumen or wax, which entangles small insects, particles of dust, and other small foreign bodies, and prevents their further passage into the meatus.

The *middle ear*, or *cavity of the tympanum*, is a space filled with air which is received from the Pharynx (q.v.) through the auditory tube (see fig. 1, *b*, *c*), and traversed by a chain of very small movable bones (fig. 2), which connect the membrane of the tympanum with the internal ear. It lies, as its name implies, between the external meatus and the labyrinth or internal ear, and opens posteriorly into the cells contained in the mastoid portion of the temporal bone, and anteriorly into the auditory tube. The cavity is of an irregular shape, and is lined by a very delicate ciliated epithelium, which is a prolongation of that of the pharynx through the auditory tube.

Its external wall is in great part formed by the membrane of the tympanum, which is nearly oval, and placed in a direction slanting inwards, so as to form an angle of about 55 degrees with the lower

and anterior walls of the external acoustic meatus (see fig. 1). The handle of the malleus (or hammer), the first of the chain of ossicles (see fig. 2), is firmly attached between the layers of this membrane in a vertical direction as far downwards as the centre, and by drawing it inwards renders its external surface concave.

Its internal wall has two openings communicating with the internal ear, each of which is closed by a delicate membrane. These openings are termed the *fenestra vestibuli* and the *fenestra cochleæ;* the former leads to the vestibule, and is connected by its membrane with the base of the stapes (or stirrup-bone), the last of the chain of ossicles; while the latter opens into the cochlea.

The ossicles of the tympanum are three—viz. the *malleus*, the *incus* (or anvil), and the *stapes*. We have already explained how the malleus is connected with the membrane of the tympanum by means of its handle. Through this connection, the tension of that membrane may be modified by the agency of a muscle which is attached to this ossicle. This muscle is the *tensor tympani*, which arises from the under surface of the petrous portion of the temporal bone, and is inserted into the medial edge and anterior surface of the *manubrium mallei* near its upper end. The mode in which the malleus articulates with the incus is sufficiently explained by the figure. The *incus* much more closely resembles a molar tooth with two fangs than the anvil from which it derives its name. Of the two processes which it gives off (see fig. 2), the short one, *sc*, runs backwards, and is attached to the posterior wall of the tympanum near the entrance to the mastoid cells; while the long one, *lc*, inclines downwards, and terminates in the lenticular or orbicular process, *a*, to which the head of the stapes is attached. The *stapes* is almost sufficiently described by the figure. It has a head, neck, two branches, and a base, which, as has been already mentioned, fits into the *fenestra vestibuli*. A minute muscle, the *stapedius*, takes its origin from a hollow conical eminence termed the *pyramid*, which lies behind the *fenestra vestibuli*, and is inserted into the neck of the stapes; its function is probably to act as an antagonist to the *tensor tympani*.

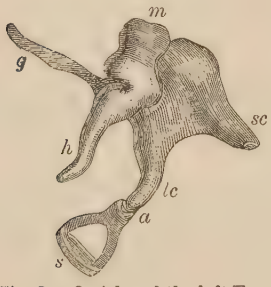


Fig. 2.—Ossicles of the left Ear, as seen from the outside and below:

m, head of the malleus; *g*, the slender process, or *processus anterior*; *h*, the manubrium or handle; *sc*, the short crus, and *lc*, the long crus of the incus; *a*, the position of the lenticular process, through the medium of which it articulates with the head of the stapes; *s*, the base of the stapes. Magnified three diameters.

The Eustachian tube, into which the tympanic cavity opens anteriorly, is about an inch and a half in length, and passes downwards, forwards, and inwards to its opening in the pharynx. It is partly osseous, but chiefly cartilaginous. Its chief use is to allow the free passage of air in and out of the tympanum.

The *internal ear* or *labyrinth* is the essential part of the organ of hearing, being the portion to which the ultimate filaments of the auditory nerve (see BRAIN, NERVOUS SYSTEM) are distributed. It is composed of three parts—viz. the *vestibule*, the *semicircular canals*, and the *cochlea*, which form a series of cavities presenting a very complicated arrangement, and lying imbedded in the hardest part of the petrous portion of the temporal bone. They communicate externally with the tympanum by the two openings already described—the *fenestra vestibuli* and the *fenestra cochleæ;* and internally with the internal auditory canal, which conveys the auditory nerve from the cranial cavity to the internal ear. The very dense bone immediately bounding these cavities is termed the *osseous labyrinth*, to distinguish it from the *membranous labyrinth*, which lies within a portion of it.

The *vestibule* is a common central cavity into which the semicircular canals and the cochlea open (see fig. 3, V). It is about a fifth of an inch in height and in length from before backwards, its transverse diameter (from side to side) being somewhat less. On its posterior wall are five orifices

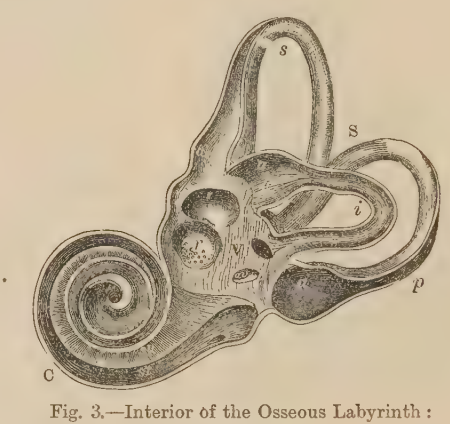


Fig. 3.—Interior of the Osseous Labyrinth:

V, vestibule; *av*, aqueduct of the vestibule; *r*, maculæ cribrosæ; S, semicircular canals; *s*, superior; *p*, posterior; *i*, lateral; *a*, *a*, *a*, the ampullar extremity of each; C, the cochlea; *sv*, osseous zone of the lamina spiralis, above which is the scala vestibuli, communicating with the vestibule; *st*, scala tympani, below the spiral lamina. Magnified 3½ diameters.

for the semicircular canals, one of the orifices being common to two of the canals. Anteriorly, the cochlea enters it by a single opening, partially divided by an osseous partition—the *lamina spiralis ossea*. On its outer wall is the *fenestra vestibuli*, and on its inner are the *maculæ cribrosæ*, containing several minute orifices for the entrance of filaments of the auditory nerve.

The *semicircular canals* are three in number, and open into the vestibule by means of five orifices, the two vertical canals having at their non-ampullate extremities a common orifice. They vary in length, and notwithstanding their name, each is considerably more than a semicircle, the superior vertical canal being the longest. The average diameter is about a twentieth of an inch, one extremity of each canal exhibiting a dilatation or *ampulla*. Each canal lies in a different plane, very nearly at right angles to the planes of the other two; they are distinguished from each other by their position, and are named superior, posterior, and lateral.

The *cochlea*, which derives its name from its resemblance to a common snail-shell, forms the anterior portion of the labyrinth. It consists of an osseous and gradually tapering canal, about an inch and a half in length, which makes two turns and a half spirally around a central axis, termed the *modiolus*, which is perforated at its base for the entrance of the filaments of the cochlear portion of the auditory nerve. This spiral canal gradually diminishes towards the apex of the cochlea. At its base it presents an opening into the vestibule, partially divided into two. In

the recent state, one of these openings (*scala tympani*) does not communicate with the vestibule, but is closed by the membrane of the *fenestra cochleæ*. Its interior is subdivided into two passages (*scalæ*) by an osseous lamina. This is the *lamina spiralis*, which incompletely divides the cochlea into an upper passage, the *scala vestibuli*, and a lower one, the *scala tympani*—i.e. the division is incomplete so far as the skeleton goes, but is completed during life by soft parts afterwards to be described. At the apex these two passages communicate by an opening to which the term *helicotrema* has been applied.

We now return to the *membranous labyrinth*. The membranous and osseous labyrinths have the same shape, but the former is considerably smaller than the latter, a fluid, termed the *perilymph*, intervening in some quantity between them. At certain points recent investigations have shown that the membranous is firmly adherent to the inner surface of the osseous labyrinth. The vestibular portion consists of two sacs, an upper and larger one, of an oval shape, termed the *utriculus*, and a lower and smaller one, of a globular shape, called the *sacculus*. The membranous semicircular canals resemble in form and arrangement the osseous canals which inclose them, but are only one-third of the diameter of the latter.

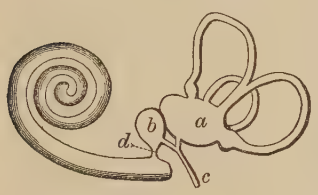


Fig. 4.—Scheme of Mammalian Labyrinth:

a, utricle; *b*, saccule; *c*, aquæductus vestibuli, dividing into two branches, going to saccule and utricle respectively; *d*, canalis or ductus reuniens.

It will be remembered that the osseous structure of the cochlea is that of a tube almost but not quite divided into two by the lamina spiralis ossea. The division is completed by the lamina spiralis membranacea (or basilar membrane). From near the junction of the osseous with the membranous lamina springs the membrane of Reissner, which, stretching across to the wall of the osseous cochlea, shuts off a third space known as the *ductus cochleæ*. The cochlear duct terminates blindly at both ends, but near its lower extremity is connected with the saccule through a delicate membranous channel known as the *ductus reuniens*. Upon the basilar membrane is situated the organ of Corti, which consists of the following parts (to name only those of most importance) from within outwards: (1) a single row of so-called inner hair-cells; (2) the two rods of Corti (known as inner and outer); (3) four or five rows of outer hair-cells. These are again protected by the curtain-like *membrana tectatoria*.

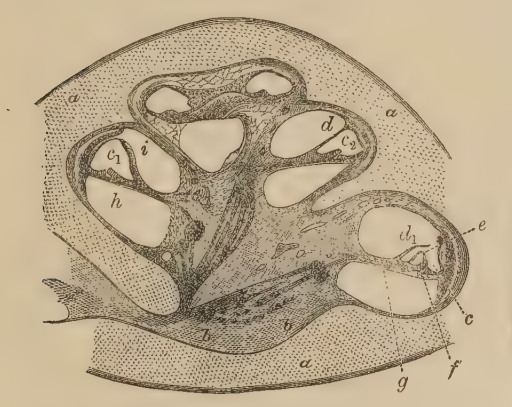


Fig. 5.—Section through the Cochlea of a Human Embryo:

a, *a*, *a*, cartilage, which afterwards ossifies; *b*, *b*, tissue, which afterwards becomes the modiolus; *c*–c_2, duct of the cochlea; *d*, d_1, membrana vestibularis; *e*, membrana tectatoria, rather elevated from its proper position; *f*, position afterwards occupied by the organon spirale; *g*, lamina spiralis; *h*, scala tympani; *i*, scala vestibuli.

The auditory nerve leaves the medulla oblongata together with the facial, and passing into the internal auditory meatus, divides into two branches, which pass respectively to the vestibule and the cochlea. The former ends in a peculiarly modified epithelium with projecting processes situated in the ampullæ of the semicircular canals and on certain spots within the saccule and utricle, known as the *maculæ acusticæ*. In the latter situation are also found small crystalline bodies, called otoconia (Gr. *konis*, or *konia*, 'dust'), which are suspended around the maculæ; they consist of small rhombic crystals of carbonate of lime. The cochlear branch of the auditory nerve probably terminates in the inner and outer hair-cells of the organ of Corti (see fig. 6). The saccule and utricle communicate with each other and with the interior of the skull through the *aquæductus vestibuli*, while the *aquæductus cochleæ* connects the perilymph of the scala tympani with the arachnoid space.

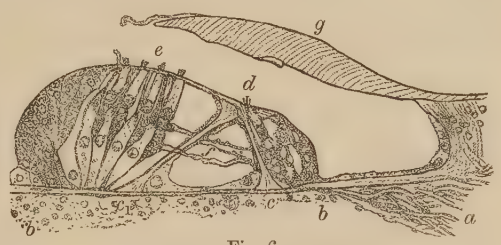


Fig. 6.

a, lamina spiralis ossea, with nerve bundles from cochlear nerve; *b*, *b*, membrana basilaris; *c*, inner rod or pillar of Corti; c_1, outer rod or pillar of Corti; *d*, inner hair-cell; *e*, outer hair-cells; *f*, nerve fibres; *g*, membrana tectatoria.

PHYSIOLOGY.—(1) *Of the External Ear.*—A true auricle only exists in the mammalia, and in this class it varies from little more than an irregularly shaped cartilaginous disc with little or no motion, as in man and the quadrumana, to an elongated funnel-shaped ear-trumpet movable in all directions by numerous large muscles, as in the horse, the ass, and the bat. The mode in which we see it employed by those animals in which it is highly developed sufficiently indicates that its main function is to collect and concentrate the sounds which fall upon it. But the experimental investigations of Savart, with an apparatus constructed to resemble the tympanic membrane and the external auditory apparatus, show that these parts are also adapted to enter into vibrations in unison with those of the air; and he suggested that the human auricle, by the various directions of different parts of its surface, could always present to the air a certain number of parts whose direction is at right angles with that of the molecular movement of the air, and therefore is the most favourable position for having the vibrations communicated.

(2) *Of the Tympanum and its Contents.*—Savart's experiments show that the membrane of the tympanum is thrown into vibration by the air, and that it always executes vibrations equal in number to those of the sonorous body which excites the oscillations in the air. He further ascertained that

the malleus participates in the oscillations of the tympanic membrane, and that these vibrations are propagated to the incus and stapes, and thus to the membrane of the *fenestra vestibuli*. The malleus has further the office of regulating, through the *tensor tympani* muscle, the tension of the tympanic membrane; and to allow of the motion necessary for this purpose, we find movable joints between it and the incus, and again between the latter bone and the stapes. The contraction of the stapedius muscle similarly modifies the tension of the membrane of the *fenestra vestibuli;* and as compression or the reverse exercised on this membrane extends to the perilymph, and is propagated through it to the *fenestra cochleæ*, the tension of the membrane of the latter opening is also influenced by the muscle in question. The incus is much more limited in its motions than either of the other bones, and its use seems to be to complete the chain of ossicles in such a manner as to prevent any sudden or violent tension of the membranes, such as we can easily conceive might occur if the conductor between the membranes were a single bone. The presence of air in the tympanic cavity serves a double purpose: in the first place, it preserves a uniform temperature on the outer surfaces of the fenestral membranes, and thus supports a fixed elasticity in them, which would not be the case if they were freely exposed to ordinary atmospheric changes; and secondly, the action of the chain of ossicles as conductors of sound is materially increased by their being completely surrounded by air, as is obvious from the first principles of acoustics; further, were it not for the presence of air within the tympanum, the drum membrane would be arched inwards, and the resulting displacement and change of tension would produce deafness.

(3) *Of the Labyrinth.*—Sonorous vibrations may be conducted to the labyrinth through the bones of the skull; but during the ordinary act of hearing, the movements of the tympanic membrane are propagated through the chain of ossicles and the labyrinth, and thus perceived by the auditory nerve. A considerable amount of mystery surrounds the functions of the saccule and utricle. The fact that they are so closely connected with the semicircular canals suggests that, like the canals, they function as organs of equilibration. Breuer has advanced the view that these organs give us information regarding the position of the head when at rest, or when making progressive, as opposed to rotary, movements, and accordingly supplementing the functions of the semicircular canals.

The semicircular canals have been much studied. It has now been conclusively demonstrated that they are intimately associated with the maintenance of the body in the erect position. Injury of a semicircular canal tends to produce rotatory movements of the body and eyes, and it has therefore been suggested that the functions of these organs may be connected with the reflex act of listening, as exemplified in the lower animals by pricking the ears and rotation of the head. From experiments on animals, and observations on the human subject in disease, it has now been proved that a lesion of the semicircular canals is followed by giddiness or vertigo, which manifests itself either in involuntary falling, rotation, or in a subjective condition, during the continuance of which surrounding objects seem to revolve round the patient. It is generally believed by physiologists that the cochlea has the special function of analysing sounds. It has been found that the basilar membrane is not equally broad throughout, but that it increases gradually from base to apex. It therefore presents a series of strings of different lengths, and the short ones are assumed to vibrate in the perception of high notes, while the long ones are stimulated to motion by low tones. The lower part of the cochlea is therefore chiefly concerned in the perception of sounds of high pitch, while the upper parts respond to those of low pitch. Some observers, however, do not accept this view—e.g. Voltolini and Rutherford, but believe that sounds are analysed in the auditory centre, which, according to the investigations of Munk and Ferrier, is located in the temporal lobe. For the hearing of birds, reptiles, &c., see BIRD, REPTILES, &c.

THE DISEASES OF THE EAR.—It is manifestly impossible to attempt any account of the various individual ear diseases in an article like the present. Since aural surgery has become an exact science, the medical profession have come to realise that such phrases as a 'cure for deafness,' or a 'treatment for earache,' are not only inexact but absurd. Deafness—varying in degree from a slight impairment of hearing up to total inability to perceive sounds—may be due to a great variety of causes, and any of these causes may produce not only deafness, but noises in the head. Thus the auditory canal may be blocked by wax, the products of skin eruptions affecting its lining membrane, tumours, masses of fungus, the results of inflammation, &c. The tympanic membrane may be displaced or thickened, the ossicles may be impeded in their movements by the presence of exudation, or by fibrous adhesions or swelling of the mucous membrane within the tympanum. Then again these parts may be injured either by disease or by violence. The auditory nerve may be affected in any part of its course from the auditory centre to the labyrinth, and thus deafness may result. We have only indicated some of the pathological causes of impaired hearing, but enough has been said to show that before deafness can be prescribed for with any hope of success, an examination of the ear must be made by a competent medical man.

Turning now to earache, let us consider some of its causes. Sometimes it is due to the presence of boils in the auditory canal, or the whole lining membrane of the passage, including the outer layer of the membrana tympani, may become inflamed. Perhaps the most common cause of earache is inflammation of the drum-cavity. Such inflammation often stops before the inflammatory products have taken on a purulent character. This mild form is very common in children, and often sows the seeds of deafness in after-life if appropriate treatment be not applied. Occasionally earache is altogether due to the presence of a diseased tooth, which need not necessarily be tender or painful. By far the most dangerous form, however, is that which arises in connection with a so-called 'running ear.' The general meaning of this symptom in such cases is an accumulation of decomposing matter and sometimes diseased bone in close proximity to the brain, and a fatal result is by no means uncommon. Vertigo, or giddiness, is a very frequent symptom of ear disease, and can often be relieved or cured by attention to this organ.

A feeling of fullness in the head, and disinclination for mental effort, is far from uncommon. Rarer or less important symptoms of aural affections are (1) anomalies of taste, owing to involvement of the chorda tympani nerve on its way through the drum-cavity; (2) paroxysmal cough and sneezing; (3) neuralgia of the head; and (4) epilepsy; the last named being fortunately extremely uncommon. We should not be justified in omitting to mention that adenoid vegetations in children are often the cause of deafness. This is all the more important, because such cases when taken early can almost always be cured.

From what has been said, it will be obvious that any remarks we could, without unduly extending

this article, make with regard to treatment would be useless. We feel it, however, to be our duty to warn those who suffer from ear disease from consulting unqualified quacks. This resort to empirics is all the more uncalled for as there are now numbers of respectable highly-qualified practitioners who devote attention to aural maladies.

There are, however, a few points of general interest and of great importance which may be touched upon.

It is a common delusion that it is a dangerous thing to cure a discharge from the ear. Now this is by no means true; indeed it may be at once stated that life is never safe so long as a chronic putrid discharge issues from the ear. In all such cases it is not only safe but necessary to syringe the meatus with a warm disinfecting solution, such as boracic lotion, or water to which some Condy's fluid has been added. The ear should then be dried by carefully introducing a wick of absorbent cotton-wool. The origin of the superstition anent the danger of stopping a discharge is easily explained. If the putrid matter be present, it is better that it should find its way out. Now, if in such a case some physical obstacle prevents its exit, a fatal result is apt to supervene. It had thus been noticed that in many cases the 'running from the ear' stopped before dangerous symptoms set in, and hence the delusion. Another point as to which much misapprehension exists, is the danger caused by the presence of a foreign body in the ear. It has been observed by a noted specialist that 'the point of a dagger in the meatus is less likely to do harm than unskilled efforts to remove it.' No endeavour should ever be made to remove a foreign body which is not seen, and all probing in the dark is to be absolutely avoided. Most extraneous objects can be removed simply by means of warm water and a syringe used by a skilled hand. If the object be a pea, bean, or any other body which is likely to swell from absorbing moisture, it is better not even to attempt syringing, and to wait until skilled advice can be obtained.

Should an insect get into the ear, it can almost invariably be syringed out with warm water, or if a syringe be not at hand, the ear may be filled with warm oil or even water.

Deafness occasionally runs in families, and the symptom is then usually due to chronic thickening of the tympanic structures. Persons in whom this hereditary tendency exists should, on the first indication of ear trouble, seek advice.

It need hardly be said that picking the ears ought to be avoided. This habit may lead to the 'ear pick' being driven through the drum membrane. Should the ear be made to bleed, and should there be any doubt as to whether the drum membrane be wounded, scrupulous care should be taken to prevent the entrance of fluid. If the tympanic membrane be accidentally perforated, syringing, or instilling ear drops is almost certain to be followed by inflammation. After fifty the hearing tends to fall off a little, but except possibly in extreme old age, marked deafness for conversation is always abnormal. It is a curious fact that elderly people who require a watch to be put quite close to the ear, can often hear conversation well. This is explained by the fact that after middle life the auditory nerve is less sensitive, and the power of readily perceiving high-pitched tones is then less acute.

According to the writer's experience, almost complete deafness in one ear, while the other is perfect, does not necessarily endanger the sound organ. Others, however, take the opposite view. It must be remembered that in most cases, impairment of hearing is bilateral, and this is always the case when deaf persons have to be addressed in an elevated voice.

The instruction and training of children who have been born deaf is dealt with in the article DEAF AND DUMB.

EAR-TRUMPETS, &c.—The number of ear-trumpets now advertised makes any detailed account of them impossible. The application of one of three principles exists in most, if not all, to wit: (1) a tube with a suitable ear-piece at one extremity, and a more or less conical mouthpiece at the other; (2) a bell-shaped sound-collector, with an ear-piece for insertion into the auditory canal; (3) appliances for tilting the auricle forwards. There can be no doubt that a person who desires to purchase an ear-trumpet will best gain his end by carefully testing a large number of instruments, and choosing that which suits him best.

As a rule small invisible instruments are useless. Politzer has constructed a small tube made of vulcanite and flesh-tinted, the object of which is to prolong the tragus backwards; in a very few cases this is found to be an exception to the above rule. The micro-telephone has been much advocated as an aid to hearing, its use being suggested by the fact that deaf persons often hear telephones well. In many cases, however, it is not of much service, and causes the patient great annoyance by producing a considerable amount of secondary noise. In some cases—those in which the drum membrane is destroyed—the introduction of an artificial drum is useful. The simplest and most effective form of drum (also fortunately the cheapest) consists of a pledget of cotton-wool.

In all cases of marked deafness, when the sight is not defective, the patient may with advantage take lessons in lip-reading. At least thirty are required, besides practice at home.

Ear-cockles. See WHEAT.

Earl, a title of nobility now the third in the peerage of the United Kingdom. Among the northern races of Europe a *jarl* or *eorl* was one of the noble class, as opposed to the *ceorl,* who was the mere freeman (see also THANE). Of the noble class, a certain number, under the name of *ealdormen,* were made governors and judges over particular districts, and were sometimes designed in Latin phraseology *comites,* sometimes *duces.* William the Conqueror rewarded his chief followers by granting them the lands and also the offices of the Saxon nobles. The office of ealdorman, so long as Norman-French continued to be spoken in England, was, as on the Continent, called *count,* and its holder was considered the *comes* of the sovereign (see COUNT); and though the designation earl was afterwards reintroduced, the French term continued to give a name to the district (county) over which the earl presided, and the title of countess to his wife. After, as before the Conquest, each earl, besides having supreme authority under the crown in his own county, had a fixed revenue from it, consisting of the third penny of the pleas. When Geoffroy de Mandeville was made Earl of Essex, the Empress Maud, besides giving him and his heirs the third penny of the shrievalty of the pleas as an earl ought to have within his county, made him and his heirs in direct terms 'hereditabiliter' earls of Essex. In other cases, however, down to the reign of King John, an earl was so constituted by a grant of the third penny of the pleas, of which the earldom was assumed to be a pertinent, the words being added, '*unde comes est,*' or '*ut sit inde comes;*' and the newly-created earl was invested with his dignity by girding on the sword, a ceremony which was a survival from Saxon times.

William the Conqueror, by making earldoms hereditary, probably took the first step to convert a title of office into one of dignity. Deputies, *vice-*

comites, or sheriffs had necessarily to be appointed when the earl was a minor, or otherwise incapacitated from discharging his duties, and by degrees the office itself passed to the deputy. In the reign of King John a fixed sum, payable from the profits of the county, began to take the place of the third penny, and the words '*unde comes est*' were supplanted by the words '*sub nomine comitis*,' showing that the official power had ceased, and the dignity only survived. In the reign of Edward III. earldoms began to be created by charter or patent, certain lordships or lands being generally erected into a *comitatus* to descend with the newly-created dignity. But the girding on of the sword as a solemnity of investiture still continued, to which the imposition of a cap of dignity or golden circlet was added in the reign of Edward VI. In 1615 these ceremonies were declared unnecessary, and in the reign of Queen Anne it became the practice to insert a clause in patents expressly dispensing with them.

Until late in the reign of Edward III. earldoms were limited by the charters constituting them to heirs-general, and an heir-female often succeeded, her husband generally obtaining the title of earl; but in the case of more co-heirs than one, the lands were divided, and the dignity, which could not subsist without them, reverted to the crown. So inseparable at that period were the lands from the dignity, that there seem to be one or two instances where the title was taken away on the ground of poverty. But in fact the will of the crown at times diverted the succession from its regular channel, and occasionally the rights of the heir were suspended for a time and then recognised.

Towards the end of the 14th century it became the rule for patents of earldom to be limited to the heirs-male of the body of the grantee, the title on their failure merging in the crown; and there are a few occasional instances of the dignity being conferred for life. The title of countess, more than any other degree in the peerage, has from time to time been conferred for life on females. The idea of earls being territorial officers has been so entirely departed from that the designation bestowed on them is occasionally (as in the case of Earls Grey, Nelson, Spencer, Russell, and Cairns) their own surname with the prefix earl.

In Scotland the earl was the successor of the Celtic *mormaer* or great steward, who was first a tributary king, and afterwards a hereditary judicial officer placed over a certain territory. In the reigns of Alexander I. and David I. the mormaers gradually assumed the title of earls or comites, while vice-comites or sheriffs were appointed, who, if they did not at once supersede them, at least exercised a concurrent jurisdiction with them. Seven earls are enumerated by their names, not titles, in the foundation charter of the abbey of Scone in 1114; and during the 12th century there existed a body called the Seven Earls, with whose sanction the king acted. With the introduction of feudalism, the earls passed into the position of feudal lords, holding the lands with which their connection had at first been judicial as an earldom of the crown. The creation of additional earldoms formed a part of the feudalising process; and though the earldoms continued to be spoken of as seven, those enumerated were not always the same. The coronation of Alexander II. (1214) is the latest date at which the earls are specified as seven in number; and their functions as advisers of the sovereign were afterwards merged in those of the 'communitas.'

Earldoms continued territorial much longer in Scotland than in England. From the beginning of the feudal period down nearly to the 17th century, the title was usually conferred by the erection of certain lands into an earldom, the charter but rarely making specific mention of the dignity of earl. In 1578 the practice first became general of introducing the title of earl into the charter; and from that date till 1600 half the charters of earldom in the Register of the Great Seal (they are eighteen in all) make special mention of it. Patents of the dignity of earl after the English fashion were first introduced in 1600, the earliest being that of the Earl of Winton. The older earldoms, like lands and other heritable subjects, passed to heirs of line; and in the case of co-heirs the lands were divided, the dignity with the principal messuage passing to the eldest. The husband of a countess was often, though not always, designed by the courtesy title of earl.

An earl's mantle is scarlet with three doublings of ermine. He is styled the 'Right Honourable,' and in formal documents the sovereign usually designs any peer of the degree of an earl as 'Our trusty and well-beloved Cousin,' an appellation which originated in the reign of Henry IV., who was either by descent or alliance related to every earl in the kingdom. An earl's eldest son takes as a Courtesy Title (q.v.) one of his father's inferior titles. The younger sons take 'The Honourable,' with Christian name and surname added, and the daughters 'Lady,' with Christian name and surname. See ADDRESS (FORMS OF), CORONET.

Earle, JOHN (1601?–65), probably the best and most humane of English character-writers (see CHARACTER), was born in York, studied at Oxford, was chaplain and clerk of the closet to Charles II. in exile, and bishop first of Worcester and then of Salisbury. His anonymous *Microcosmographie* appeared in 1628.

Earle, JOHN (1828–1903), philologist, born at Elston, South Devon, was educated at Plymstock, Plymouth, Kingsbridge, and Magdalen, Oxford, took a first in classics (1845), was elected a fellow of Oriel (1848), and was professor of Anglo-Saxon in 1849–54 and again permanently from 1876, being also a prebendary of Wells.

Earle, WILLIAM, was born in Liverpool in 1833, entered the army in 1851, and served through the Crimea; he held several staff appointments abroad, and was military secretary to the governor-general of India in 1872–76. Promoted major-general in 1880, he commanded the garrison of Alexandria in 1882–84, and was killed leading a column of the Gordon rescue expedition in 1885.

Earl Marshal. See MARSHAL.

Earlom, RICHARD, mezzotint engraver, born in London in 1743, was a pupil of Cipriani, and early began his art under the patronage of Boydell. He engraved over sixty plates, which were very popular, and are still highly esteemed by collectors. He died in 1822. Among his works was a fine series of prints from the originals of Claude Lorraine's *Liber Veritatis*.

Earlston, or ERCILDOUNE, a village of Berwickshire, 4 miles NNE. of Melrose, with a railway station and manufactures of ginghams, woollens, &c. Between it and Leader Water is a fragment of the 'Rhymer's Tower,' the traditional abode of Thomas the Rhymer (q.v.); whilst one mile south is Cowdenknowes, with its 'bonny broom.'

Early, JUBAL ANDERSON, Confederate general, was born in Virginia in 1816, graduated at West Point, and served in the Florida and Mexican wars. During most of the years 1838–61, however, he practised law in his native state. On the outbreak of the civil war he entered the Confederate service as a colonel, and commanded a brigade at Bull Run, and a division at Fredericksburg and Gettysburg. In 1864, after some successes, he was

defeated by Sheridan in several battles; and, Custer having also routed him at Waynesboro in March 1865, he was relieved of his command a few days later. He returned to legal practice, and died 2d March 1894. See Life by R. H. Early (1913).

Early English, the term generally applied to the form of Gothic in which the pointed arch was first employed in Britain. The Early English succeeded the Norman towards the end of the 12th century, and merged into the Decorated (q.v.) at the end of the 13th. Its characteristics are beautiful and peculiar. Retaining much of the strength and solidity of the earlier style, it exhibited the graceful forms without the redundancy of ornament which latterly degenerated into a fault in the Decorated. Generally, it may be said to bear to the Decorated something like the relation which an expanding rosebud bears to a full-blown rose. The pointed arch was introduced in the 12th century in the north of France, when it was found convenient in enabling the cross vaulting of oblong spaces to be carried out, so that the ridges of the groins might all be kept at the same height. The wall ribs being pointed, led to the windows within them being made of the same form, and thus the pointed arch came to be gradually adopted in all the wall openings. The windows are long and narrow, and are often acutely pointed, when they are called lancet windows. When gathered into a group, they are frequently surmounted by a large arch, which springs from the extreme mouldings of the window on each side. The space between this arch and the tops of the windows is often pierced with circles, or with trefoils or quatrefoils, which by degrees led to the development of tracery. Each window, however, is generally destitute of any tracery in itself. 'The mouldings,' says Parker, 'in general consist of alternate rounds and deeply-cut hollows, with a small admixture of fillets, producing a strong effect of light and shadow.'—*Glossary of Architecture.* From the same work we borrow the accompanying illustration of two very beautiful piers, surmounted by a lancet-shaped arch, and decorated in the manner peculiar to the style. They are from Westminster Abbey. Circular windows are much used, and trifoliated archways over doors are also to be found, as at Salisbury Cathedral. By far the most characteristic decoration of the style is the Tooth-ornament (q.v.), which is often used in great profusion. Where foliage is used, it is conventionally treated and cut with great boldness, so as to throw deep shadows, and produce a very fine effect. The under-cutting is often so deep as to leave nothing to connect the leaves with the mouldings but the stalks, and occasionally the edge or point of a leaf. The caps of the columns are often composed of mouldings only, and are circular in plan, both of which features distinguish Early English from the Early Pointed style of France. The buttresses are more prominent than in the Norman style, and pinnacles and flying buttresses are introduced. The term Early English is said to have been introduced by Mr Millers in 1805. It corresponds to *Ogivale primitive* of French writers, and is very often known as the First Pointed or lancet-arched amongst ourselves. See GOTHIC ARCHITECTURE.

Early English Piers and Arch.

Earn, a river and loch in the south of Perthshire, in the finely-wooded, beautiful valley of Strathearn. Loch Earn lies to the north of Ben Voirlich; its eastern extremity is 24 miles west of Perth. Lying 306 feet above sea-level, it is 6½ miles long from east to west, from a half mile to nearly a mile broad, and 287 feet deep; it is surrounded by bold and rugged hills. The river Earn flows east from the loch 46 miles through the strath, past Comrie, Crieff, and Bridge of Earn, into the estuary of the Tay, 7 miles south-east of Perth. Its waters contain salmon, trout, perch, and pike.—The Bridge of Earn, a much frequented village, stands on the right bank of the river, 4 miles SSE. of Perth, and near the saline springs of Pitcaithly.

Earnest (in Scotland, ARLES) is a sum of money given in token that the parties to a bargain are in earnest (though 'earnest' in this sense is etymologically distinct), and mean their agreement to be binding. The contracts in which earnest is most frequently given are sale and service. Earnest is not the same as part payment; it is something given 'to bind the bargain;' whereas it is plain that there can be no part payment until the bargain is concluded. It is also necessary to distinguish between 'dead earnest'—i.e. some small gift or payment made by way of evidence of the bargain, and the payment of a sum to be deducted from the price if the bargain is completed, to be forfeited by the purchaser if he fails to complete. For the English law on this subject, see Benjamin on *Sale;* for the Scots law, Erskine's *Institutes.* The term 'earnest' is sometimes used to include the symbolical acts of hand-shaking, thumb-licking, &c., by which, in various countries, consent to a bargain is or has been signified.

Ear-ring, a ring suspended from the ear by a hook passing through a hole bored for the purpose, or (latterly) by a clamp. They were used by both sexes among the Persians, Babylonians, Lydians, Libyans, and Carthaginians. They were always worn by the Greek women, from Hera in the *Iliad* down to the Venus de Medici, whose ears are pierced for the reception of ear-rings. Pliny tells us that there was no part of dress on which greater expense was lavished amongst the Romans. Many Egyptian ear-rings of very beautiful design have been preserved, and these antique designs have often been imitated in modern times. During the reigns of Elizabeth and James I., ear-rings were worn in England by men, a custom which is still continued by many sailors. Otherwise, at the present day in England and the United States they are worn only by women. The ears are bored usually at about seven years of age. The boring is still popularly believed to be a valuable remedy in cases of sore eyes, by producing counter-irritation. This idea, however, is without satisfactory evidence in its support, and certainly there are much more efficient and beneficial methods of producing the desired effect.

Ear-shell. See HALIOTIS.

Earth is the name applied to the third planet in order from the sun. This planet is of unique importance as the dwelling-place of man, and is the only portion of the universe of which we have direct knowledge. Like other members of the solar system, the earth revolves in an elliptical orbit round the sun in a definite plane termed the plane of the Ecliptic (q.v.). The mean distance of the earth from the sun has been calculated from the Transit of Venus observations in 1874 and 1882 as 92,800,000 miles. The minimum distance,

attained in December, is 91,250,000, and the maximum in June, 94,500,000, the difference, or 3,250,000 miles, is the eccentricity of the earth's orbit or the extent of its departure from a circle. The earth is accompanied by one satellite, the moon, at a mean distance of 238,800 miles.

Figure of the Earth.—It was anciently believed that the earth was a flat disc of land (see PTOLEMAIC SYSTEM), surrounded by a great world-river (Oceanus), but the theory of a flat earth has been abandoned by all but a few fanatics. The earth's figure may be popularly said to be that of a ball; many irregularities in form make it impossible to speak of it strictly as a sphere or even a spheroid. In consequence of the dip of the horizon, the field of view—the boundary line of which is a circle in all parts of the earth—becomes wider as the height of the observer increases. On a wide, smooth surface also, such as the sea or a great plain, the upper part of a distant receding object remains in sight when the lower part has disappeared. These facts, being verified experimentally in innumerable places scattered over the earth's surface, can only be explained on the assumption that the earth is like a ball. On travelling northwards or southwards from any place, the position of the stars, their daily path in the heavens, and the time of rising and setting are altered; and new stars, altogether invisible before, come into view as the traveller proceeds. This also can be explained only by the rotundity of the earth. The most convincing proof to the popular mind is, however, that the earth has been circumnavigated by vessels steering always in the same general direction.

If the earth were a sphere or perfect ball, the arc of the surface subtending an angle of 1° at the earth's centre would be equal in every part of the circumference. The angle in degrees subtended by any arc of a meridian can readily be found astronomically (see LATITUDE), and the length of this arc in ordinary lineal units such as feet or metres can be accurately measured (see GEODESY). This has been done in several places, and the result (see DEGREE) shows that towards the north and the south the degree becomes longer than it is near the equator. It results that the earth is flattened somewhat at the poles and projects in the equatorial region. Delicate experiments at sea-level by means of the spring-balance or the pendulum show that the force of Gravitation (q.v.) is greater in high than in low latitudes. A standard mass weighed in a spring-balance is heavier in Greenland than in Brazil, even after making the necessary correction for the result of centrifugal force (see CENTRE). Since the mass of the two attracting bodies remains the same, their centres must be nearer at the station where the weight is greater—i.e. the polar regions must be flattened so as to lie nearer the earth's centre than is the equator. The extent of the flattening is such that the polar diameter is approximately $\frac{1}{299}$ shorter than the mean equatorial diameter, a deviation from the form of a sphere far too slight to be detected by sight or touch in any model which is small enough to be seen at one view. Accurate measurements of degrees of longitude in tropical regions suggest that the equator is not a circle, as it would be if the earth's figure were that of an oblate spheroid, but an ellipse of very slight eccentricity (estimated by some calculators as $\frac{1}{10000}$, by others as $\frac{1}{4000}$), the longer diameter running from about the meridian of Ireland to that of New Zealand.

The earth's surface is ridged and wrinkled with innumerable irregularities, so that the simile of an orange with its slightly corrugated rind, its flattened poles, and slightly irregular equator gives a very fair idea of the form. The surface of the sea, supposed to be produced through the continents, would give the geometrical figure of the earth or *geoid*. For 'sea-level,' see CONTINENT.

Dimensions.—Supposing the earth to be an oblate spheroid or ellipsoid of revolution, its polar or shortest diameter has been determined as 7900·2 miles, sufficiently near the value of 500 million inches to be conveniently remembered. The longer, or equatorial mean diameter is 7926·9 miles, a difference of 27 miles. The vertical distance between the greatest natural height and hollow (Mount Everest, and a point in the Pacific Ocean near the Ladrones) amounts to 11½ miles, or $\frac{1}{688}$ of the mean diameter.

The meridional circumference of the earth is 24,856 miles, and the Metre (q.v.) was intended to be $\frac{1}{40000000}$ of this distance, though really made somewhat shorter. The circumference at the equator is 24,899 miles, and this is the longest distance which can possibly be travelled in a direct line over the surface. The total area of the earth's surface calculated from these dimensions is 197 million square miles, and the corresponding volume 260,000 million cubic miles.

Mass of the Earth.—The problem of measuring the mass or amount of matter in the earth is one of peculiar interest. The usual mode of measuring mass is by means of weight or the attraction of the earth on bodies, and this method is of course inapplicable in determining the mass of the earth itself. The method that is employed is to compare the attraction of gravity between two known masses, and between one of these masses and the whole earth. The simplest method is by observing the deviation from the vertical of a plumb-line near an isolated mountain. The volume of the mountain is first found by survey, and its density calculated from the geological structure and the density of its component rocks. Observations have been made on Chimborazo, on Schiehallion in Perthshire, and on Arthur's Seat, with fairly concordant results. Airy in 1854 made experiments in a coal-pit at South Shields, and Von Sterneck in 1882–85 in deep shafts in Austria, on another principle. The rate of vibration of a pendulum at the surface depends on the attraction of the earth as a whole; but at the bottom of a shaft the same pendulum will vibrate at a different rate for two reasons: (1) faster, because it is nearer the centre; (2) slower, as the attracting mass is less. The spheroidal skin of the earth's crust equal in thickness to the depth of the shaft ceases to exert any influence, and the force of gravity due to this spheroidal shell is the difference between the force measured by the vibration of the pendulum at the surface and that at the bottom of the mine. If then the mean density (and hence the mass) of this spheroidal skin can be ascertained, the problem would be solved; but this it is impossible to do in a satisfactory way, and so the experiment is vitiated, and the results compare badly with other methods. Professor P. G. Tait pointed out that an excellent opportunity of making an experiment of a similar kind is afforded on the shores of estuaries where there is a high rise of tide—e.g. the Bay of Fundy. It would be easy to estimate the gravitational influence exerted by the alternate piling up and clearing away of a readily calculated mass of water.

The most satisfactory method of finding the mass of the earth is that devised by the Rev. John Mitchell, but carried out carefully by Cavendish, and hence known as the 'Cavendish Experiment.' It consists of measuring very accurately the minute attraction exerted by two large spheres of metal on two much smaller metal balls fixed to the extremities of a light lever which is suspended by a wire. The slight attraction of the large spheres is

measured by the Torsion Balance (q.v.), of which the smaller balls form part, and the distance of the attracting bodies is known. Hence, making the proper allowance for distance in each case, the attraction of the large spheres on the small balls is to the attraction of the earth on the small balls—i.e. the *weight* of the small balls—as the mass of the large spheres is to the mass of the earth. The attraction measured is so minute that the most elaborate precautions are necessary to get a definite result. Cavendish used leaden spheres a foot in diameter, which were swung round so as to exert their attraction alternately on opposite sides of the torsion balance. The apparatus was much simplified by Cornu, who alternately filled with mercury and emptied hollow iron spheres suitably placed with regard to the small balls. When Professor C. V. Boys succeeded in making extremely fine quartz fibres he applied them in the construction of a torsion balance of such extreme delicacy that in 1895 he repeated the Cavendish experiment with an apparatus little more than one foot square, and obtained the best results yet secured. Von Jolly and later Mr J. H. Poynting made a modification of this experiment by using an ordinary Balance (q.v.) of great delicacy, with double scale pans, the lower pan of each pair being suspended by a fine wire from the centre of the upper. In the simplest form the experiment was conducted thus: on the right-hand side this fine wire is surrounded by a massive perforated cast-iron cylinder built up in sections. On standard masses being placed in the upper pans, the one on the right-hand side is *heavier* by the attraction of the iron; then when the masses are changed to the lower pans the right-hand mass is *lighter* by the attraction of the iron, so that the difference of weight represents twice the attraction. The iron cylinder is then taken to pieces, and built up round the left-hand wire, and the process repeated several times.

Mean Density of the Earth.—The result of all these experiments shows the mass of the earth to be approximately 6,000,000,000,000,000,000,000 tons. The mean density calculated from this mass, and the known volume of the earth, is a more manageable figure, and may be given as an example of the degree of accordance in the various measurements. The values arrived at by the various experimenters varied between 4·86 and 6·56. The average of the concordant results yielded by the best methods may be taken as 5·5, the density of pure water at 4° C. being 1. The density of surface rocks is only about 2·5, but lavas of deep origin have densities ranging up to 3 or even higher, and it follows that the density becomes greater towards the centre. The whole earth is bound together mainly by the force of gravity, cohesion being of much less importance, and the pressure at great depths is so enormous, that at the centre it is calculated to amount to 15,000 tons per square inch. At this pressure the density of the ordinary rocks would be far greater than the mean density of the earth will warrant, so that instead of being obliged to suppose that all the heaviest metals have accumulated at the centre in order to account for the high mean density, we have to seek in the elevated temperature of the interior a reason for the mean density being so small as it is. The density of the crust of the earth is irregularly distributed. It must be greater under the Pacific Ocean, in order to balance the projecting mass of Africa and Europe on the opposite side of the world, otherwise, the globe would be lop-sided. In many places observations with the pendulum or plumb-line show discrepancies that cannot be accounted for by the configuration of the neighbouring surface, and must be due to irregularities in the density of the crust. The dimensions given refer to the earth as a perfectly smooth figure, the solid lithosphere being surrounded by a fluid shell, the hydrosphere, about 2 miles thick, which is included in the estimate, but this is enwrapped by the Atmosphere (q.v.), which is of undefined extent, and is left out of account.

Constitution of the Earth.—The elements present in the earth are, as far as can be ascertained, the same as those in the sun and other members of the solar system. Of the ninety or more elements recognised by chemists, very few occur free in those parts of the crust accessible to us, except the oxygen, nitrogen, and argon of the atmosphere. The hydrosphere ($\frac{1}{5000}$ of the mass of the earth) is composed of about 97 per cent. of pure water, a compound of hydrogen and oxygen. The lithosphere is made up mainly of silicates—i.e. compounds of silicon, oxygen, and a few metals. The table shows, according to Prestwich, the approximate composition of the crust of the earth; but more recent estimates give a larger proportion of iron:

As Elements.		As Oxides, &c.	
1. Oxygen	50·0	1. Silica	53·0
2. Silicon	25·0	2. Alumina	19·0
3. Aluminium	10·0	3. Lime	6·3
4. Calcium	4·5	4. Magnesia	5·8
5. Magnesium	3·5	5. Soda	2·5
6. Sodium	2·0	6. Potash	2·4
7. Potassium	1·6	7. Carbonic acid	7·5
8. Carbon	2·4	8. Iron oxides	
9. Iron		9. Sulphuric acid	
10. Sulphur		10. (Chlorides)	
11. Chlorine		11. Other oxides	3·5
12. Other elements	1·0		
	100·0		100·0

The character of the rocks composing the lithosphere varies with depth. Beneath the outer part of the crust composed of sedimentary or metamorphic rocks, there seems to occur a zone of acidic lavas—i.e. rocks in which the proportion of silica is greater than is required to saturate the bases. At greater depths, basic lavas of greater density occur, in which there is a deficiency of silica. The thickness of the crust, and the constitution of the earth beneath it, can only be guessed at from superficial indications, or by deductions from its movements. The change of temperature with depth has been carefully studied (see TEMPERATURE), especially by the Committee on Underground Temperatures of the British Association, who have collected great masses of data, and shown that as a rule beneath the stratum of invariable temperature (which lies at a variable depth, and is the limit of solar influence), the temperature increases at the rate of about 1° F. in every 55 or 60 feet. There are indications of this rate diminishing at great depths. The deepest depressions of the oceans extend about 6 miles below sea-level, and it might be expected that the heat of the earth's crust would raise the temperature of the water there, and keep up, if not a boiling sea, at least energetic oceanic circulation. This is found not to be the case, as the cold water from the polar regions has long since cooled down the bed of the open oceans to a temperature everywhere between 30° and 40° F. When a tunnel is bored horizontally through a mountain, the temperature in the interior is found to be higher than corresponds to its distance from the centre of the earth, but quite in accordance with the depth beneath the summit of the mountain. Although the temperature in the interior of the earth is unquestionably high enough to melt, and possibly even to vaporise all known substances, the fact that the melting-point of rock-materials is raised by pressure makes it probable that the earth as a whole is a solid body, and is not merely a thin hard crust like an egg-shell encircling a vast molten sphere. Astronomical observations, and the investigations on

earth-tremors and tides, indicate that the lithosphere, as a whole, has a rigidity approximately equal to that of steel. The theory of a solid earth in no way hampers the explanation of Volcanoes (q.v.) emitting vast quantities of fused rock-materials, as there may be relatively small accumulations of fluid rocks here and there, or more likely some temporary relief of pressure lowers the melting-point, and allows the rocks to liquefy explosively. Considerations of the thickness and rate of deposition of stratified rocks have suggested that the crust has been solid for about 1000 million years. Lord Kelvin, arguing from the rate of loss of heat, allowed less than 100 million; but the discovery of radium and the remarkable thermal effects of radio-active minerals deprives this line of reasoning of all quantitative value, and a greater age must be conceded. The transformation of radio-active elements supplies a new measure for the antiquity of the earth, and Lord Rayleigh deduces an age of several thousand million years by this method for the earth while in a condition to support life. This figure gives the geologists sufficient elbow-room for their processes. See GEOLOGY, NEBULÆ.

The Surface of the Earth.—After a solid crust had been formed, the contraction consequent on cooling caused the core of the earth to shrink away, parts of the unsupported crust either fell into the cavities formed, or were drawn in by the contracting nucleus, and so gave rise to hollows and ridges on the surface. The oceans conceal so much of the earth's surface from our view, that we are apt to form a wrong idea of its real configuration. If the hydrosphere were of one quarter its present extent, only the deepest hollows would be covered with water, and all the rest would be land, while, if it were four times as extensive, even the highest ridges would be submerged. As it is, the emergent ridges or land areas amount to 28 per cent. of the entire surface, with a mean height of about 2300 feet above the sea, and the submerged hollows occupying the remaining 72 per cent. of surface have an average depth of about 11,500 feet beneath sea-level. The distribution of land and water is such that the land is massed mainly in the northern hemisphere, the Arctic Circle having the largest proportion of land in its course, nearly seven-eighths of its length; the equator crosses land only for one-sixth of its length, and the parallel of 57° S. runs entirely over sea. If the world were divided into two hemispheres, with the English Channel at the centre of one and New Zealand at the centre of the other, the proportion of land to sea in the former would be twelve to thirteen, and it would contain seven-eighths of the land; the proportion of land to sea in the latter would be one to twelve, and it would contain three-quarters of the sea of the globe. The question of the permanence of the main lines of surface-features is referred to in CONTINENT and in SEA. Sir John Murray's discussion of the height of land and depth of sea has been supplemented by estimates by Professors Wagner and Krümmel. According to Wagner's classification the *Depressed Area* or ocean deeps more than 16,400 feet below sea-level occupy 3 per cent. of the earth's surface, the *Oceanic Plateau* depths between 7400 and 16,400 feet occupy 54 per cent., the *Continental Slope* between 660 and 7400 feet 9 per cent., the *Continental Plateau* between 660 feet below and 3300 feet above sea-level 28 per cent., and the *Culminating Area* above 3300 feet 6 per cent. Unsurveyed regions leave some doubt as to the exact figures. The total volume of ocean is fourteen times as great as that of dry land; if all the land were levelled down to sea-level, only one-fourteenth of the oceanic depressions would be filled up. For the comparative area of land and water, see SEA.

Movements of the Earth.—The fact that the earth rotates always in the same way gives the globe *polarity*, or the property of two-endedness, and the fact that the axis of rotation coincides with the shortest diameter of our planet, strongly confirms the nebular hypothesis by indicating that the earth assumed its existing form, approaching an oblate spheroid, by rotating rapidly about its present axis while in a fluid or at least a plastic state. The rotation of the earth gives the power of distinguishing and defining directions. The direction towards which rotation takes place is the east, that from which it takes place is the west. These terms are purely relative. Compared with Britain, America is the western continent; compared with Japan, it is the eastern continent; there is nothing like an east or west pole. The ends of the earth's axis are fixed points—one called the north pole, the other the south pole. The north pole is defined as that end of the axis which points towards a bright star in the constellation of the Little Bear, the star being named in consequence Polaris, or the Pole-star (see LATITUDE, POLES). While the rate of angular rotation is uniform in all parts of the earth, namely, one complete revolution in 24 sidereal hours (or in 23 hr. 56 min. 4 sec. solar time), or 15° per hour, the tangential velocity varies with the cosine of the latitude. At the equator, with its circumference exceeding 24,000 miles, the velocity of a point on the surface of course exceeds 1000 miles an hour. At the parallel of 60°, which is only half the length of the equator, the tangential velocity is 500 miles an hour, while at the poles themselves there is no tangential velocity, but rest as far as axial rotation is concerned. In virtue of inertia, the property of matter defined in Newton's first law of motion, the direction of the axis of a rotating body tends to remain unchanged. As the earth has a rapid motion of revolution round the sun, varying from a maximum in perihelion to a minimum in aphelion, the plane in which it moves also tends to remain unchanged, and these two directions afford standards in space to which the inclination of all other planes and lines may be referred. The eccentricity of the earth's orbit is subject to changes, maxima of eccentricity occurring at irregular intervals of about half a million years, but its plane is much more constant. The time occupied by the earth in its circuit of 580 million miles is one year, or 365 days, 6 hours, 9 minutes, which implies an average velocity of 66,000 miles per hour.

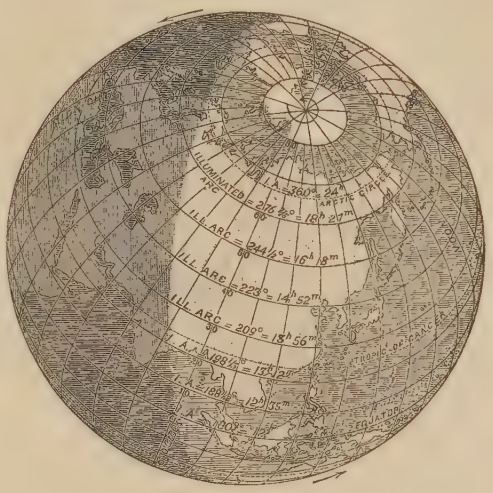
The inclination of the earth's equatorial plane to the plane of the ecliptic is 23° 28′, and the variations are scarcely perceptible. The most important of the earth's motions resulting from perturbations by other heavenly bodies, is Precession (q.v.), which is due to the differential attraction of the sun and moon on the bulging equatorial region. This attraction constantly tends to turn the earth's axis at right angles to its orbit; but it results only in a slow rotation round a perpendicular axis which occupies about 25,800 years, and has the effect of making the pole describe a circular path in the heavens. The possibility of changes in the inclination of the earth's axis having taken place within recent periods, is a question of great importance with regard to geological climate (see GLACIAL PERIODS); but the balance of evidence seems to be against the probability of any such change. Astronomical observations indicate a movement of the poles over the surface of the earth at the rate of a foot per annum, within a circle of about 50 feet in diameter, giving rise to minute variations in latitude. The proofs of the diurnal rotation of the earth are numerous and complete. A consequence of rotation from west to east has been deduced by Ferrel to the effect that any body

moving on the earth's surface, *in whatever direction*, tends to deviate from a straight path towards the right in the northern hemisphere, and towards the left in the southern. For bodies moving towards or from the equator, this can be easily understood. Suppose an ocean current to start from the equator, flowing due north. At the equator it has, if the earth rotates from west to east, a much greater eastward velocity than has the part of the earth's surface to which it flows, so that it must of necessity flow eastward as well as northward—i.e. it must turn towards the right as it proceeds. Similarly moving southward from the equator, the current must retain an easterly drift as it advances, thus deviating to the left. This is the mode of circulation which actually takes place in the oceans. Many large rivers of the northern hemisphere, such as the Volga, press harder on the right bank, which is accordingly steep and always receding, while the left bank is a more gentle slope. The same thing is observed in a more marked degree in the case of winds; and even in gunnery, allowance has to be made for the deviation of the projectile from this cause. The fact that a bullet dropped from a lofty tower falls a little to the east of the vertical, has been repeatedly verified, and can only be accounted for by the upper part of the tower having a greater tangential eastward velocity than the base, on account of its being farther from the earth's centre, this greater velocity being shared in by the dropping bullet. But the most convincing proof was given by Foucault with the Pendulum (q.v.). A long and heavy pendulum swings in a plane, the direction of which is by Newton's first law of motion constant in space. Yet when such a pendulum is set swinging in a room, its plane of vibration very soon appears to be changing. The plane always appears to twist round in the same direction, and since we know that the plane of the pendulum does *not* change, we must conclude that the room turns round it in consequence of the rotation of the earth. Direct proofs of the revolution of the earth round the sun are less simple. The Aberration of Light (q.v.) proves that the observer accomplishes some yearly journey at a rate that is comparable, though remotely, with the velocity of light; and the parallax of some of the nearer stars when corrected for aberration, indicates that we view them at opposite seasons of the year from opposite ends of a line, 180 million miles long.

The earth performs none of its motions with rigorous precision. The solar system is so balanced and knit together that each of its members exerts some influence in determining the movements of all the rest. See PERTURBATIONS.

Distribution of Solar Energy on the Earth.—The energy of the sun continually beating upon the earth keeps up the circulation of the atmosphere and hydrosphere, through which it acts on the lithosphere and becomes available for the use of living creatures. Only $\frac{1}{2000000000}$ of the energy actually given out by the sun is intercepted by the earth, but this minute fraction is great enough to produce enormous results. As the globe rotates, one half is always exposed to sunlight, one half always immersed in darkness. The refractive power of the atmosphere makes the rising or setting sun appear higher than its true position in the sky, and so keeps it visible for a longer time than if there were no air. The length of the day and the amount of daylight in high latitudes are thus very considerably increased.

Not considering the effect of refraction, it is easily understood how at the summer solstice of the northern hemisphere, when the north pole is inclined towards the sun, sunlight falls 23½° beyond the pole, and as the earth rotates all this region remains in daylight the whole twenty-four hours. At this time the south pole is turned from the sun to the same extent, and no light can reach within 23½° of the south pole. The circles bounding those regions of continuous daylight or darkness at the solstices are termed the Arctic and Antarctic circles, and the space within them the North and South Frigid zones. At the summer solstice of the northern hemisphere the sun is vertical at a distance of 23½° N. of the equator. This is the highest north latitude at which a vertical sun is experienced, and is termed the Tropic of Cancer from the constellation in which the sun appears at the time. At the winter solstice of the northern hemisphere the sun is vertical at a distance of 23½° S. of the equator or on the Tropic of Capricorn, which is the highest south latitude for a vertical sun. As the sun appears overhead in all places between these circles twice in the year, and thus exerts its maximum heating power, this broad belt of the earth is termed the torrid zone. Between the tropics and the polar circles there are two regions, each 43° wide, in which the sun is never overhead, nor is it ever beneath or above the horizon continuously for a period of twenty-four hours. These are the northern and southern temperate zones. In high latitudes the sun's rays strike the earth's surface obliquely, and have thus less heating power than in low latitudes (see CLIMATE; see also DAY and SEASONS). The northern winter and southern summer occur in perihelion, so it might be supposed that more heat reaches the southern than the northern hemisphere. Kepler's second law explains, however, that the earth moves so much more rapidly when near the sun than it does when distant from that centre, that the amount of heat received in equal times is the same in both cases.



View of Earth from the zenith of a point in 50° N. lat. and 90° E. long. at 6 o'clock A.M., on its summer solstice (21st June):

The figures on the parallels of latitude indicate the length of the illuminated arc in degrees, and the period of daylight (longest day) in hours.

Work of Solar Energy.—The sun's heat-power is constantly at work breaking down the rocks of the higher parts of the lithosphere, and spreading the triturated substance as soil over the lower ground. The circulation of water is the great instrument for this work; vapour raised from the oceans and carried by wind is condensed as rain on the high-lands, and returning to the sea in the form of springs and streams, has a chief share in wearing down the surface of the land. This process would ultimately reduce all the land to a uniform

low level, were it not counteracted by the continual gentle elevations and depressions of the surface, consequent on internal changes (see UPHEAVAL). The energy of the sun acting through living plants enables these to recombine the elements of the soil and the air, and thus to form a variety of new products, most of which can as yet be produced in no other way. Thus the greater part of the land surface of the earth is covered with growing vegetation. The distribution of plants over the earth's surface depends on configuration, climate, and soil. Where these conditions were favourable, great stores of solar energy have been laid up in the potential state by the preservation as fossils of ancient forests. Coal is the best example, and the distribution of coal is at present one of the most important factors in the life of a modern manufacturing community. Animal life, which is ultimately dependent on plant-life, and cannot get energy from the sun direct, carries on the process of rearrangement and redistribution of matter farther. It also has had a share in producing the present condition and aspect of many parts of the earth. The chalk, limestone, and marble which characterise many regions of the land, and the coral reefs and islands of tropical seas, are immediate consequences of the action of animal life. The distribution of plants and animals in their natural state is determined solely by the physical conditions of their surroundings; but the actual distribution has been greatly modified by the action of man.

Man to a large extent modifies and reverses the ordinary course of natural phenomena and the laws of Geographical Distribution (q.v.). The greatest density of human population would occur naturally in those regions where the means of life are most abundant and most easily obtained, such as the alluvial plains of hot regions; hence the valleys of the Nile and Ganges and the plains of China have always been amongst the most populous parts of the world. With the development of means of transport and of manufacturing processes a drift of population set in towards regions of mineral wealth, so that in manufacturing countries, such as western Europe and the eastern United States, the coal-fields are most densely peopled, and the population is fed by grain and flesh raised in far distant parts of the earth. Tribes of the human race early began to claim exclusive rights to the region of the earth's surface they inhabited, and definite districts of the earth have from remote historical times been associated with particular races, who either continue to hold them if strong enough to resist invasion, or are superseded by more powerful immigrants. The artificial boundaries of countries appeal so much more strongly to the popular mind than the natural boundaries of such regions of the earth's surface as plains, plateaus, or river-basins, that until recently in most atlases the maps were coloured to show only the arbitrary human divisions. It is the purpose of Geography (q.v.) to consider the earth in its special relations to man.

The intense manufacturing activity of modern life has an important bearing on the future of the earth as a habitable planet. Mineral fuel and metals are being extracted and consumed with great and increasing rapidity, and from many causes they are being produced and stored up at a slow and decreasing rate. Hence, to view the subject from the standpoint of geological time, the supply of potential energy is approaching an end. The sun pours upon the earth every day enormous quantities of energy, continually available in wind and water power, and these must be utilised more and more as the accumulated reserve of energy in coal and metals diminishes. In the same way vegetation is a regenerative process; but by the destruction of forests without replanting and the exhaustion of soils the availability of solar energy in this way has been destroyed in some parts of the world, and greatly impaired in others. It is necessary, in viewing the earth as a home for man, to bear in mind that if it is to continue capable of maintaining its present population in comfort—not to speak of the increase at the rate of about 10,000,000 a year—the stores of potential energy must be carefully preserved, and care must be taken to allow the daily solar supplies to produce their fullest effect by applying the principles of forestry and agriculture.

The Future of the Earth.—The principle of the degradation of energy as stated before the possibilities of radio-activity were known, taught that the earth will gradually cool down. The sun also cooling, although at a slower rate (about 1° in 3000 years), will gradually reduce the supply of external energy, the friction of lunar tides will lengthen the rotation period of the earth until it coincides with its reduced period of revolution round the sun. Ultimately, if this principle holds good, all the bodies of the solar system will clash together, restoring by the impact much of the potential energy to the kinetic state, and in so doing they will start a reduced duplicate of the old solar system, with a less supply of energy. The cycle of nebula, sun, and planet will go through the same round again and again with diminishing speed, until ultimately in the course of infinite time all the matter of the universe will be accumulated in one vast mass, with all the energy of the universe uniformly diffused through it at one level of temperature and utterly unavailable, and the universe will be dead.

The internal composition and gradual changes of the interior, the somewhat complicated distribution and mode of origin of the surface irregularities of the lithosphere, the various motions of the earth as a whole, and the action, modified by all these conditions, of solar energy on the atmosphere, hydrosphere, and lithosphere, determine all the changes of the earth's condition and appearance, including its relations to living plants and animals. The investigation and description of these features and their rationale constitutes the study known to the Germans as *Erdkunde*, to the French as *Physique de Globe*, and in this country by the unsatisfactory and inadequate names of physical geography and physiography.

For the full explanation of the phenomena of the earth, reference may be made to many other articles, some of the more important of which are:

Africa.	Day. Desert.	Lakes.	Ptolemaic System.
America.	Earthquake.	Latitude.	Rain.
Antarctica.	Ecliptic.	Longitude.	Rivers.
Antarctic Ocean.	Europe.	Magnetism (Terrestrial).	Sea.
Arctic Ocean.	Foucault.	Meridian.	Season.
Asia.	Geodesy.	Meteorology.	Snow.
Astronomy.	Geographical Distribution.	Mountains.	Solar System.
Atlantic.	Geography.	Nebulæ.	Sounding.
Atmosphere.	Geology.	Nutation.	Storms.
Australia.	Glacial Period.	Pacific Ocean.	Temperature.
Climate.	Gravitation.	Planets.	Tides.
Continent.	Ice.	Polar Exploration.	Volcanoes.
Copernicus.	Indian Ocean.	Poles.	Water.
Creation.	Island.		World.

Earth, in Chemistry. See EARTHS.

Earth Closet. See SEWAGE.

Earthenware. See POTTERY.

Earth-houses, or YIRD-HOUSES, the name which seems to have been generally given throughout Scotland to the underground buildings, which in some places are called also 'Picts' Houses' (q.v.), and in others, it would appear, 'Weems,' or caves. Martin, in his Description of the Western Islands, printed in 1703, when their use would appear to have been still remembered, speaks of them as 'little stone-houses, built under ground, called

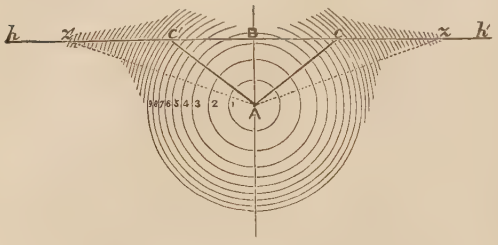
earth-houses, which served to hide a few people and their goods in time of war.' The prehistoric earth-house of the Scottish mainland, however, is a long narrow gallery of a curved form, increasing in height and in width from the entrance to the farther end. These cave-like structures, which are sometimes over 80 feet in length, are built of unhewn and uncemented stones, roofed by unhewn flags, and entered usually at the narrow end. When the chamber is unusually wide, the side-walls converge, one stone overlapping another, until the space at top can be spanned by stones of 4 or 5 feet in length. In some cases the earth-house shows two or more chambers, communicating with one another by a narrow passage. Occasionally, as many as forty or fifty earth-houses are found in one group, as in the moor of Clova, not far from Alford, in Aberdeenshire. They are generally so near the surface of the ground that the plough strikes upon the flagstones of the roof, and thus leads to their discovery. The objects most frequently found in them are those of domestic use or personal ornament, and the refuse of food. The indications afforded by the character of the relics assign the occupation of the earth-houses in Scotland to post-Roman times. Occasionally, the surface of the ground beside the earth-house shows vestiges of dwelling-houses, and folds or inclosures for cattle. This, with other things, would indicate that the earth-houses of Scotland and Ireland (for they are found also in that island) were put to the same purpose as the caves which, as Tacitus (writing in the 2d century) tells us, the Germans of his day dug in the earth, as storehouses for their corn, and as places of retreat for themselves during winter, or in time of war. For plans and descriptions of many earth-houses in Scotland, see Anderson's *Scotland in Pagan Times: the Iron Age* (1883).

Earth-nut, a popular name of the tubers of certain umbelliferous plants, particularly *Bunium bulbocastanum* and *B. flexuosum*, which are common in most parts of Europe. Names of the same signification are given to them in a number of European languages. *Arnut*, *Yernut*, *Ground-nut*, and *Jurnut*, Scots and English provincial names, are corruptions of earth-nut. *Pig-nut* and *earth-chestnut* are also common English names. They are wholesome, nutritious, sweet, starchy, and very slightly acrid on the palate. When boiled or roasted they are delicious; cooked in the latter way under embers they resemble chestnuts, but are more aromatic, and generally preferred to them by the inhabitants of countries where both are indigenous. In Holland, the Alps, and in some parts of England, particularly in Hertfordshire and Cambridgeshire, where they are plentiful, they are used in soups. They form an article of trade in Sweden, and have sometimes been recommended as worthy of an attention which they have never yet received in Britain. The two species are very similar in general appearance, although *B. bulbocastanum* has by some botanists been referred to the genus Carum, because its carpels have single vittæ between the ribs, *B. flexuosum*, with three, to Conopodium. The former is also a plant of stouter habit. Both have umbels of small white flowers, much divided leaves with very narrow segments, and a single roundish tuber at the root of each plant. *B. flexuosum* is common in woods, pastures, waysides, &c., in most parts of Britain. *B. bulbocastanum* is found only in some of the chalk districts of England, but is abundant in many parts of Europe. *B. ferulaceum* likewise affords tubers, which are used as food in Greece.—The somewhat similar tubers of another umbelliferous plant, *Oenanthe pimpinelloides*, which grows in the pastures of some parts of the south of England, are sometimes also used for food, notwithstanding the very poisonous qualities of some of its congeners (see WATER-DROPWORT).—A Himalayan umbelliferous plant (*Chærophyllum tuberosum*), a species of Chervil (q.v.), yields edible tubers or *earth-nuts*. —The name earth-nut is sometimes extended to other small tuberous roots of similar quality, although produced by plants widely remote in the botanical system, as *Apios tuberosa* and *Lathyrus tuberosus;* as also to the very different Ground-nut (q.v.) or Ground-bean, the *Arachis*.

Earthquake, the term applied to any tremor or shaking of the ground. Many earthquakes are so gentle as to pass almost unrecognised, others again are sufficiently pronounced to excite general remark or alarm, without, however, causing any damage, while some spread enormous destruction over wide areas. Probably no part of the earth's surface is entirely free from vibration, but, fortunately, destructive earthquakes are confined to comparatively limited regions. According to Mallet, the well-known authority upon seismology (*seismos*, 'an earthquake,' *logos*, 'a discourse'), the almost universal succession of phenomena recorded in notable earthquakes is first a trembling, next a severe shock, or several in quick succession, and then a trembling gradually but rapidly becoming insensible. In most cases, each shock lasts only a few seconds, but the tremblings that follow may be continued for days, weeks, or even months. Noises of sundry kinds usually precede, accompany, or succeed an earthquake. These have been variously described, some likening them to the howling of a storm, the growling of thunder, the clanking and clashing of iron chains, the rumbling of heavy wagons along a road, the shattering and crashing of enormous masses of obsidian or glass, &c. Such noises are conducted through the ground, or they may travel through the sea, or be transmitted through the air. They are often propagated through the ground for very great distances, so that they may be heard in regions far removed from the disturbed area. Cases are on record where such sounds have travelled more than 158 geographical miles. Some earthquakes, however, are not attended by any subterranean sounds. This has been the case with some of the most destructive South American disturbances. Thus at the time of the terrible shock which destroyed Riobamba in Ecuador on 4th February 1797, a complete silence reigned. On the other hand, subterranean sounds may be heard without any earth-tremor being perceived. Humboldt tells us that at Guanajuato, in Mexico (1784), the inhabitants were terrified by loud subterranean thunder, which continued for more than a month, but was not accompanied by any trace of earthquake. The noise ceased gradually as it commenced, and was curiously local, as it was not heard at the distance of only a few miles.

Earthquakes are felt either as *vertical shocks*, from below upwards, as *horizontal* or *lateral shocks*, or as *undulatory movements*. As illustrating the force of a vertical shock, it is related that in 1837, at the fort of San Carlos in Chile, a flagstaff which was sunk for 30 feet in the ground, and secured with iron rods, was violently shot into the air, leaving a round hole in the ground. Again, at the time of the great earthquake of Riobamba, the bodies of many of the inhabitants were projected across the river and fell upon La Culla, a hill over 300 feet in height. During the Calabrian earthquake of 1783, the undulatory motion was well marked by the way in which the trees swayed to and fro, their branches touching the ground. The same appearance was noted at New Madrid (Missouri) during the earthquakes of 1811–12, where the trees were observed bending as the earth-waves passed under them, and immediately afterwards recovering their

position. Numerous observations of this kind have led physicists to the belief that an earthquake is a wave or true undulation of the crust. The wave produced by the original impulse travels outwards



Earth-waves:

h'h, the horizon; A, centrum; B, epicentrum; AB, Ac', Ac, Az', Az, wave-paths; 1, 2, 3, 4, &c., spherical concentric shells, or similar phases of the earth-wave. The most destructive effects upon buildings are produced at some point between the epicentrum, B, and *z'* or *z*, say at *c'* or *c*.

in all directions from the 'focal cavity,' or 'centrum,' A, in successive spherical shells (1, 2, 3, &c.), the form of which, however, as we shall see presently, is subject to many modifications. The point or area on the surface of the ground directly above the 'origin' or centrum is called the 'epicentrum,' B, and it is at this point where usually the shock is felt as a vertical stroke coming from below upwards. As we recede from this point, the direction of motion becomes more and more horizontal, and gradually also decreases in intensity until it becomes insensible. Away from the epicentrum, then, it is obvious that the earth-wave at every point comes up obliquely *from below* —the radial lines along which an earthquake is propagated from the centrum being called 'wave-paths,' AB, Ac', Ac, Az', Az. If the earth's crust were composed of perfectly homogeneous materials, then the undulations propagated from the centrum would extend equally in all directions, and might be shown diagrammatically by describing a series of concentric circles round the epicentrum. But the crust is very far from being homogeneous. It is composed of different kinds of rock, arranged often in very discordant ways, and traversed by irregular joints, fissures, cavities, and dislocations. All these differences affect the transmission of an earthquake; and the direction of motion is still further influenced by the configuration or varying topographical features of the disturbed districts. Thus geological structure and topographical features combined lead to continual deflections and delays of the earth-wave; but inasmuch as the topography of the surface is fundamentally influenced by the nature and structure of the underlying rocks, we may assign the irregularities of the isoseismic circles primarily to geological causes. Hitherto we have been supposing that the earth-waves are propagated in successive *spherical shells*, the shape of which is modified in various ways. We must remember, however, that the impulse may not originate from a point or spherical cavity, but from a fissure inclined at a considerable angle from the vertical. In such a case the waves, even in a homogeneous medium, would not be concentric circles, but, originating from all points of the fissure, would spread outwards in *ellipsoidal shells* to the surface, where the waves would take the form of ovals or distorted ellipses. In such a case as this, the greatest effect of shock would not be felt in the area vertically above the centrum, but rather to one side of the epicentrum; in other words, the direction of greatest effect would coincide with the major axis of the ellipsoidal shells. As a matter of fact, isoseismic lines, or lines of equal disturbance, are seldom circles; elliptical or irregular curves being the common forms. And that their form is greatly influenced by geological structure and topography, is shown by the circumstance that earthquakes are propagated not unfrequently in lines or zones—the major axis of elliptical areas of disturbance often having a general direction parallel to the trend of some great valley or considerable mountain-range. In the South American earthquakes, the vibrations are confined to the long narrow strip of low ground between the Andes and the sea, and are not felt on the eastern side of the mountains. Similarly the earthquakes that shake the coast-lands of Venezuela, Carácas, and New Granada are rarely transmitted inland across the coast-ranges.

The velocity of propagation of an earthquake is very variable. Thus in the case of the earthquake of Lisbon in 1755, it seems to have considerably exceeded 1000 feet per second, while in the Lisbon earthquake of 1761 the rate was three times greater. At Tokio, in 1881, the velocities, as estimated by Professor Milne, varied between 4000 feet and 9000 feet per second. From his own observations, taken in connection with those of previous investigators, Milne thought we might conclude (1) that different earthquakes, although travelling across the same country, have velocities which may vary between several hundreds and several thousands of feet per second; (2) that the same earthquake travels more quickly across districts near to than far from its origin; (3) that the greater the intensity of shock, the greater is the velocity.

Various attempts have been made to estimate the depth at which earthquakes originate. Mallet was of opinion that the centrum of the Neapolitan earthquake of 1857 was probably 5½ miles from the surface. His calculations were based on the assumption that the earth-wave radiated in straight lines from the centrum. Immediately above the centrum the wave-path was supposed to be vertical, while at points at different distances from the epicentrum the wave-paths would be oblique, and emerge at different angles at the surface. These angles he obtained by drawing lines at right angles to the direction of the large cracks and rents observed in numerous buildings. The lines so drawn converged approximately to a point below the area of greatest disturbance (epicentrum)—the point of convergence indicating the site of the original impulse or earthquake centrum. The same eminent physicist thought that an earthquake centrum probably never exceeded a depth of 30 geographical miles. According to Professor Milne, the angles of emergence of the earth-waves obtained during the Yokohama earthquake of 1880 showed that the depth of origin of that earthquake might be between 1½ and 5 miles; and he gives a table, compiled from the writings of various observers, which exhibits the mean depths at which certain earthquakes have originated. These estimated depths range from 17,260 feet to 127,309 feet. Two of these depths were obtained by Mallet's method, and four were made by the assistance of Seebach's method, which depends, amongst other things, on the assumption of exact time-determinations, direct transmission by waves from the centrum, and a constant velocity of propagation. Milne's conclusion, however, was that even if the observations of time be practically accurate, yet the other assumptions may often lead to errors of such magnitude that the calculated results may be of but little value.

The area disturbed by an earthquake is generally proportionate to the intensity of the shock.

The great earthquake of Lisbon disturbed an area four times as great as the whole of Europe. In the form of tremors and pulsations, Mr Milne remarks, it may have shaken the whole globe.

Mr Mallet made a preliminary subdivision of all the earthquakes recorded in his great catalogue (British Association Report, 1854) into three classes, as follows: (1) *Great earthquakes*, in which large areas were shaken violently, numerous cities destroyed, and multitudes of people killed, rocky masses dislocated, and powerful secondary effects produced; (2) *mean earthquakes*, sometimes with a wide superficial area, but doing less damage to cities, and attended by scarcely any loss of life, and effecting little or no change on natural objects; (3) *minor earthquakes*, in which buildings were shaken and sometimes fissured, but natural objects were not at all affected, and which left few or no traces of their occurrence after the shock. The first class may be assumed to have a sensible diameter of about 1000 to 1200 miles; the second about 400 miles; and the third about 100 or 150 miles. These of course are only mean results made upon the assumption that the areas of disturbance had sensible surface-boundaries approaching to irregular circles or ellipses. When we come to the great earthquakes of modern times, the boundaries of which have been approximately ascertained, we find that these have been sensible in certain surface radii, or great circles, over 18°, or perhaps even 20°.

Earthquakes are not confined to the land. Many, perhaps the larger number, seem to originate under the sea, particularly along lines parallel to the shores of continents and islands that rise abruptly from great depths. In a violent submarine earthquake, the ordinary earth-wave and sound-wave are accompanied by sea-waves. When the earth-wave is started, a great sea-wave is generated at the same time, while a sound-wave is produced in the air. These waves travel shorewards at different rates. The earth-wave, carrying on its back a small 'forced sea wave,' is the first to reach the shore, and as it passes inland, it causes a slight recession of the sea as the 'forced wave' slips from its back. The 'great sea-wave' is the last to reach the shore. Its appearance is generally heralded by the flowing back of the sea—the recession varying from 30 or 40 feet or less in some cases, to several miles in others. The time taken for the withdrawal of the water from the shore is equally variable—sometimes it is only a few minutes, in other cases half an hour, or even several hours have elapsed before the appearance of the great sea-wave, or waves. These waves may be 20, 60, or even 80 feet higher than the highest tide, and are usually more dreaded than the earthquake shock itself in such regions as the maritime districts of South America. The greatest sea-wave on record is that which, on October 6, 1737, is said to have broken near Cape Lopatka, at the south end of Kamchatka, 210 feet in height.

The changes which earthquakes produce on the earth's surface deserve the careful attention of the geologist. By causing landslips, and now and again producing crevasses in the ground, they occasionally interrupt or even entirely revolutionise the drainage system of a country, and have thus frequently led to many modifications of a land-surface. Very considerable changes are likewise caused by the great sea-waves which so frequently accompany the violent disturbances of low-lying maritime tracts—blocks of rock, shingle, gravel, and sand, and marine organisms being often swept inland for great distances beyond the reach of the highest tide. Permanent elevations and depressions of the land are sometimes accompaniments of earthquakes. Thus, after the great earthquakes of 1750, the coast of Chile was found to have been permanently raised from three to four feet. Well-known examples of permanent depressions are those of the Runn of Cutch and the coast-lands near Chittagong, which were submerged suddenly during the Bengal earthquake of 1762.

Earthquakes are of most common occurrence in volcanic and mountainous regions. The 'great belt of fire' which circles round the shores of the Pacific Ocean marks out for us the most earthquake-shaken regions of the globe. Professor Milne draws attention to the fact that the shores of those regions slope into the sea at a much steeper angle than the shores of countries where earthquakes seldom occur. Looking at the broad features of the globe, he says, we see on its surface many depressions. Some of these saucer-shaped hollows form land surfaces, as in Central Asia; the majority, however, are occupied by the oceans. Now, most earthquakes seem to have their origin on or near the bottom of these slopes; but to this rule there are of course exceptions.

When we come to inquire into the cause of earthquakes, we are left very much to conjecture. Some earthquakes may be due to the sudden collapse of underground cavities. Some doubtless are associated with volcanic explosions, which for long were held to be, directly or indirectly, the cause of all great earthquakes. Investigation has shown clearly, however, that volcanic explosions are distinctly local in their effects, and, moreover, that earthquakes are more numerous and more potent in non-volcanic than in volcanic regions. Most authorities agree that the chief cause of great earthquakes is to be found probably in the snapping of rocks subjected to great strain. The destruction of Messina and Reggio may be taken as an example. The affected area lies close to one of the great lines of folding of the Alpine system, and the earthquake in all probability was due to a settling down along lines of fracture of the depressed area which forms the Tyrrhenian sea. Many other causes of earthquakes besides those already referred to have been suggested. Amongst these are the attractive influences of the sun and moon, fluctuations in temperature, and the pressure of the atmosphere, &c. But according to Professor Milne, exogenous phenomena such as these play but a small part in the production of earthquakes—their greatest effect being to cause a slight preponderance in the number of earthquakes at particular seasons. Thus, most earthquakes occur during the cold months or winter, and it is then also that barometrical fluctuations are most numerous.

EARTH-TREMORS are vibratory motions of the ground so gentle as seldom to be perceived without the aid of instruments. These microseismic movements appear to be experienced in every region where scientific observations have been made, and may be common to the surface of the whole globe. Their cause has not been determined. They may be due, according to Professor Milne, to slight vibratory motions, the result of the bending or crackling of rocks, produced by their rise upon the relief of atmospheric pressure. Another notion is that they may be caused by an increased escape of vapour from the molten matter under the earth's crust consequent upon similar relief of pressure.

EARTH-PULSATIONS are another set of phenomena discussed by Milne. According to him, these pulsations are slow but large wave-like undulations travelling over or disturbing the surface of the globe. Their existence may be indicated by changes in the levels of seas and lakes, by pendulums, by delicate levels, &c. Some of these pulsations are attributable to earthquakes, while on the other hand certain earthquakes are attributable to earth-pulsations. Thus, according to Milne, the short

quick vibrations of the Lisbon earthquake which overthrew the cities of Portugal had, by the time they had radiated to distant countries, become changed into long flat waves, having a period of perhaps several minutes. These movements were too gentle to be perceived, except in the effects produced by tipping up the beds of lakes and ponds.

Among memorable earthquakes may be noted that of Lisbon, 1st November 1755, which left the city a heap of ruins, destroyed 35,000 lives, and was felt from the Madeiras to Britain; that which destroyed Aleppo in 1822; that at Mount Ararat in 1840; at Brussa, Asia Minor, in 1855; at Quito, 1859; Mendoza, South America, 1860; Manila, 1863; in Peru, 1868; Cúcuta, in Colombia, 1875; Manila, 1880; Valparaíso, 1880; Ischia, 1881 and 1883; at the eruption of Krakatao, 1883; Colchester, 1884; Málaga and Granada, 1884 and 1885; Charleston, 1886; Japan, 1891; Assam, 1897; NW. India, 1905; San Francisco, 1906; Valparaiso, 1906; Messina and Reggio, 1908–9; Turkey, 1912; Central Italy, 1915; Mexico, 1920; China, 1920; Japan, 1923. Milne reckoned that there is at least one earthquake daily in Japan, and probably from twenty to fifty daily on the earth's surface. Buildings are specially erected to withstand earthquakes in Japan, South America, and elsewhere; and similar principles have been applied even to lighthouse-building.

The Seismometer (q.v.) will be described under that head.

See Humboldt's *Cosmos* and *Travels;* Mallet's *Reports to the British Association* (1850–52, 1854, 1858, 1861); Milne's *Earthquakes* (1898) and *Seismology* (1899); F. Fouqué, *Les Tremblements de Terre* (Paris, 1888); Dutton's *Earthquakes* (1904); Davison's *A Study of Recent Earthquakes* (1905) and *British Earthquakes* (1924); and Hobbs's *Earthquakes* (1908).

Earths, the name applied by the alchemists and earlier chemists to certain substances now known to be oxides of metals, which were distinguished by being infusible, and by insolubility in water. The term was made to include the oxides of calcium, strontium, and barium, which undergo chemical change by contact with water, and yield alkaline solutions. On account of this property these oxides were called the alkaline earths. The term earth is now disappearing from modern text-books of chemistry. See SOILS.

Earth-shine, the light by which the dark portions of the moon's surface are rendered faintly luminous for a few days before and after new moon, resulting in an appearance popularly known as 'the old moon in the new moon's arms.' It is caused by the light reflected to the moon from the sunlit surface of the earth. It is stronger before than after new moon. See MOON.

Earthworks. See CAMP, CASTLE, FORTIFICATION, HILL-FORTS; also such books as Windle, *Remains of Prehistoric Age in England,* Mrs Armitage, *Early Norman Castles,* Hadrian Allcroft, *Earthwork of England,* the 'Victoria County History,' and the reports of the Earthworks Committee of the Congress of Archæological Societies.

Earthworm, a general name for terrestrial Oligochæta, or Chætopods with a relatively small number of bristles. There are many genera, such as Lumbricus and Allolobophora, which are well represented in Britain.

Structure.—A common earthworm, such as *Lumbricus herculeus,* shows a body with many rings or segments, a transparent, often iridescent, cuticle, a sensitive hood or prostomium overhanging the mouth, a swollen glandular 'saddle' or clitellum, four double rows of minute bristles or setæ, and a terminal anus. By contracting its well-developed muscles, some of which are connected with the bristles, the animal moves along the surface of the soil, sticking its bristles like pins against the ground. Its burrowing progress underground is helped by its habit of eating the soil as it goes, and the head is also used as a lever. The body-cavity is divided by cross partitions into segments corresponding to the external rings. The food canal has a number of distinct parts: first, the muscular pharynx, by aid of which the worm grasps leaves or stones; then the gullet, with three pairs of lateral lime-glands, which act chemically upon the food; then the swollen crop; then the muscular mill or gizzard where the soil is ground up; and lastly, the long digestive portion, covered with yellow cells, which are familiar to those who pierce the worm with the hook. The nervous system exhibits the usual dorsal brain, ring round the gullet, and ventral chain of double ganglia, with numerous lateral nerves. There are no special sense organs, but the worms are sensitive to light, and though they have no ears, they disappear 'like rabbits into their holes,' when somehow aware of vibrations on the ground or even in the air. The circulatory system is well developed. The excretory system is represented by a pair of small kidney-tubes (*nephridia*) in almost every segment; through these waste particles may be by means of cilia removed from the body-cavity to the exterior. The reproductive organs are hermaphrodite and complex.

Habits.—Earthworms are shy of the light, and keep underground during the day. Of the activity of their nocturnal peregrinations the abundant trails left on the damp soil bear witness. At night they often keep their tails fixed in the mouth of the burrow, while they explore with their bodies in a circle round about. They feed on vegetable matter in the soil, on leaves, &c.; the food is chemically

Common Earthworm:
a, young worm escaping from the cocoon.

acted on by the gullet-glands, ground up in the gizzard, digested in the intestine; the debris is expelled in the familiar castings. A number of eggs, along with spermatozoa and albumen, are surrounded by a common cocoon, which is formed from a secretion of the skin. The cocoon is stripped off towards the head of the worm by contractions of the body, and when it is freed the ends close. There is no asexual reproduction, but the animals are able to regenerate a lost head or tail. Some species of Lumbricus exhibit superficial Phosphorescence (q.v.). Leaves are frequently carried below ground, sometimes for food, but also for making the burrows comfortable. Darwin's observations showed that the earthworms display considerable dexterity in seizing even strange leaves in the manner most convenient for transport. Stones of relatively large size are cleverly moved along, and used to protect the mouths of the tunnels. Moles and birds are their chief enemies. Gregarinida (q.v.) are always found parasitic in the male reproductive organs,

and little threadworms are common in the kidney-tubes.

Related Forms.—Besides Lumbricus and Allolobophora, of which many species occur, there are numerous other genera, such as Perichæta, Cryptodrilus, Acanthodrilus, Eudrilus, Criodrilus, and Alma. The great Antæus of South America is several feet in length, the African Ilyogenia only an inch. An Australian species (*Megascolex gippslandicus*) measures towards 6 feet, and produces a gurgling noise as it retreats underground.

Geological Importance.—Earthworms have strong claims to be ranked as the most useful animals. They were ploughers before the plough. In the long past they have made a great portion of our most valuable soil, and now they are improving and renewing it without ceasing. They burrow and open the way alike for the rain-drops and the plant-roots; they bruise the soil particles in their gizzard mills, and liberate the mineral elements. They are continually burying the surface by triturated castings brought up from below. The importance of their humble labour is sublime. This was long ago appreciated by Gilbert White and Jenner, but was only realised after Darwin's marvellously patient observations. Some of these lasted about thirty years. The result was to show that earthworms have been the principal agents in the formation of vegetable mould. In some cases vegetable mould does seem to accumulate without much aid from earthworms, and the constant rain of dust, as Richthofen emphasised, must not be overlooked; yet there is not a shadow of a doubt as to the momentous action of earthworms as soil-makers. Darwin showed that there are on an average over 53,000 worms in an acre of garden, that ten tons of soil per acre pass annually through the bodies of the inhabitants, that they bring up mould from below at the rate of 3 inches thickness in fifteen years. Greater results have seldom been demonstrated by the adding up of infinitesimal items. Darwin's loving patience included many most interesting observations on the habits of earthworms, and his whole work most clearly shows that the truth of nature is stranger than romance. The archæologist owes the worms thanks for the way in which they have buried and thus preserved tesselated pavements and other antiquities. The use of worms to anglers needs no comment.

'Earthworms, though in appearance a small and despicable link in the chain of nature, yet, if lost, would make a lamentable chasm. . . . Worms seem to be the great promoters of vegetation, which would proceed but lamely without them, by boring, perforating, and loosening the soil, and rendering it pervious to rains and the fibres of plants, by drawing straws and stalks of all kinds into it; and, most of all, by throwing up such infinite numbers of lumps of earth. . . . Worms probably provide new soils for hills and slopes where the rain washes the earth away. . . . The earth without worms would soon become cold, hard-bound, and void of fermentation; and consequently sterile.'—Gilbert White, 1777.

'It may be doubted whether there are many other animals which have played so important a part in the history of the world as have these lowly-organised creatures.'—Darwin, 1881.

See Darwin, *The Formation of Vegetable Mould through the action of Worms* (Lond. 1881); Vejdovsky, *System und Morphologie der Oligochæten* (Prague, 1844); Perrier, 'Lombriciens Terrestres,' *Nouv. Arch. Mus. Hist. Nat.* (Paris, viii. 1872); Beddard, *Monograph of the Oligochæta* (1895), and *Earthworms and their Allies.*

Ear-trumpet. See EAR.

Earwig, a general name for members of the family Forficulidæ, often ranked with cockroaches, &c., in the order Orthoptera, often kept in a special order Dermaptera. The body is elongate; the segments are imbricate; the hind-wings are folded in a very complicated way under the leathery fore-wings or tegmina, but wingless forms are common; there is a pair of forceps or callipers or the like at the posterior extremity of the body; the young form is very like the adult.

The common earwig (*Forficula auricularia*) is best known for the pincer-like organ at the end of the abdomen. This is sometimes used in defence, giving a slight nip; and it is also of service in packing up the hind-wings. The forceps are larger and more curved in the males. The hind pair of wings serve for rare flight; they are much larger than the firm front pair, and are folded when at rest in a complex way, not only like a fan, but also transversely. When folded up they are almost completely covered by the anterior pair. The shape of the expanded hind-wing is somewhat ear-like, and this has given origin to the improbable etymology which regards earwig as equivalent to earwing.

Common Earwig: *a* and *b*, young stages; *c*, adult with wings expanded.

Earwigs avoid the light, and do most of their work in the dark. They feed on decaying vegetable and animal matter, and sometimes nibble flowers to get at the nectar. They are given to seeking shelter in crevices, and are thus readily caught in artificial shelters provided for their destruction. They are very sensitive to tobacco smoke. In spite of their names—*earwig*, Ger. *Ohrwurm* ('ear-worm'), Fr. *Perce-oreille* ('pierce-ear'); the Armenian name also means 'ear-enterer'—they are not known to enter the ears of sleepers.

The eggs of the common species are laid in spring, fifteen to twenty, in some convenient cavity. These are carefully watched, and some naturalists have stated that the mother tends the newly hatched young as a hen her chicks.

The distribution of the common earwig is very wide, and the same is true of the order. The largest European species (*F. gigantea*) measures about an inch in length. A little earwig (*Labia minor*) is common in Britain and elsewhere, and may be often seen flying on warm summer afternoons. In the genus Chelidura the hind-wings are lost, and the front pair rudimentary. Labidura is another important genus.

Easdale, a small isle on the west coast of Argyllshire, in the Firth of Lorn, 16 miles SW. of Oban. It contains 1½ sq. m., and is separated from the much larger Seil Island by a channel 400 yards wide. It is noted for its great slate-quarries. The workings date from about 1630, and extend to a depth of 220 feet below sea-level.

Easel (Dut. *ezel*, 'an ass,' cf. clothes-*horse*), the wooden frame on which painters place pictures while at work upon them.

Easement. In English law, a person may have rights of several kinds in the land of another. He may have the right to take or receive part of the produce or profit of the land; this right is

called a Profit. He may have the right to use his neighbour's land for his own convenience (as e.g. by making use of a road over it, by laying out nets to dry upon it, &c.), and this kind of right is called a Positive Easement. Again, he may have the right to prevent his neighbour from making an inconvenient use of the land—e.g. the right to prevent him from erecting buildings which obstruct the light—and this kind of right is called a Negative Easement. An easement can only be enjoyed by an owner and occupier of land; the property in respect of which the right is enjoyed is called the dominant tenement; the property over which it is enjoyed is called the servient tenement. Profits and easements are both regarded as rights of property in land; they are 'incorporeal hereditaments.' Easements are of many kinds; they include rights of way, rights to water, light, and air, rights to support from neighbouring land, rights to transmit the vapours and noises of an offensive trade, &c. They are acquired by express or implied grant (as when a house is conveyed together with a right of way), and also by prescription and custom; they may be extinguished by express or implied release and in other ways. The period of enjoyment which gives a good title is for an easement 20 years and for a profit 40. The American law on this subject is in its general principles the same as the English. In Roman and Scots law, profits and easements are both included under the title of Servitudes (q.v.).

East (O.E. *éast*, cognate with Lat. *aurora*, 'dawn,' Gr. *aurion*, 'morning'; compare also *Easter*, *Austria*) is, vaguely speaking, that quarter of the horizon where the sun rises, or which a person with his face to the south has on his left hand. It is only at the equinoxes that the sun rises exactly in the east point. A line at right angles to the meridian of a place points exactly east and west. From very early times, the east has been invested with a certain sacred character, or at least held in higher respect than other points of the compass. It was the practice of many ancient pagans to fix their altar in the eastern part of their temples, so that they might sacrifice towards the rising sun (see SUN-WORSHIP). Contrariwise, in the temple of Jerusalem the Holy of Holies was at the western end; and hence it was customary for Jews in other parts of the world to turn towards the west in prayer. But the custom of praying towards the east was adopted by the early Christian church from at least the 2d century, as a symbol of Christ as the 'Sun of righteousness,' the 'Dayspring from on high,' and the 'Morning Star,' a reason assigned by Clement of Alexandria, who died about 220 (*Stromata*, vii.), and who is followed by Tertullian and St Athanasius. Accordingly, in the ancient baptismal forms, the candidate was made to face westward when renouncing the devil and his works, but then to turn round to the east in order to make his profession of faith in Christ; while, for a similar reason, the sanctuaries of Christian churches, wherein the altar stood, were built at the east end, a custom enjoined as early as the compilation of the *Apostolical Constitutions* (ii. 57). It was said, further, that Christ had been placed in the tomb with his feet towards the east, and that at the day of judgment he should come from the eastward in the heavens. From these various circumstances (see ORIENTATION) bowing to the east on uttering the name of Jesus, and burying with the feet to the east, were also introduced as customs in the church. The churches of the city of Rome do not conform generally to the principle of orientation, probably because some of the more important among them were originally secular buildings of the imperial times, and served as examples for subsequent erections. It is a curious instance of the inveteracy of popular custom, that in Scotland, where everything that savoured of ancient usage was set aside as popish by the reformers, the practice of burying with the feet to the east was maintained in the old churchyards, nor was it uncommon to set down churches with a scrupulous regard to east and west. In modern cemeteries in England, Scotland, and America, no attention appears to be paid to the old preference for burying with the feet to the east, the nature of the ground alone being considered in the disposition of graves.

The eastward position of the officiating priest at the prayer of consecration of the eucharist has been matter of much controversy in the Church of England. The High Church party interpret the rubric (1552) as allowing or enjoining that position (the consequence of which is that the celebrant has his back to the congregation); but the legality of the position, decided against in the Purchas case (1870), was again called in question in that of the Bishop of Lincoln (1889).

East Africa. See KENYA, TANGANYIKA, UGANDA, ZANZIBAR; for Portuguese East Africa, MOZAMBIQUE; and for Italian Somaliland, see ITALY, SOMALILAND.

East Anglia. See ANGLIA.

Eastbourne, a favourite Sussex watering-place, especially for the wealthier classes, in the Rape of Pevensey, nearly midway between Brighton and Hastings, and 66 miles S. of London. Roman remains bear witness to its antiquity, but nothing is known of its ancient history. In the Domesday Book it is called Borne (after the burn or stream which still flows there), and is stated to have been held by the Confessor at forty-six hides. The Conqueror bestowed it upon the Earl of Morton, and it subsequently passed through the Barons of Badlesmere and De Roos to the Manners family, and thence to Selwyns, Gildridges, and Burtons, from whom the Duke of Devonshire and C. Davies Gilbert inherited the manorial rights. The fine 12th-century church clearly belonged to a much more important place than the four groups of houses and cottages which, at a late period, constituted the fishing-hamlets of East-Borne, South-Borne, Meads, and Sea-Houses. The last third of the 19th century witnessed the growth of the modern watering-place, which now challenges comparison, in respect of its attractions to visitors and advantages to residents, with any of its south-coast rivals. Its air is singularly healthy, and on the hillside bracing. The death-rate is low. The close vicinity of the bold promontory of Beachy Head and the 'front-hills' of the South Downs affords unusual facilities for exercise, and the country is regularly hunted. The sea-front, defended by a redoubt and other obsolete fortifications, boasts a parade three miles long, laid out in spacious terraces in three tiers, bordered by creeping plants. The streets are broad and lined with trees. Devonshire Park has a winter garden and a concert hall. There are admirable golf links. Much of the improvement is due to the seventh Duke of Devonshire, but the town took an enterprising share, for which loans were incurred since 1864 to the amount of £173,000. The handsome town-hall was opened in 1886, the Free Library in 1896. The acreage of Eastbourne borough is 6474; the population in 1821 was but 2007; in 1861, 5795; in 1891, 34,977; in 1911, 52,542; and in 1921, 62,030. Eastbourne was incorporated a borough in 1883. By an Act of Parliament of 1910 Eastbourne became a county borough in 1911, with a greatly extended area, a portion of Willingdon parish being absorbed.

East Cape, the name of the south-eastern extremity of New Guinea, in Goschen Strait, and of the most easterly headlands of Madagascar, the North Island of New Zealand, and Siberia. The last, on Behring Strait, and in 169° 38′ W. long., is the easternmost extremity of Asia, and is a bold, rocky promontory of syenite, almost cut off from the mainland by swamps and lakes.

East Chicago, a city and port of Indiana, on Lake Michigan, practically part of Chicago, has iron and steel manufactures; pop. 36,000.

Easter (Ger. *ostern*, Fr. *pâques*, Scot. *pasch*, from Gr. *pascha*, 'the passover'), the festival of the resurrection of Jesus Christ, derives probably its name from Eastre, an English spring (and dawn) goddess, whose festival was kept at the vernal equinox. In the ancient church, the celebration of Easter lasted an octave (eight days). After the 11th century, however, it was limited to three, and in later times, generally to two days. It was formerly the favourite time for performing the rite of baptism. The courts of justice were closed, and alms dispensed to the poor and needy, who were even feasted in the churches—a custom which led to much disorder. Slaves also received their freedom at that season; and as the austerities of Lent were over, the people gave themselves up to enjoyment; hence the day was called the 'Sunday of joy' (*Dominica gaudii*). In the East it is still known as the 'Bright Day,' and in Bohemia it is designated the 'Great Night.' To the popular sports and dances were added farcical exhibitions, in which even the clergy joined in some places, reciting from the pulpits stories and legends, with a view to stir the hearers to laughter (*risus paschalis*). Against this indecency the Reformers of the 16th century loudly and successfully raised their voices. During the whole week before Easter—i.e. in the interval between Palm Sunday and the beginning of the Easter festival—daily services were held (see HOLY WEEK, and GOOD FRIDAY).

On Easter Day, the people saluted each other with the Easter kiss, and the exclamation *Surrexit* ('He is risen'); to which the reply was *Vere surrexit* ('He is risen indeed')—a custom still retained in the Greek Church. Thus, in Russia, at the time of salutation, red eggs are exchanged, and cage-birds are let loose, as emblematical of that liberty which is consecrated by the Easter solemnities. The chief solemnity has always consisted of the celebration of the Lord's Supper; and Easter is the one time in the year at which, by the Fourth Lateran Council, Roman Catholics must communicate.

The proper time for the celebration of Easter has occasioned no little controversy. In the 2d century a dispute arose on this point between the Eastern and Western Churches. The great mass of the Eastern Christians celebrated Easter on the 14th day of the first Jewish month or moon, considering it to be equivalent to the Jewish Passover. The Western churches kept it on the Sunday after the 14th day, holding that it was the commemoration of the resurrection of Jesus. The Council of Nice (325 A.D.) decided in favour of the Western usage, branding the Eastern usage with the name of the 'quartodeciman' heresy. This, however, only settled the point that Easter was to be held, not upon a certain day of the month or moon, but on a Sunday. The proper astronomical cycle for calculating the occurrence of the Easter moon was not determined by this council. It appears, however, that the Metonic cycle was already in use in the West for this purpose; though great discrepancies obtained as late as 541; and the British churches clung closely to an old cycle of eighty-four years, originally adopted from the Roman Church. The controversy as to the celebration of Easter in England was practically authoritatively settled by the adoption of the Roman usage at the Council of Whitby in 664, Wilfrid being the spokesman of the victorious party, Colman the defender of the traditional Celtic usage. It was on the metonic cycle that the Gregorian Calendar, introduced in 1582, was arranged. The method on which this calendar is constructed is too complex for description here. An elaborate account of the whole matter was published by Professor De Morgan in the *Companion to the British Almanac* in 1845. The time of Easter, being the most ancient and important of all the movable feasts of the Christian church, determines all the rest. It was debated, at the time of the introduction of the Gregorian Calendar, whether Easter should continue to be movable, or whether a fixed Sunday, after the 21st of March, should not be adopted. It was deference to ancient custom that led the ecclesiastical authorities to adhere to the method of determination by the moon. It must be remembered, however, that it is not the actual moon in the heavens, nor even the mean moon of astronomers, that regulates the time of Easter, but an altogether imaginary moon, whose periods are so contrived that the new (calendar) moon nearly always follows the real moon (sometimes by two days). The effect of this is, that the 14th of the calendar moon—which had, from the times of Moses, been considered 'full moon' for ecclesiastical purposes—falls generally on the 15th or 16th of the real moon, and thus as a rule after the real full moon, which is generally on the 14th or 15th day. With this explanation, then, of what is meant by 'full moon'—viz. that it is the 14th day of the calendar moon—the rule is, that Easter Day is always the first Sunday after the paschal full moon—i.e. the full moon which happens upon or next after the 21st of March (the beginning of the ecclesiastical year); and if the full moon happens upon a Sunday, Easter Day is the Sunday after. For any given year, the day on which the paschal full moon falls, and then Easter Day, are found by the following table and rule:

Days of the Month.	Dom. Letter.	Golden Number.	Days of the Month.	Dom. Letter.	Golden Number.
March 21	C	14	April 9	A	15
" 22	D	3	" 10	B	4
" 23	E	..	" 11	C	..
" 24	F	11	" 12	D	12
" 25	G	..	" 13	E	1
" 26	A	19	" 14	F	..
" 27	B	8	" 15	G	9
" 28	C	..	" 16	A	..
" 29	D	16	" 17	B	17
" 30	E	5	" 18	C	6
" 31	F	..	" 19	D	..
April 1	G	13	" 20	E	..
" 2	A	2	" 21	F	..
" 3	B	..	" 22	G	..
" 4	C	10	" 23	A	..
" 5	D	..	" 24	B	..
" 6	E	18	" 25	C	..
" 7	F	7			
" 8	G	..			

First ascertain the Dominical Letter (q.v.)—taking the second, where there are two—and the Golden Number (q.v.); look for the golden number in the third column of the table, and opposite to it stands the day of the full moon; then look for the dominical letter, next after the day of full moon, and the day standing opposite the dominical letter is Easter Day. It sometimes happens that Easter Day, as thus determined, is different from what it would be if by 'full moon' were understood the astronomical full moon. Thus, in 1818 Easter Day, by the calendar, fell, and was celebrated on the 22d of March, the earliest

possible day, although the full moon was on that day; and in 1845 it again fell on the day of the actual full moon (the 23d March).

One object in arranging the calendar moon was that Easter might never fall on the same day as the Jewish Passover. They did occur together, however, in 1805 on the 14th of April; in 1825 on the 3d of April; in 1903 on the 12th of April; in 1923 on the 1st of April; and will do so again in 1927 on the 17th April; and in 1981 on the 19th April. The Jewish festival usually occurs in Passion-week, and never before the 26th of March or after the 25th of April (new style). On the other hand, the Christian festival is never before the 22d of March, or after the 25th of April. In 1761 and 1818 Easter fell on the 22d of March, a date which will not recur before the end of the 20th century. In 1913 it fell on the 23d of March, as it did in 1845 and 1856. The latest Easters in the 19th and the 20th century occur in 1886 and 1943 on the 25th of April. In 1848 Easter fell on the 23d of April; and in 1859, on the 24th of April. A fixed date for Easter is among the ends that have been proposed in various plans for the reform of the calendar. A bill for this purpose, for instance, was introduced in the British parliament in 1921. In 1923 a congress of the Orthodox Churches at Constantinople adopted the Gregorian calendar, and passed a resolution in favour of keeping Easter upon the first Sunday after the first full moon after the equinox—full moon and equinox both being reckoned by astronomical tables. Many Anglicans favour the second Sunday in April.

Popular Observances.—Many of the popular observances connected with Easter are clearly of pagan origin, and traceable to the feast of the goddess 'Éastre;' the Old English name of April having been Éaster-mónath, which still survives in the German Ostermonath. The worship of this deity, introduced into England by the Saxons, continued to be celebrated in many parts in the north of Germany down to the beginning of the 19th century by the kindling of bonfires and numerous other rites (see BELTANE). Like the May observances of England, it was especially a festival of joy. With her usual policy, the church endeavoured to give a Christian significance to such of the rites as could not be rooted out; and in this case the conversion was particularly easy. Joy at the rising of the natural sun, and at the awaking of nature from the death of winter, became joy at the rising of the Sun of Righteousness—at the resurrection of Christ from the grave. The bonfires can be traced in the great 'paschal tapers,' or 'Easter candles,' sometimes weighing 300 lb., with which the churches were lighted on Easter Eve. In the ancient church disbursements of St Mary-at-Hill, in the city of London, there is even an entry 'for a quarter of coles for the hallowed fire on Easter Eve, 6d.'

The Easter offerings or dues are 'customary sums' which from time immemorial have been paid, and are recoverable as small tithes before the justices of the peace.

One of the most popular features of Easter was the Pasch or Easter egg, an old emblem of the resurrection; although the egg, as symbolical of renewed life, may be traced back to a very primitive period. De Gebelin has connected it with the ancient Egyptians, Persians, Greeks, and Romans; and Schwartz says it was customary among the Parsees to distribute red eggs at their spring festival. In Germany, instead of the Easter egg, is presented an emblematical print, in which three hens are holding a basket wherein are three eggs; whereas in Vienna the Easter egg is composed of silver, mother-of-pearl, or bronze, and filled with knick-knacks of some kind. Formerly in this country the Easter egg was solemnly blessed by the priest, and being elaborately coloured, was often kept as an amulet. Most of the old customs and superstitions associated with the Easter festival have fallen into disuse, but as a holiday season its popularity is not likely to decrease. Easter cards are greetings like Christmas (q.v.) cards. For the Easter term, see TERM.

Easter Island, a lonely Pacific islet in 27° 8′ S. lat., and 109° 24′ W. long. Discovered by Roggeveen on Easter Day 1722, and visited in 1773 by Captain Cook, it is 47 sq. m. in area; is entirely volcanic, with many extinct craters rising more than 1000 feet; and is fertile, but badly off for water. Sheep and cattle grazing was started by a French house in Tahiti, after the departure in 1878 of the missionaries, with 300 natives, for the Gambian Archipelago, 500 having been shipped to Tahiti four years earlier. The natives still left are fair Polynesians, with some Melanesian characteristics; since 1860 they have dwindled from 3000 to 220, as well from polyandry as from emigration. They have little to say as to the origin of the picturesque remains that

Stone Statues on the side of the Volcano Ronororaka, Easter Island.

have made Easter Island famous. These include over 500 rude stone statues or busts, varying from 3 feet high to 70. There are besides 100 stone houses, with painted interiors and (undeciphered) incised tablets. Most of the natives were carried off in 1863 by the Peruvians to work guano. The island has been, since 1888, a Chilean possession. See Thomson, *Report to the U.S. National Museum* (1892); Churchill, *Easter Island* (1912); Mrs Routledge, *Mystery of Easter Island* (1919); J. M. Brown, *The Riddle of the Pacific* (1924).

Eastern Church. See GREEK CHURCH.

Eastern Empire. See BYZANTINE EMPIRE.

Eastern Question is the name given primarily to the problem what is to become of the east of Europe—specifically, the area of Europe now or lately under the authority of the Turks. In the 18th century the western European powers were jealous of Russia and Austria in their wars with Turkey, and sympathised more or less openly with the Turks. England supported Turkey against Bonaparte in Egypt in 1798. The question was from time to time raised by Russia's claim to be the protector of the Christian populations in the Turkish area, which till 1878 comprised more or less directly Rumanians, Serbs, Greeks (of Macedonia, &c.), and Bulgarians; as also by Russia's aim to be regarded and treated as the heir-in-chief of the 'sick man.' The question became acute in 1854, and the Crimean War (q.v.) was an attempt to solve or shelve it, France supporting England in the

struggle to maintain the *status quo*. The Russo-Turkish war in 1877–78, the Berlin Congress of 1878, the Italo-Turkish war, the Balkan wars of 1912–13, the various conferences and treaties connected with them, were chapters in the history of the question. Sometimes the question has been practically how to prevent the undue aggrandisement of Russia, especially as against England; and Asia Minor, Persia, Turkestan, Afghanistan, even Egypt and India, have come within the sphere of this complicated and formidable question, and not merely the Balkan Peninsula. At last Russia's designs upon Constantinople, Germany's 'Drang nach Osten,' France's ambitions in Syria, Italy's in Anatolia, Britain's solicitude about India; Armenian, Arab, Egyptian, Indian, and Balkan nationalism, were merged in the greater complex of the European war and its political sequelæ.—Of late 'the Far-Eastern Question' includes China and Japan, and the rivalries of European powers in these regions.

See BALKAN PENINSULA, RUSSIA, TURKEY, &c.

Eastern Rumelia. See BULGARIA.

East Ham. See HAM.

Eastham, a township and parish of Cheshire, on the Mersey, 6½ miles SE. of Birkenhead, near the seaward end of the Manchester Ship Canal.

East India Army. When the East India Company (q.v.) first sent factors or agents to India, an army was not thought of. Military forces arose out of the exigencies of the times, and at first included adventurers, convicts, and deserters from European armies. Gradually organisation was introduced, and as the power of the Company increased, natives entered the service, until at length most of the troops were Hindus or Mohammedans, drilled by non-commissioned officers sent out from England. A few regiments were raised in England, a much larger number in India; but all alike were officered by the Company's English officers. Before the outbreak of the Mutiny the forces in the pay of the Company comprised about 280,000 men, including 180,000 native regulars, and 60,000 native irregular horse; and these troops formed three distinct armies, one for each presidency, and each with its own commander-in-chief, although the commander-in-chief in Bengal exercised authority over the other two, an arrangement maintained under the later organisation till 1893. To what extent this fine force melted away during 1857 and the two following years is described under INDIA. Under the Act of 1858 the army also was transferred to the crown, the government, to prevent a threatened disturbance, allowing such as chose to retire. As the Sikhs had behaved well, most of the regiments from the Punjab were retained, as well as most of the native regiments in the Bombay and Madras presidencies; but it was not deemed expedient to restore the native regiments of Bengal proper which had proved so treacherous.

The strength of the British forces *lent* to India is annually fixed in the army estimates laid before parliament, and comprises about 80,000 officers and men. The Indian army numbers about 160,000, of whom the infantry exceed 120,000, and the cavalry amount to about 25,000, so that the total military force of India may be stated at 220,000 (see ARMY). These figures are exclusive of the armies maintained by the feudatory or independent states; their total strength is estimated at 350,000 men. During the Eastern crisis a force of native Indian troops was sent to Malta; and in the Egyptian war of 1882 and the European war of 1914 Indian troops fought with distinction along with their English fellow-subjects.

East India Company. The establishment of an East Indian trade dates from the time when the Portuguese navigator, Vasco da Gama, having effected the eastern passage to India by doubling the Cape of Good Hope, cast anchor off the city of Calicut on the 20th May 1498. The Portuguese, however, never actually founded a trading company; their admirals were the king's officers, whose efforts were directed rather towards the conquest and conversion of the eastern races than to mere commerce, except as a royal monopoly. Nevertheless they were supreme in the seas they had opened from 1500 to 1600, and dispensed the treasures of all the islands of the East, from Goa to Celebes, and as far northward as Japan; for it was on the islands that the Europeans, one and all, first gained a permanent footing. In the next century their place was rapidly taken by the Dutch, whose first vessel had rounded the Cape only in 1596, and whose East India Company was founded in 1602. The earliest incorporated East India Company was the English, to which Queen Elizabeth granted a charter on the last day of the 16th century (31st December 1600), under the title of 'The Governor and Company of Merchants of London trading to the East Indies.' Two later companies, after a short period of competition, united with the original association; and in 1709 its last and most formidable rival, the English Company (1698), was amalgamated with the London Company, under the style of 'The United Company of Merchants of England trading to the East Indies.' About 1624 the English were compelled by the Dutch to withdraw nearly all their factories from the archipelago, and, shut out from the trade of the islands, they began to found settlements on the coast of the Indian peninsula. The nucleus of Madras dates from 1639; Bombay came to the Company in 1668; Calcutta was founded in 1686; finally, in 1689 the Company passed the resolution to acquire territorial sway, to 'make us a nation in India,' which was to change its factors and clerks into governors and conquerors. The old Company's charter, granting exclusive trading rights in the Indian and Pacific oceans, had been renewed from time to time, with various modifications, though not without much contention and difficulty; and these exclusive privileges were extended, in consideration of sundry loans to the government aggregating £3,200,000, to the united Company, whose constitution thus established was maintained with little alteration as long as the Company existed. Every shareholder who held £500 of the Company's stock became a member of the Court of Proprietors, which annually chose twenty-four to form a Court of Directors from those of their number who held not less than £2000 of stock. Six of the directors went out of office every year; they retired in rotation, so that each had four years of office. It was a general custom with the proprietors to elect the same persons as directors over and over again. Theoretically, the constitution of the Company was very democratic, but practically the affairs were in the hands of the directors; for the proprietors took little other interest than in receiving their half-yearly dividends. The proprietors had from one to four votes each, according to the amount of stock held by them. The Board of Control, of later formation (1784), bore relation to the governmental affairs of India.

Properly speaking, the Company were only merchants: sending out bullion, lead, quicksilver, woollens, hardware, and other goods to India; and bringing home calicoes, silk, diamonds, tea, porcelain, pepper, drugs, saltpetre, &c. from thence. Not merely with India, but with China and other parts of the East, the trade was monopolised by the Company; and hence arose their great trade in China tea, porcelain, and silk. Until Clive's day, however, paltry and insufficient salaries were paid

to the servants of 'John Company,' who were permitted to supplement their income by every means in their power—to 'shake the pagoda tree.' By degrees avarice and ambition led the Company, or their agents in India, to take part in the quarrels among the native princes; this gave them power and influence at the native courts, and hence arose the acquisition of sovereign powers over vast regions. India thus became valued by the Company not only as commercially profitable, but as affording to the kinsfolk and friends of the directors opportunities of making vast fortunes by political or military enterprises. It is not the purpose of the present article to trace the political affairs of the Company, or the rise of a British empire in India; that will be done under INDIA.

In 1744 the Company obtained a renewal of their charter till 1780, but not without a loan of £1,000,000 to government; for the monopoly was distasteful to the nation at large. France, too, had an East India Company (six had been established between 1604 and 1719), and the struggles between the two companies for power in the southern part of India led to constant warfare between them during the 18th century. Other loans to government were the means of obtaining further renewals of the charter in later years. In 1833 the legislature took away all the *trading* privileges of the Company. The dividends to proprietors of East India stock were thenceforward to be paid out of taxes imposed by the Company on the people of India, in such provinces as were under British dominion. From that year the Company's powers became anomalous; the Company could not *trade*, and could not *govern* without the sanction and continued interference of the imperial government. The wars in India since that year have been waged by Britain as a nation, rather than by the Company; and Britain practically, though not nominally, became responsible for the enormous cost of those wars. In 1853 the charter was renewed for the last time, for an indefinite term of years, but with a further lessening of the power of the Company, and an increase of that of the crown; patronage also was abolished.

After the Mutiny the Company was forced, in spite of a strenuous resistance, to cede its powers in 1858 to the crown, under an act for the better government of India. Most of the distinguished men, military and political, till then in the Company's service, accepted office under the crown, to assist the government by their general knowledge of Indian affairs. These affairs are now managed by a Secretary of State for India. The East India House (1726) was demolished in 1862; and Haileybury (q.v.), the East India college since 1806, was closed in 1858.

See Sir John W. Kaye, *The Administration of the East India Company* (1853); J. T. Wheeler, *India under British Rule* (1886); Danvers' *Records of the E.I.C.* (1896 *et seq.*); Beckles Willson, *Ledger and Sword* (1903); and other books cited under INDIA.

East Indies, as distinguished from *West Indies*, include not merely the two great peninsulas of Southern Asia, but likewise all the adjacent islands from the delta of the Indus to the northern extremity of the Philippines (see INDIA). For the Dutch East Indies, called sometimes *Insulinde*, see HOLLAND.

Eastlake, SIR CHARLES LOCK, President of the Royal Academy, was born at Plymouth in 1793, and studied in London and Paris. When the *Bellerophon*, with Napoleon on board, appeared in the port of Plymouth, Eastlake profited by the opportunity, and produced, from a number of rapid sketches taken in a shore-boat, two full-length portraits of the emperor. From 1816 to 1830 he made his home in Rome, where he executed the 'banditti' pictures that first attracted attention to him in England. In this period also he exhibited 'Isidas the Spartan,' 'Pilgrims in sight of Rome,' and 'Byron's Dream.' In 1827 he was elected an Associate, and in 1830 a full member of the Royal Academy. In 1839 appeared 'Christ blessing little Children,' and in 1841 his great work, 'Christ weeping over Jerusalem,' now in the National Gallery. In 1850 he was elected President of the Royal Academy, and received the honour of knighthood. In 1855 he was appointed Director of the National Gallery, in which capacity his services were as valuable as they were unsparingly given; and it was during one of his journeys in search of pictures for the national collection that he died at Pisa, 14th December 1865. Eastlake became an eminent art authority, and published *Materials for the History of Oil Painting* (1847); translated Goethe's *Theory of Colours* (1840); and prepared valuable papers, collected in *Contributions to the Literature of the Fine Arts* (1848 and 1870). To the second series a Memoir is prefixed by Lady Eastlake (Elizabeth Rigby, of Norwich, 1810–93), the authoress of *Letters from the Baltic*, and the venomous reviewer of *Jane Eyre* in the *Quarterly*. (See her own *Journals*, 1896.) Eastlake was F.R.S., D.C.L. of Oxford, and a Chevalier of the Legion of Honour.

East Liverpool, a city of Ohio, on the Ohio River, 32 miles WNW. of Pittsburg, with extensive potteries, steel and rubber works; pop. 21,000.

East London, a South African seaport, at the mouth of the Buffalo River, 36 miles SE. of King Williamstown, and 700 miles E. of Capetown, with a large export and import trade. It is the terminus of a railway to the interior. Harbour works have been erected to protect the formerly exposed anchorage. Pop. 30,000. The division of East London, with an area of 1225 sq. m., was formed from part of British Kaffraria in 1866.

East Lothian. See HADDINGTONSHIRE, LOTHIAN.

East Main, the name formerly given to a region of Canada, also known for a time as Ungava. It occupies all the peninsula of Labrador (q.v.) except the southern portion, from which it is divided by the East Main and Hamilton rivers, and the eastern coast strip belonging to the Newfoundland territory of Labrador (see map at article CANADA). Its area is estimated at about 456,000 sq. m. It was transferred in 1912 from the North-West Provinces to Quebec.

Easton, capital of Northampton county, Pennsylvania, stands in the fork between the Delaware and Lehigh rivers, 52 miles N. of Philadelphia. A number of railways and canals meet here, and the town has considerable trade, and manufactures silks, wire, flour, &c. Easton is the seat of Lafayette (Presbyterian) College (1832). Pop. 34,000.

East Orange, a city of Essex county, New Jersey, inhabited by New York and Newark business men, manufactures electrical apparatus; pop. 51,000.

East Providence, a town of Rhode Island, separated from Providence by the Blackstone River; pop. 22,000.

East River, the strait between Long Island Sound and New York Harbour, separating the New York boroughs of Brooklyn and Queens from Manhattan and the Bronx. It is about 10 miles long, and ½ mile wide at the narrowest point, and is navigable by the largest ships.

East Saginaw (now 'Saginaw East Side'), the former name of that portion of Saginaw

lying east of the Saginaw River, incorporated with Saginaw (q.v.) in 1890.

East St Louis, a city of Illinois, connected with St Louis, Missouri, by a grand steel bridge over the Mississippi. It is an important railway terminus, contains Catholic and Baptist colleges, manufactures iron goods, soda, and glass, and has huge stockyards. Pop. (1890) 15,190; (1900) 29,655; (1910) 58,547; (1920) 66,767.

Eastwick, Edward Backhouse, English Orientalist and diplomatist, was born at Warfield, in Berkshire, on 13th March 1814, and educated at the Charterhouse and Oxford. Proceeding to India as a cadet of the East India Company in 1836, he was soon chosen to fill political offices in Kathiawar and Sind. From 1845 to 1859 he was professor of Hindustani at Haileybury College, and in the latter year was appointed assistant political secretary in the India Office. He then spent three years (1860–63) as secretary of legation in Persia. He died at Ventnor, Isle of Wight, 16th July 1883. His best works are translations from the Persian (Saadi's *Gulistan*, 1852; *Arrival of the Parsees in India*, 1845; *Life of Zoroaster*, 1843; and *Anvar-i Suhaili*, 1854); a *Hindustani Grammar* (1847; 2d ed. 1858); *Journal of a Diplomate in Persia* (1864); and *Kaisar-nama-i-Hind* or *Lay of the Empress* (1878–82). He also translated into English Bopp's *Comparative Grammar* (1856) and Schiller's *Revolt of the Netherlands* (1844).

Eau Claire, capital of Eau Claire county, Wisconsin, at the mouth of the Eau Claire River, and at the head of navigation on the Chippewa River, 183 miles NW. of Madison by rail. It has a vast trade in lumber, and contains numerous saw-mills, besides planing-mills, grist-mills, foundries, and machine-shops. Pop. (1870) 2293; (1880) 10,119; (1900) 17,517; (1920) 20,906.

Eau Créole, a very fine liqueur, made in Martinique, by distilling the flowers of the Mammee Apple (*Mammea americana*) with spirit of wine.

Eau de Cologne, a celebrated perfume, the reputed inventor of which is Johann Maria Farina (1685–1766), a native of Piedmont, who settled in Cologne in 1709, though his claim to be the inventor is not undisputed. The secret of the process of its manufacture is claimed by from thirty to forty firms, bearing the name of Farina, now existing in Cologne. The recipe is said to be twelve drops of each of the essential oils neroli, citron, bergamot, orange, and rosemary, along with one drachm of Malabar cardamoms and one gallon of rectified spirit. The whole is distilled together, and the condensed liquid constitutes Eau de Cologne. In Great Britain, where chemists and others make an article little, if at all, inferior to the imported one, the oils are usually mixed with a highly purified spirit, and the subsequent distillation dispensed with.

Eau de Vie. See Brandy.

Eaux Bonnes, a watering-place of France, in the department of Basses-Pyrénées, is situated in a narrow gorge of the Pyrenees, at an altitude of 2454 feet, and 29 miles S. of Pau. Pop. 500, with 6000 to 10,000 visitors in the season (July to August). The springs, both hot and cold, the former with a temperature ranging from 53° to 91° F., contain sulphur and sodium; the water is used for disorders of the chest and respiratory organs.

Eaux Chaudes, a watering-place of France, 27 miles S. by W. of Pau, situated in a narrow Pyrenean valley, 2215 feet above sea-level. Its waters, which are sulphurous, and range in temperature from 50° to 93° F., are useful in cases of catarrh and rheumatism, also for skin-diseases.

Eavesdrip, an ancient Saxon custom, corresponding to the well-known urban servitude of the Romans called stillicide (*stillicidium*), where a proprietor was not allowed to build to the extremity of his estate, but must leave a space regulated by the charter by which the property was held, so as not to throw the eaves-drop on the land of his neighbour.

Eaves-droppers 'are such as listen under walls or windows, or the eaves of houses, to hearken after discourse, and thereupon to frame slanderous or mischievous tales' (Blackstone). Such persons are, by the law of England, regarded as common nuisances, and are punishable by fine.

Ebal. See Gerizim.

Ebb and Flow. See Tides.

Ebbsfleet. See Ramsgate.

Ebbw Vale, an urban district in the north-west corner of Monmouthshire, 21 miles NNW. of Newport, lies in the middle of a rich iron and coal district. Pop. 35,000.

Ebenaceæ, an order of dicotyledonous trees and shrubs allied to Sapotaceæ. About 250 species are known, mostly tropical, of which many furnish hard and durable timber (see Ebony); several are natives of the United States. The fruits are often edible. See Date Plum.

Ebenezer (Heb. 'stone of help'), a monument raised by Samuel after his victory over the Philistines, was assumed by early Christian hermits to be at a place now called Deiraban, near the western border of Judah. But the site is not really known.

Eberhard, August Gottlob, a well-known German writer, was born at Belzig in 1769, studied first theology at Leipzig, then devoted himself to a busy life as a man of letters at Halle, Hamburg, and lastly at Dresden, where he died, 13th May 1845. Eberhard's literary reputation depends upon his *Hannchen und die Küchlein* (1822), an idyl which has been translated into many languages, and is still popular, and his long poem in hexameters, *Der Erste Mensch und die Erde* (1828). His collected works fill 20 vols. (1830–31).

Eberhard, Johann August, philosophical writer, was born at Halberstadt, 31st August 1739; studied theology at Halle, and after some years preaching in Berlin and Charlottenburg, became professor of Philosophy at Halle in 1778. He died 6th January 1809. Eberhard's first work was his *Neue Apologie des Socrates* (1772), an able and outspoken book, in which the rights of common sense are vindicated against the assumptions of a narrow theology. Among his numerous books may be mentioned, *Sittenlehre der Vernunft* (1781), and *Versuch einer allgemeinen Deutschen Synonymik* (6 vols. 1795–1802), a work which was enriched and improved by Maas (12 vols. 1818–21), and again by Gruber (6 vols. 1826–30). Towards the close of his life, Eberhard vainly strove to controvert the metaphysics of Kant by vindicating the earlier theories of Leibniz and Wolf.

Ebers, Georg Moritz, a distinguished Egyptologist and novelist, was born 1st March 1837, at Berlin, was educated at Froebel's school, and studied law at Göttingen. He afterwards devoted himself to the study of Egyptology at Berlin, in pursuit of which he visited the chief museums of Europe. He established himself in 1865 as a lecturer at Jena, where in 1868 he was made professor. Next year he made a long journey to the East, and in 1870 was called to Leipzig as professor of Egyptology. His visit to Egypt had resulted in the discovery of the celebrated hieratic medical *Papyrus Ebers*, which he published in 1875. His most important work besides this is *Aegypten und*

die Bücher Moses (vol. i., all published, 1868). His interesting and picturesque, if slight, *Durch Gosen zum Sinai*, and *Aegypten in Bild und Wort*, have been translated into English. In 1876 he became paralysed, and necessary inaction induced him to continue the writing of historical novels, begun in 1864 with his *Egyptian Princess*, in which a good plot is made the foundation for much Egyptological learning. Ill-health compelled him to resign his post, and he lived mainly in Munich. He died 7th August 1898. See his *Story of my Life* (trans. 1893), and a work by Gosche (1887).

Eberswalde, an industrial town of Prussia, 28 miles NE. of Berlin by rail, with manufactures of nails, felt, &c.; pop. 27,000.

Ebert, FRIEDRICH (1870–1925), first president of the German republic, was born in Heidelberg, a tailor's son. He became a saddler, a social democrat journalist, in 1912 a member of the Reichstag, and in 1913 chairman of his party. In the revolution of 1918 he was a majority socialist leader. He was elected president by the National Assembly in February 1919. In 1922 his term was extended to 1925 by agreement of parties in the Reichstag.

Ebert, KARL EGON, a Bohemian poet, was born at Prague in 1801, was for many years a librarian at Donaueschingen, and died at Prague, 24th October 1882. His poems include lyrics, epics, tragedies, and dramas from Bohemian history, and collected fill 7 volumes (Prague, 1877).

Ebionites (Heb. *ebion*, 'poor'), a term applied probably at the beginning of the Christian church to all Christians, afterwards the general name by which all Jewish Christians who remained outside the Catholic Church were designated after the apostolic age down to the time of Jerome. The name was, doubtless, derived in part from the poverty of the early community at Jerusalem, partly from the close connection between poverty and piety dwelt on in the Psalms and Prophets and by Christ himself. A distinction between the Ebionites and Nazarenes, indicated by Justin and Origen, and first clearly made by Jerome, has been carefully drawn out by Bishop Lightfoot in the dissertation on 'St Paul and the Three' in his commentary on Galatians (6th ed. Lond. 1880); but Harnack holds that the Judaising Christians, though of many shades, were not divided into two distinct parties, and were not originally distinguished from the 'Great Church' by differences of 'doctrine,' but only in the forms of their religious life, while they had the following ing points of controversy among themselves: (1) Whether the observance of the law was a necessary condition of the reception of the Messianic salvation; (2) whether it was to be insisted on in the case of Christians born in heathenism, before they could recognise them as Christians; (3) whether, and in how far, they ought to hold fellowship with Gentile Christians, who did not keep the law; (4) whether Paul had been an elect servant of God, or an intruder hateful to God; (5) whether Jesus was a son of Joseph, or miraculously conceived by the power of the Holy Ghost. Their Gospel was some form of that known as the *Gospel to the Hebrews*. On the foundation of earlier Ebionite writings arose the Pseudo-Clementines, which must be used with great caution as evidence of the tendencies and inner history of syncretistic Jewish Christianity, as it is not till the 3d century that acquaintance with them is clearly traceable in the literature of the church. Hippolytus and Origen (in Eusebius) describe a kindred Syrian variety of Jewish Christians, who from their sacred book, supposed to have fallen from heaven, called themselves *el kesi* ('hidden power'), and are hence distinguished as Elkesaïtes. In the time of Epiphanius, who calls them 'Ebionites,' they were in large numbers in the Dead Sea district. To them Jesus was merely a prophet, whose teaching had been completed by a succeeding prophet, and by a new revelation, which seems to have been a confused mixture of Christian, Essene, and heathen elements. Their characteristic tenets reappear in Mohammedanism.

See Harnack's *History of Dogma*, vol. i.; Schürer's *Jewish People*; and the article in Herzog-Hauck.

Eblis. See DEMONOLOGY.

Eboli (ancient *Eburi*), a town of Italy, 49 miles SE. of Naples by rail; pop. 13,000.

Ebonite. See VULCANITE.

Ebony (Lat. *ebenum*), a wood remarkable for its hardness, heaviness, and deep black colour, is the heart-wood of different species of Diospyros (order Ebenaceæ), the genus of the Date Plum (q.v.) and other fruits. The best ebony is the produce of *D. ebenum*, a large tree of India and Ceylon; but a number of species or varieties are also of value; others present variations in colour, density, and durability, and acquire different names —e.g. *D. hirsuta* of Ceylon is Calamander Wood (q.v.), and *D. lotus* (see LOTUS) is Green Ebony. Part of the true ebony of commerce is furnished by the closely allied *Maba ebenus* of the Moluccas. The African ebony of the Cape is from species of Euclea. The Texas Persimmon (*D. texana*) affords a small amount of excellent ebony. Of unrelated forms may be mentioned *Jacaranda brasiliana* (Bignoniaceæ), Blue Ebony, Jacaranda or Palisander Wood (see ROSEWOOD). Several leguminous trees also share the name, notably *Ebenus cretica*, which yields the red or brown ebony of Crete, *Dalbergia melanoxylon*, ebony of Senegal, and *Brya* (*Pterocarpus*) *ebenus*, West Indian ebony, false or green ebony. German ebony is simply yew-wood stained, and other imitations are current (see TIMBER, VENEER). Ebony is chiefly used by cabinetmakers for veneering. The ancient Greeks and Romans are thought to have obtained it either from India or Madagascar. They frequently inlaid it with ivory, for contrast of colour. It is mentioned by Ezekiel (xxvii. 15) as an article of Tyrian commerce. It was at one time used in medicine.

Eboracum. See YORK.

Ebro (Lat. *Hibērus*), a river of Spain, rising at an altitude of 2778 feet, in the province of Santander, within 20 miles of the Bay of Biscay. Thence it flows 442 miles south-eastward past Frias, Miranda, Haro, Logroño, Tudela, Zaragoza, Mequinenza, Mora, and Tortosa, till it falls into the Mediterranean. Its basin comprises 38,580 sq. miles. The mouth is choked up with sand, but a canal called the San Carlos has been carried through the delta. Affluents are the Najerilla, Jiloca, and Guadalope from the right, and the Aragon, Gallego, and Segre from the left. The Ebro runs chiefly through narrow and sometimes rocky valleys, and its course is obstructed by many shoals and rapids. This is partly remedied, however, by Charles V.'s Imperial Canal, which extends from Tudela to 40 miles below Zaragoza.

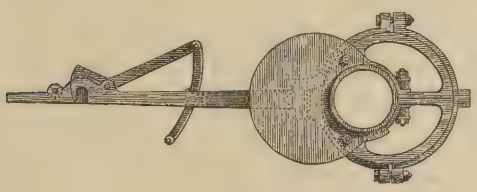
Écarté, a game played with thirty-two cards (all cards from the two to the six being removed from the pack). It is played by two persons. The player cutting the lowest écarté card deals. King is highest, then queen, knave, ace, ten, nine, eight, seven. The dealer gives five cards to each player, by three at a time and by two at a time, or *vice versâ*, and turns up the eleventh card for trumps. If the turn-up card is a king, the dealer marks one; if the king of trumps is in either hand, the holder marks one. If the non-dealer is not satisfied with his hand, he may *propose* to discard. The dealer

may either *accept* or *refuse*. If he accepts, each player discards as many cards as he pleases, an equivalent number of cards being dealt from the stock. After taking cards, the non-dealer may propose again, and the dealer may again accept or refuse. The hand is next played (the king, if in hand, being first marked). The highest card of the suit led wins the trick; trumps win other suits. The second player must win the trick if he can. Three tricks count one; five tricks count two. If the non-dealer plays without proposing, and fails to make three tricks, or if the dealer refuses the first proposal and fails to make three tricks, the adversary counts two. The game is five up. Écarté was first played in the Paris *salons* early in the 19th century; but a similar game, called *Triomphe* or French Ruff, in which there was no score for the king, is of considerable antiquity.

Ecbat'ana (Heb. *Achmetha*, as in Ezra, vi. 2), the capital and chief fortress of Media. It was situated 1½ mile from Mount Orontes (now *Elvend*), and at the foot of a hill crowned with the royal citadel and a magnificent temple of the sun. According to Herodotus, Ecbatana was founded by Deioces (about 700 B.C.), who surrounded it with seven walls, each higher than the next outside it, and having its battlements of a different colour. The inmost wall inclosed the citadel, with the treasury and the archives, among which Darius found the roll containing the edict of Cyrus for the rebuilding of the temple at Jerusalem (Ezra vi.). Ecbatana was taken by Cyrus in 549 B.C., after which it became the chief seat of his government. Its cool mountain climate made it a favourite summer residence of the Persian kings; and Alexander the Great lingered here for two months in 324 B.C. After his death Ecbatana sank to a mere provincial town, till, under the Parthians, it became once more the summer residence of kings. From the time of its conquest by the Sassanidæ it is scarcely again mentioned in history. In the Mohammedan period there rose on the site of the ancient city the modern *Hamadan*. Inscriptions of Xerxes have been found on the summit and slopes of Mount Elvend (10,728 feet).—There were six other Asiatic cities or strongholds to which the name Ecbatana was given by Greek writers, and Sir H. Rawlinson identifies the Ecbatana of Herodotus not with *Hamadan*, but with a hill half-way between it and Tabriz.

Ecce Homo ('Behold the man!' from the words of Pilate, cf. John, xix. 5), a name in art for a picture representing the Saviour wearing the crown of thorns, either in a half-length figure in a group (as Correggio's 'Ecce Homo' in the National Gallery), or the one head alone (as Guido Reni's).

Eccentric, in Machinery, is a contrivance for taking an alternating rectilinear motion from a revolving shaft. It consists of a disc or circular



Eccentric.

frame, fixed on a revolving shaft or axis which does *not* pass through the centre of the disc. The disc is surrounded by a hoop of metal, and to this hoop a rod is attached. When, therefore, the shaft revolves, carrying the eccentric with it, the rod attached to the encircling hoop receives a reciprocating motion, just as it would do if attached to a crank in the shaft (see CRANK).

Eccentric, in pre-Copernican Astronomy. See PTOLEMAIC SYSTEM.

Ecchymosis (Gr. from *ek*, 'out of,' and *chymos*, 'juice'), a discoloration of the surface, produced by blood effused below, or in the texture of, the skin. It is attended by swelling to a greater or less extent, and is usually the result of injury (see BRUISE), but also occurs in disease. See PURPURA, SCURVY.

Ecclefechan, a small village of Dumfriesshire, nearly a mile from a station on the London, Midland, and Scottish Railway, 20 miles NW. of Carlisle. Its only interest is that it is the birth and burial place of Thomas Carlyle, and the 'Entepfuhl' of his famous spiritual autobiography, *Sartor Resartus*. The house in which he was born still stands.

Eccles, a municipal and parliamentary (1918) borough of Lancashire, on the Irwell (where it is merged in the Manchester Ship Canal), 4 miles W. of Manchester, is practically a suburb of Manchester; pop. 44,000.

Eccles, or EAGLES, SOLOMON (1618–83), born in London, was a teacher of the virginals and viols. About 1660 he burned his books and instruments on Tower Hill, and became a shoemaker; and in 1667, in *A Musick-Lector*, he 'doth give his judgment and sentence' against music, 'but yet approves of the Musick that pleaseth God.' His zeal, sometimes aggressive or eccentric, as when during the Great Plague he ran naked about London with a brazier of burning brimstone on his head, threatening the fate of Sodom, brought him repeatedly into trouble both at home and in the West Indies and New England. He helped to organise Quakerism in Barbados and Jamaica. It is believed that before his death he had returned to the practice and composition of music. His sons John and Henry were composers and violinists, and Thomas a violinist.

Ecclesfield, a northern suburb of Sheffield.

Ecclesia (Gr., 'convocation'), a popular assembly, especially that of Athens (q.v.), where the people exercised full sovereignty, and at which every citizen of twenty years of age was entitled to vote. The Athenian ecclesia held originally four, ultimately forty, ordinary meetings in the year (see SOLON). The term was applied by the Septuagint translators to the Jewish commonwealth, and so was naturally adopted by New Testament writers to designate the church (compare Fr. *église*; Welsh *eglwys*).

Ecclesiastes. This title is borrowed from the Septuagint, and is the transliteration of a Greek word which means 'Preacher.' The Hebrew title is Koheleth, the meaning of which is more difficult to determine. Both the Authorised Version and the Revised Version render 'preacher,' but the margin of the latter translates 'the great orator.' The word itself is a feminine participle, and the noun has to be mentally supplied. Whether that noun is 'Solomon' or 'Wisdom' has been a matter of debate among scholars. The traditional view of the book maintains that it is the work of King Solomon, written late in his career, and containing his reflections upon the value of life. This theory, however, has now been entirely abandoned on the grounds that (*a*) the language and style of the book belong to a late stage of Hebrew; (*b*) the book does not reflect the conditions which prevailed in the reign of Solomon; (*c*) Solomon, if he had been the writer, could not have spoken of himself in the past tense as in i. 12, 'I was king over Israel;' (*d*) there was a tendency in the late period to ascribe books to Solomon—the Book of Wisdom,

for instance, was called the Wisdom of Solomon. Most modern scholars think that Ecclesiastes was written either at the close of the Persian period, about 320 B.C., or during the Greek period (250–200 B.C.). It was one of the latest books to be admitted into the Old Testament Canon, and for some centuries there was a controversy as to its right to a place in Scripture (see BIBLE: *The Formation of the Old Testament Canon*). Ecclesiastes belongs to the group of books known as the Wisdom Literature, and ranks, therefore, with Job and Proverbs. It contains reflections on the practical questions of life and destiny. At the time when it was written the age of faith, represented by the prophets, had passed away, and been succeeded by an age of doubt and 'obstinate questionings.' The problem with which the writer deals is, 'Is life worth living; and if it is, how can we make the best of it?' But though it is easy to state the problem, it is far more difficult to find the writer's answer to it, and many different suggestions have been made. (1) Some scholars regard Ecclesiastes as a kind of spiritual autobiography of a man who started in quest of the *summum bonum* of life, tried all the ordinary avenues which are supposed to lead to happiness, found them to be 'vanity of vanities,' and at last discovered the solution of the problem 'in the fear of God and the keeping of his commandments.' But though this is the most common interpretation of the book, it is doubtful whether it really represents its message. The references to religion as the key to the problem of life are very scanty. The one clear and definite statement is found in the epilogue (xii. 13, 14), and there is a widespread feeling among modern scholars that this epilogue is a later addition inserted for the purpose of introducing a satisfactory conclusion to the book. (2) Many interpreters have found in the book—especially in the frequent denunciations of the vanity of pleasure and wealth—a plea for asceticism, and even monasticism; but this view can scarcely be maintained in face of such explicit statements as 'There is a time to weep, and a time to laugh; a time to mourn, and a time to dance' (iii. 4); 'A man hath no better thing under the sun than to eat, and to drink, and be merry' (viii. 15). (3) A. B. Davidson thinks that the book enunciates three main principles: (*a*) Life is vanity; nothing is to be gained by it. 'What profit hath man of all his labour?' 'It is a sore travail that God hath given to the sons of men.' (*b*) Since, however, life is our portion, we must endeavour to make the best of it. 'There is nothing better for a man than that he should eat and drink, and make his soul enjoy good in his labour' (ii. 24). (*c*) In order to obtain the highest good from life it is necessary for a man to possess some regulating principle, and the only principle which will enable a man to secure the maximum of happiness is 'wisdom.' (4) Other scholars think that the teaching of the book is frankly pessimistic and utilitarian. Dr Peake sums up the moral of Ecclesiastes thus: 'Life is a bad business at the best, but it lies within our power to palliate its misery by prudence and the due enjoyment of what little pleasure we can get. And we should be all the more eager to make the most of our opportunities for pleasure that in the dreary darkness of Sheol no possibility of enjoyment will be found. His motto is "*Carpe diem*," and if in the abstract it be not a high motto, we must remember the misery of his time, and the absence of any hope of improvement in this world or immortality in the next.'

See articles by Davidson in *Ency. Biblica*, and Peake in Hastings's *Bible Dictionary*; Cheyne, *Job and Solomon*; Dillon, *Sceptics of the Old Testament*; the small commentaries of Plumptre (Cambridge Bible); G. C. Martin (Century Bible); Wright, *The Book of Koheleth*; Barton (International Critical Commentary).

Ecclesiastical Commissioners. In 1835 commissioners were appointed to inquire into the revenues of the bishoprics, cathedrals, &c. of England and Wales, with a view to the more equal distribution of such revenues, and to a better provision for the spiritual necessities of the people. The commissioners presented four very valuable reports, and on their recommendation a permanent Commission was established by act of parliament in 1836. The Commission now consists of the archbishops and bishops, the deans of Canterbury, St Paul's, and Westminster, certain judges and ministers of state, eminent laymen appointed by the crown (of whom two are appointed to act as Church Estates Commissioners), and a third Church Estates Commissioner appointed by the Archbishop of Canterbury. The commissioners are a corporation, empowered to hold lands and other property. The powers of the Church Building Commissioners were transferred to them in 1856. Though the acts which relate to the Ecclesiastical Commissioners are numerous and complicated, the general outline of their duties is tolerably clear. Certain canonries, prebends, and other offices have been suppressed by parliament; the revenues of other offices have been restricted to a fixed sum, under schemes of reform prepared by the Ecclesiastical Commissioners and sanctioned by the sovereign in Council. The revenues thus set free have been carried to a common fund, out of which grants are made in aid of poor benefices and of the new districts created to meet the wants of the more populous and necessitous parts of the country. Under the Church Building Acts the Commissioners have power to divide and unite parishes, and to make new districts for ecclesiastical purposes. Reports of the work of the Ecclesiastical Commissioners are laid annually before parliament. Their proceedings have seldom led to political discussion; but the very large powers which they exercise render them liable to keen criticism from clergymen and others interested in church matters.

The Ecclesiastical Commissioners are the largest landowners in England; their estates, about 300,000 acres, comprising much of the best agricultural land in the country. The increase due to them in incomes of benefices is over £1,000,000 per annum.

Ecclesiastical Courts. In the early Christian church there were courts, presided over by bishops and presbyters, which dealt with questions of discipline, and with disputes which arose among the brethren. It is to these courts that St Paul refers when he condemns those who go to law with a brother 'before the unbelievers, and not before the saints.' When Christianity became an established religion, these courts changed their character. The state permitted church courts to exercise jurisdiction over the whole civil community in ecclesiastical matters, and in matrimonial and other causes which had to be decided by the 'law Christian.' In England and elsewhere the goods of a deceased person were distributed, or his will was proved, in the court of the 'ordinary' ecclesiastical judge, usually the bishop of the diocese: this was done, because a part of the goods went by custom to the bishop, to be spent for pious uses. The early history of the English church courts is obscure; such information as we possess will be found in the report presented to parliament by a Royal Commission in 1883. These courts became in time a fruitful source of disputes between the crown and the see of Rome. After a long struggle, the crown prevailed: clergymen were made subject to the law of the land; the king's court maintained its right to prohibit ecclesiastical judges from going beyond

their jurisdiction; appeals to Rome were forbidden, under penalty of *Præmunire* (q.v.). At the Reformation the king was acknowledged as the legal head of the church, charged as such with the administration of the 'law spiritual;' the final appeal was to delegates or commissioners of review appointed by him. The final appeal in ecclesiastical cases is now to the Judicial Committee of the Privy-council. Modern legislation has greatly diminished the importance of church courts; their jurisdiction in matrimonial and testamentary causes is gone; and Acts of Toleration prevent them from exercising coercive powers over the general community (see CONVOCATION, DOCTORS' COMMONS, and DIVORCE). Under the Public Worship Regulation Act of 1874, a new ecclesiastical judge was appointed to try offences in the matter of ritual. There is a party in the church which objects to the jurisdiction of this judge and of the Judicial Committee on the ground that their decisions are not those of ecclesiastical courts in the proper sense of the term. The Bishop of Lincoln's case, tried in 1889 by the Archbishop of Canterbury, with the assistance of four bishops, raised the interesting question, by what court a bishop may be tried for alleged offences against the law of the church.

In Scotland, the church judicatories are kirk-sessions, presbyteries, synods, and general assemblies. The 'spiritual independence' of these tribunals has been the theme of much controversy, especially at the time of the Disruption of 1843 (see FREE CHURCH). The Commissary Court and the Court of Teinds are semi-ecclesiastical in their character. Both in England and in Scotland, dissenting churches have courts of their own; the jurisdiction of such courts depends entirely on contract or voluntary submission. See Sir R. Phillimore's *Ecclesiastical Law of the Church of England* (2d ed. 1895), and T. E. Smith's *Law and Practice in the Ecclesiastical Courts* (5th ed. 1902).

Ecclesiastical Law. See CANON LAW, TITHES, TEINDS; ENGLAND (CHURCH OF), SCOTLAND (CHURCH OF), ROMAN CATHOLIC CHURCH.

Ecclesiastical Titles Act was the name of a Protestant measure provoked in 1851 by an edict issued by the Papal court in 1850, dividing Great Britain into territorial bishoprics, under an Archbishop of Westminster. The Act of 1851, passed by Lord John Russell, declared the papal edict null and void, and imposed penalties on persons assuming Catholic titles named from bishoprics, deaneries, &c. in England or Ireland. No prosecution took place under the act, the popular excitement died down, and the act was finally repealed in 1871. No opposition was made to the constitution of a regular Catholic hierarchy in Scotland in 1878, with territorial titles.

Ecclesiastical Year. See YEAR, CHRONOLOGY, EASTER, FESTIVALS.

Ecclesiasticus, one of the most important books of the Apocrypha. The word Ecclesiasticus means 'belonging to the church,' or 'used in the church,' and this title was bestowed upon the book by the Vulgate to denote its popularity and its suitability for use in public worship. In the Greek versions the book is generally described as the 'wisdom of Jesus, son of Sirach,' and so it is often referred to as the Book of Sirach. The book was originally written in Hebrew by Jesus, the son of Sirach (between 190 and 170 B.C.), and translated into Greek by his grandson who bore the same name (between 130 and 120 B.C.). All traces of the Hebrew original were lost up to 1896, when Mrs Agnes Lewis brought a fragment from Palestine containing chap. xxxix. 15 to xl. 18. This discovery led to further investigations, and many other fragments have now been brought to light. The book was held in very high esteem by the early Christian Church; and when Augustine, towards the end of his life, made an anthology of the passages of Scripture which he considered specially helpful for the culture of the spiritual life, the quotations from Ecclesiasticus occupied no less than an eighth of the book, twice as much space as was given to the Gospel of St Matthew.

The book consists of a number of moral apophthegms, proverbs, and counsels strung loosely together, without any definite plan or arrangement. It gives advice in the regulation of conduct under all possible circumstances and in every relationship of life. As Schmidt says, 'It teaches a man how to govern his wife, his children, and his slaves; how to deal with his friends and his foes, his superiors and inferiors, his creditors and his debtors, the rich and the poor; how to behave at the banqueting table and in the house of mourning, in the home and in the public assembly, in the temple and in the mart; how to control his passions, practise moderation, cultivate his nobler tastes, emulate the example and seek the company of the wise.' The writer's ethical outlook is utilitarian; all his sanctions are prudential; the end of morality is always the man's own well-being and happiness. He deals mainly with the external aspects of morality, and very little is said about the motives and ideals of the inward life. Another limitation is to be found in the fact that the writer's horizon is limited to the present life; rewards and punishments are therefore restricted to man's present existence. The ethical teaching of the book, too, is individualistic; no interest is taken in the national life or in society as a whole. The book affords us an excellent picture of the moral ideals and practices of the average Jew in the second century B.C., but it lacks originality (the writer describes himself as 'one that gathered after the grape-gatherers') and prophetic glow. In the hands of Sirach religion has become purely practical and entirely commonplace. There is every reason, however, for thinking that if the book had been written a little earlier, and published under a different name, it would have been admitted into the Christian Canon.

The most modern edition is that of Box and Oesterley in the Oxford *Apocrypha and Pseudepigrapha* (1913), while Oesterley's edition in the Cambridge Bible (1912) is the most useful commentary for the general reader. The best English commentary on the Greek text is that of Hart (1909). There are good articles in Hastings's *Bible Dict.* and the *Ency. Biblica.*

Ecclesiology, the study of church architecture, decoration, and archæology. See CHURCH.

Echegaray, JOSÉ (1832–1916), born in Madrid, was professor of Physics, member of the Cortes (1868), minister of education (1873), dramatist, and minister of finance (1905). Possibly *Folly or Saintliness* (trans. by Lynch, 1895) is his masterpiece; others translated are *El Gran Galeoto*, *The Son of Don Juan*, and *Mariana.*

Echelon (Fr. *échelle*, 'ladder'), is such a formation of troops that, if viewed from a height, they would resemble a staircase. Each division behind has its front clear of that in advance, so that, by marching directly forward, it can form line with it.

Echidna, or PORCUPINE ANT-EATER, a genus included with Ornithorhynchus (q.v.) and another genus in that lowest sub-class of Mammalia which has been variously designated Monotremata, Ornithodelphia, or Prototheria. In many ways the few animals in this section are primitive—in skeleton, brain, heart, and reproductive organs especially.

None of their peculiarities, however, are more striking than their oviparous, instead of viviparous habit. They lay eggs instead of bringing forth their young as such, like other mammals. The temperature of the body is very low (in Echidna 28° C.), and this may be taken as a sort of physiological index of the low pitch of the life. In several features besides the egg-laying habit the Prototheria resemble birds, derived doubtless from a far back common ancestry.

The genus Echidna is found in Australia, Tasmania, and New Guinea. In size and general appearance the animal (as shown in the illustration) much resembles a hedgehog. The hair is partly replaced by the porcupine-like spines, which are doubtless useful in protection and in burrowing; the toes are armed with strong claws, dexterously used in rapid digging both for food and for concealment; the tail is rudimentary; the skull is prolonged into a narrow snout; the mouth, which has a very small aperture, is entirely toothless, but contains a long extensile worm-like tongue, viscid with saliva, which is quickly moved out and in for catching ants. The hind-leg or heel of the males bears a horny spur, connected with a gland on the thigh, but of unknown significance. The

Echidna aculeata.

Echidna has a better brain than the duckmole, the cerebral hemispheres being not only larger, but well convoluted. A unique skeletal peculiarity for a mammal is the incompletely ossified socket (*acetabulum*), where the thigh-bone works on the hip-girdle. In skull, mouth, feet, tail, skin, and general habit, the Echidna is obviously very different from the Ornithorhynchus. The animal is emphatically a burrower. In walking, the hind-toes are turned outwards and backwards. It feeds on ants, caught as above described, and crushed by spines on the tongue and palate. The Echidna is thus a prophecy of the true Ant-eaters (q.v.). The eggs are large, and inclosed in a tough egg-shell. After being laid, they are carried in a pouch developed round about the depressed area on which the milk-glands open. There are no teats.

There are several species of Echidna, the best known being *E. aculeata*, in Australia and Tasmania. Another form, 'with longer fur almost concealing the spines,' is distinguished as *E. setosa*. A third species—*E. lawesii*, from New Guinea—has also been distinguished. All these have five claws on each foot. A larger form, with only three claws, occurs in New Guinea, and is separated as a distinct genus, *Acanthoglossus* or *Pro-echidna bruijnii*. The upper arm of a fossil Echidna has been found among Pleistocene remains.

See Gould, *Mammals of Australia* (3 vols. 1845–63); Gervais, *Ostéographie des Monotrèmes* (Paris, 1878); Oldfield Thomas, *Proc. Zool. Soc. Lond.* (1885); Baldwin Spencer, *Nature*, xxxi. (1884–85); and Haacke on 'Oviparity,' in *Proc. Roy. Soc.* xxxviii. (1884–85).

Echinococcus. See TAPEWORM, HYDATID.

Echinodermata (Gr., 'thorny-skinned'), a well-defined division of Invertebrates, including Holothuroidea or Sea-cucumbers (see HOLOTHURIANS), Sea-urchins (q.v.) or Echinoidea, Starfishes (q.v.) or Asteroidea, Brittle-stars (q.v.) or Ophiuroidea, Feather-stars or Crinoidea (q.v.), and several wholly extinct classes, e.g. Cystoidea (q.v.) and Blastoidea. Limy depositions, forming skeletal framework, are developed to a variable, but usually predominant, degree in the middle layer or mesoderm. Most of the adults show an approximation to radial symmetry, but the larvæ are bilateral. There is a well-developed body-cavity, and from this there is separated off a peculiar water-vascular (locomotor or respiratory) system. A remarkable metamorphosis usually occurs in the life-history. They are all marine barring a few Holothurians in brackish water. They appear in the Lower Silurian strata.

Echinoidea, a sub-class of Echinodermata (q.v.). See SEA-URCHINS.

Echinorhynchus (lit. 'thorny-snout'), a genus of peculiar parasitic worms, forming the class Acanthocephala, which approaches but is quite distinct from the Nematodes. The proboscis armed with hooks, the absence of mouth or food-canal, the exclusively parasitic habit and its results, are characteristic features. There are many species, one of which has been recorded from man. The adults occur in the alimentary canal of various vertebrates—e.g. pig, duck, pike, perch; the immature forms inhabit small invertebrates (eaten by the final hosts), especially small aquatic crustaceans and terrestrial larval insects. See PARASITIC ANIMALS.

Echium. See VIPER'S BUGLOSS.

Echiurida, a group of sausage-shaped marine animals with a long proboscis (used in feeding and locomotion), and a pair of hooked bristles on the ventral surface of the body. See GEPHYREA.

Echmiadzin, or ETCHMIADZIN ('the Only-begotten descended'), a monastery of Transcaucasia near the village of Vagarshabad, 12 miles W. of Erivan, the seat of the Catholicos or primate of the Armenian Church. It comprises within its crumbling 18th-century mud walls and bastions a cathedral, library, museum, seminary, unfinished new palace of the Catholicos, and incomplete observatory. Owing to renovations and extensions the monastery buildings are now almost wholly in modern style. The library is a rich storehouse of Armenian literature. The cathedral, of usual Armenian type, and with fine arabesque decorations in its dome, is said to have been founded in 302 by St Gregory, the Illuminator, on the spot where, in a vision, he had seen the earth, when struck by the golden mallet of the descended Saviour, yield up the greatest of four pedestals of gold surmounted by crosses of fire. On the other three pedestals the churches of St Rhipsimé, St Gaian, and Shoghakath were reared. In the cathedral treasury is the right arm of the Illuminator, which, enclosed in a silver case, is placed on the head of each Catholicos at his consecration, and which has for centuries been regarded as the palladium of the Armenian race. Echmiadzin was associated with the primacy from the 4th to the 5th century, when the patriarchal seat was removed first to Dvin and then to Ani; but in 1441 it was again restored.

Echo, a nymph whom Zeus employed to talk incessantly to Hera in order to keep her from observing his infidelities. The goddess discovering his artifice, changed Echo from a nymph into a mere echo. She next fell in love with Narcissus, but finding her love unreturned, pined away in hopeless grief till nothing but her voice remained.

Echo (Gr., 'sound'). Sound is produced by waves of compression and rarefaction in the air;

when such a wave comes against a wall or other opposing surface, it is reflected, and proceeds in another direction, and the sound caused by this reflected wave is called an echo. Even the surface of a cloud suffices to reflect sound, as may be observed during thunder and the discharge of cannon. That the echo of a sound may return to the point where the sound originated, the reflecting surface must be at right angles to a line drawn to it from that point. Oblique walls send the echoes of a person's voice off in another direction, so that they may be heard by others, though not by him. In order to echo words distinctly, the reflecting surface must on the whole be plane, or so curved as to resemble a concave mirror. A curved form is necessary for returning a distinct sound when the distance is considerable. Great evenness of surface, however, is not essential, as it is no uncommon thing for the edge of a wood to return an echo. The distance of the reflecting surface must also be such as to allow a sufficient time to elapse between the sound and the return of the echo for the ear to distinguish them; when they succeed too closely, they merge into one. An interval of about $\frac{1}{9}$ of a second is necessary to discriminate two successive sounds; so that if we assume 1125 feet as the distance traversed by sound in a second, $\frac{1}{18}$ of 1125, or 62 feet, will be the least distance at which an echo can be heard, as the sound will go that distance and return in $\frac{1}{9}$ of a second. If the distance is less, the echo only clouds the original sound, and is not heard distinct. It is these indistinct echoes that interfere with hearing in churches and other large buildings (see ACOUSTICS); hence anything that breaks the evenness and continuity of the reflecting surfaces is an improvement in this respect. The number of syllables that any particular echo will repeat, depends upon how many can be uttered in the time that the sound takes to go to and return from the reflecting surface. The echo at the tomb of Metella, in the Campagna, near Rome, of which Gassendi speaks as repeating a hexameter line requiring $2\frac{1}{2}$ seconds to utter it, must therefore come from a distance of about 1500 feet. Such echoes are rare, as the various conditions are seldom all fulfilled. When there happen to be several reflecting surfaces at different distances in the direction of the sound, with a sufficient interval between them, each gives a separate and distinct echo. A similar effect is produced when two surfaces are inclined to each other in such a way as to give repeated reflections of the sound from the one to the other like the mirrors of a kaleidoscope, thus producing echoes of echoes. To this multiple and repeating class belong the famous echoes of Killarney, and that produced between the wings of the castle of Simonetta, near Milan, which repeats the report of a pistol 60 times.

Echuca (formerly Hopwood's Ferry), a town of Victoria, Australia, stands on a peninsula formed by the Murray and Campaspe rivers, 156 miles N. of Melbourne. It has considerable trade in red-gum timber, wool, and wine, and important river traffic by steamer. A bridge (1905 feet) which carries a roadway and railway connects Echuca with Moama on the New South Wales side of the Murray. There are great irrigation works. The vineyards are important. Pop. 5000.

Écija, a city of Spain, in the province of Seville, 34 miles SW. of Córdoba by rail, is situated in a fertile district, producing corn, wine, and some cotton. An old Roman and Moorish town, it possesses several traces of the architecture of those peoples. On account of its great heat, it is popularly known as the 'Frying-pan of Andalusia.' The manufacture of oil and weaving are the chief industries. Pop. 30,000.

Eck, JOHANN (properly JOHANN MAIER), the zealous opponent of the Reformation, was born at the village of Eck, in Swabia, 13th November 1486. From his twelfth year he was a student, first at Heidelberg, and afterwards at Tübingen (1499–1501), Cologne, and Freiburg im Breisgau (from 1502). Having entered the priesthood in 1508, he left Freiburg in 1510 to be canon of Eichstädt and professor of Theology at Ingolstadt, and was the ruling spirit of that university till he died there, 10th February 1543. Learned and vainglorious of his great reputation for dialectic skill, he offered a challenge to Luther in his *Obelisci* (against Luther's *Theses*), attacking Carlstadt at the same time. This led to the famous disputation held in the Pleissenburg at Leipzig from the 27th June to the 16th July 1519. Eck first disputed with Carlstadt about grace and free-will, and defended the Roman Semi-Pelagianism with superior ability. Thereafter he contended at greater length with Luther for the primacy of the pope, penance, indulgences, and purgatory, and pressed the Reformer hard with the charge of Hussite heresy. Eck fought with quotations from Fathers and Councils, and sought to dazzle his numerous hearers with scholastic learning; Luther appealed to history and Scripture, and at last cried to Eck that he 'ran away from the Bible like the devil from the Cross.' Both parties claimed the victory, and at Leipzig Eck certainly achieved his object, which was to compel the great heretic to declare that disobedience to pope and council might under certain circumstances be right, and thus complete the breach between Luther and the pope. After this Eck wrote his chief work, *De Primatu Petri*, and went to Rome in 1520 to reap the fruits of his labours. He returned to Germany with the bull of 15th June 1520, which declared Luther a heretic. Eck henceforth continued with passionate violence his struggle with the Reformation. He made two more journeys to Rome; took part in the convention at Ratisbon in 1524; opposed Œcolampadius in the Baden conference in 1526; was engaged at the Augsburg Diet (1530) in the preparation of the confutation to oppose the Augsburg Confession, and was present at the conference begun at Worms in 1540, and ended at Ratisbon in 1541. Eck's appearance at the Leipzig disputation is thus described by the humanist Petrus Mosellanus: 'Eck is a tall man, with a fat, square-built body and a full, thoroughly German voice, which, supported by his powerful loins, would do well not only for an actor, but even for a public crier; still, it is more harsh than clear. His mouth and eyes, indeed his whole countenance, are such that one would sooner take him for a butcher or a barbarian mercenary than a theologian. With respect to his mind, he has a remarkable memory; and, if he only had an understanding equal to it, the work of nature on him would be complete.' Eck collected his polemical writings under the title *Operum Joh. Eckii contra Lutherum, tom. I.–IV.* (1530–35). See Seidemann, *Die Leipziger Disputation* (Dresden, 1843); and Wiedemann, *Dr Johann Eck* (Regensburg, 1865), which has a bibliographical list of his writings (81 in number).

Eckermann, JOHANN PETER, friend of Goethe, was born at Winsen, in Hanover, in 1792. After serving as a volunteer in Kielmannsegg's rifle corps during the war of 1813–14, he was for some time employed in the war office at Hanover, and was a student (from 1817) at the gymnasium of Hanover and university of Göttingen. The publication of his *Beiträge zur Poesie, mit besonderer Hinweisung auf Goethe* (Stutt. 1823), led to his removal to Weimar, where he was employed by Goethe as his assistant in preparing the final edition of his works. After being tutor to the grand-duke's son, he

travelled in Italy with Goethe's son in 1830. He edited the poet's posthumous works in 1832–33, and in conjunction with Riemer brought out in 1839–40 a complete edition of his works in 40 vols. Eckermann was librarian to the grand-duchess at the time of his death at Weimar, 3d December 1854. He has won for himself a lasting name by his *Gespräche mit Goethe in den letzten Jahren seines Lebens 1823–32* (2 vols. Leip. 1837; 6th ed. edited by Düntzer, 3 vols. Leip. 1884). These *Conversations* are of the greatest value for the light they throw on the character of Goethe both as a poet and as a man, and contain, in Eckermann's own words, 'many valuable explanations and instructions with regard to art, science, and the practical affairs of life.' The book has been translated into all the languages of Europe. The English translations are by Margaret Fuller (Boston, U.S. 1839), and John Oxenford (Lond. 1850).

Eckernförde, a port of Sleswick-Holstein, on a fjord of the Baltic, 20 miles NW. of Kiel. It has a good harbour, an extensive fishing industry, a considerable trade in agricultural products, and manufactures of tobacco, salt, and iron goods. Pop. 7000.

Eckhart, MEISTER, one of the profoundest speculative thinkers among the German mystics. Of his personal history very little is known. He was born in either Strasburg or Saxony towards the end of the 13th century; entered the Dominican order; studied and afterwards taught in Paris; acted as prior at Erfurt, and as vicar of his order for Thuringia, before 1298; filled the office of provincial for the Dominicans in Saxony for eight years from 1303, and in 1307 was also appointed vicar-general of Bohemia; some years later he preached at Strasburg and Frankfort, and from 1325 until 1327, the year of his death, at Cologne. Living in an age when the religious consciousness was very sensitive and alert, when the writings of such thinkers as Plotinus, Pseudo-Dionysius, Augustine, Amalrich of Bena, Albertus Magnus, and Thomas Aquinas were being eagerly studied, and the religious fervour of men's hearts was being kept aglow by the practical self-denying lives of the Beghards and Beguines, and the Brethren of the Free Spirit, Eckhart, from the first a religiously inclined nature, easily became inspired, under these almost irresistible educative influences, with the spirit of mystic speculation. But his genius led him beyond the position of his immediate forerunners, and brought him to what was virtually an independent standpoint. Instead of using his speculations as vehicles for the exposition of the orthodox theology of the church, he broke through its traditions and dogmas to the fundamental, permanent realities underlying them. His teaching begins with an explanation of the nature of God, and passes on to the consideration of man and of man's relations to God.

Being (*Wesen*) in its ultimate and most abstract form is without personality, and without differential characteristics; nevertheless, it contains within itself potentially the differentiæ of all existence. It is the unknown, the nothing, the negative of concrete being; the only fact known about it is that it is pure self-contained unity. This ultimate incomprehensible being is the godhead, in which God himself exists as absolute personality, but in a state of potential being, as the real selfhood of abstract being not yet personalised. Absolute personality, however, become actual self-conscious personality constitutes God the Father. The Father gives origin to the Son in the very act and moment of thus becoming conscious of himself; and the Holy Spirit is the love and will that are common to both Father and Son—that is to say, the blossoming of the process of God's revelation of his own nature to himself. But this process does not take place under any law of temporal succession: it is a single act enduring eternally. Nor are Father, Son, and Holy Spirit three separate personalities, but one and the same quintessential personality of being. And it is precisely because the abstract potential personality in the godhead does penetrate to the comprehension of its own being, and just in this very act of self-fathoming, that it is God. In this process of God's self-revelation the world is likewise contemporaneously created; for all things exist in God ideally from eternity. In the eternal now of God's conception all things belong to the unity of the divine nature. Hence all creatures are God, and the world and God are one, the original selfhood of all things partaking of the being of God. In like manner, I too am God. For the soul of man is an outflow from God's essence, and it exists in man without God's essence thereby in any way suffering diminution. In the soul of every individual therefore there exists a part which is in essence of the divine nature; this is the spark (*Funkelein*), which always yearns to return unto God, in order to find in him that perfect tranquillity and rest from energising which characterise the godhead. In the moment when the soul becomes thoroughly conscious of its essential selfhood, then is it divine, and enters into God's nature, and becomes united with him. But it does not become wholly absorbed in God's nature, for in the consciousness of itself it has permanent ground and warranty for its own personality and creatureship. Man, in order to achieve his ethical consummation, must therefore annihilate within himself all that appertains to self, must, in fact, expurgate all that is not of the essence of God, until his soul becomes filled with nothing but God; then does he understand God, and is indeed God, and his love is God's love. Thus the nullification of all self-regarding, all egoistic desire, an imperturbable serenity of spirit, not so much the doing of virtuous acts as the being virtue itself, the which is love, this is the supreme practical moment in the perfection of personal righteousness, the reality of life in its highest potency. This sanctification attained, all a man's acts are right and good.

Eckhart, however, in spite of the abstruse nature of his speculative teaching, was not neglectful of the practical precepts of pure Christianity, as is proved by many a passage in his sermons, and especially by his tractate *Schwester Katrei*. Nor did he lend any countenance to fastings, vigils, ecstatic visions, and similar over-devotional exercises, to which mystically inclined natures were in those days so prone. His power, both as thinker and as preacher, is attested by the commanding influence he won over his contemporaries and the best among his successors. Probably the deepest and most original thinker of his time, bold and paradoxical in the utterance of his opinions, gifted with a keen intuitive apprehension of truth that penetrated to the very heart and root-essence of things, with a mind that was essentially scientific, that refused to be satisfied with anything short of the surest realities and verities of religion, and with a heart that regarded inner discipline, the moral perfecting of man's nature, as supreme above the punctilious observance of churchly ordinances, Eckhart, by preaching the sufficiency of the individual soul to attain of itself unto immediate communion with God, struck a dangerous blow at the hierarchical pretensions of the clergy and the church. Nor did he escape the destiny that overtook original moral reformers in ante-reformation days. He was arraigned by the Archbishop of Cologne, in 1325, for having preached and taught heresy; but the accusation could not be sustained in face of Eck-

hart's self-justification; at all events it fell to the ground, at least for a time, but only to be revived again two years after his death, when his writings were condemned as heretical by a papal bull of John XXII. His works consist of Latin and German sermons and tractates.

Eckmühl, a little village on the Laber, in Bavaria, 15 miles by rail S. of Ratisbon, is notable for the battle fought there, on the 22d April 1809, between Napoleon I. and the Archduke Charles of Austria, in which the latter was defeated, with the loss of 6000 men and 16 guns.

Eclampsia is the name usually given to convulsions of toxæmic origin occurring during pregnancy, labour and the puerperium. It occurs about once in 500 labours. It is usually preceded by the 'pre-eclamptic state,' which is characterised by persistent headache, nausea, thirst, diminished amount of urine, œdema of the face and hands, visual disturbances, confused mental states, and somnolence or insomnia with excitement. The pulse is slow and of high tension, and the urine contains albumen, sometimes becoming solid on boiling. Death may occur without convulsions. Eclamptic fits resemble epileptic fits, only there is no cry and no aura. They last from half to two minutes, may be repeated, and a *status eclampticus* may develop. Death is usually due to exhaustion. The nature of the toxæmia is not fully known. Treatment in the pre-eclamptic period is usually successful. The maternal mortality is from 8 to 10 per cent., with a much higher fœtal one.

Eclecticism. The term eclectic (from Gr. *eklegein*, 'to choose,' 'select') was first applied in philosophy to certain Greek thinkers in the 2d and 1st centuries B.C. Stoicism and Epicureanism had subordinated the search for pure truth to that for happiness and practical virtue: Scepticism had denied that such truth could be found: Eclecticism was the attempt to reach the highest probability by selection from the already existing systems of philosophy. It arose from despair of attaining absolute truth, and from the desire for knowledge which should suffice for guidance in action. Panætius and Posidonius (later Stoics), Carneades (of the new Academy), Philo of Larissa are the chief early representatives of eclectic thought in later Greek philosophy. Philosophic eclecticism had appeared in the Sophists about the middle of the 5th century B.C. It was here also associated with, and sprang immediately from, scepticism, with which was combined a certain dogmatic tendency. Plato and Aristotle were eclectic only in a very wide meaning of the term, for the philosophic genius of each was original, and their concern for pure truth was very intense.

The chief causes of Roman eclectic philosophy were similar to those of eclecticism in Greece. Philosophic speculation was ill suited to the practical Roman mind, which was content with the most easily found explanation of man and the universe. Cicero's philosophic writings (46–43 B.C.) are chiefly ethic. They express only probable truth, and, to a large extent, like the philosophy of the Sophists, reflect what was common to all popular opinion. Cicero had studied with Epicurean, Stoic, and Sceptic teachers, and tried to unite Peripatetic, Stoic, and Sceptic doctrines. His friend Varro developed his views with greater knowledge of the history of philosophy. In the following century Seneca, the Stoic, propounded a scheme of philosophy much of which was eclectic, and most of which was determined by ethical considerations.

The last period of Greek philosophy—i.e. in the 2d and 1st centuries B.C., was characterised by a weak eclecticism—viz. that of the Neo-Pythagoreans, the Pythagorean Platonists, and the Platonic Stoics. In the 1st century B.C. a new eclecticism appeared at Alexandria, the chief representative of which was Philo, a Jew (perhaps about 25 B.C. to 45 A.D.), who interpreted the Old Testament in an allegoric sense, and in harmony with selected doctrines of Greek philosophy. These, in turn, were modified so as to remove their inconsistency with the sacred writings. He was directly indebted to Pythagorean, Platonic, Peripatetic, and Stoic schools for much of his thought. Neoplatonism, the last product of Greek speculation, was not syncretic, for it sifted and transformed the principles which it borrowed from other systems. Its fundamental doctrine of ecstasy, or immediate knowledge of God, in which the distinction of the human soul from the divine reason is completely removed, differs greatly from preceding similar theories both Greek and Oriental. It was a fusion of Greek philosophy with Oriental religion in which, however, the first element greatly predominated. The principal exponents of this philosophy are Plotinus (205–270), Porphyry (233 to about 302), Iamblichus (died about 330), and Proclus (410–484). Its purpose was religious—viz. the attainment of right relations between God and man.

There was much eclecticism in the earliest Christian philosophy. Among the Fathers of the Church Clement of Alexandria and his pupil Origen were greatly influenced by their study of Greek philosophy in Alexandria, and Christian scholasticism was pervaded by an eclectic spirit. Eclecticism was naturally a chief factor in the philosophy which immediately followed the revival of learning. It appears towards the end of the 13th century in the works of Meister Eckhardt in Germany, and in those of G. Bruno and Campanella in Italy in the 16th century. In Leibniz (1646–1716) it becomes strictly scientific. He wove into his philosophy materials from widely separated sources—e.g. from Aristotle and from Descartes. Like Hegel and Cousin, he regarded the tenets which he adopted as being imperfect in the systems from which they were taken, but as capable of being made parts of one harmonious whole in which pure truth would be completely realised. He tried to unify principles which should be applied and developed in future systems, and to find a method which philosophers of diverse schools could employ in common. Perhaps it is in the effort to establish such a method that philosophic eclecticism produces its best results. The followers of Leibniz, C. Wolf (1679–1754) and his school, degraded the eclecticism of their master into a popular, dogmatic, fixed, and formal body of doctrine. Kant and Hegel are only eclectic in the sense in which Plato and Aristotle are so. Each seeks first, through criticism, to establish his fundamental principles. The greatest modern eclectic philosopher is Victor Cousin (1792–1867). He was the pupil of Royer-Collard and Maine de Biran, through whom he became acquainted, respectively, with Scottish philosophy and the sensationalism of Locke and Condillac. He was particularly guided by the philosophy of Scotland and Germany, although he sought to discover the common and permanent elements in all preceding schemes of thought. His principle of selection was supplied by his psychologic analysis, which, however, was somewhat superficial. Cousin's school in France was large and influential. Its most distinguished members were Théodore Jouffroy and B. Saint-Hilaire. There is a strongly eclectic tendency in Italy.

It is only provisionally that eclecticism can aid philosophic research, for systems may arise in which psychologic investigation, or historic interpretation, or metaphysical speculation, reveals new truth. What is common to all philosophy in one age will cease to be so in another, and reality must be

sought not merely for its own sake, but by the original exercise of the individual intellect.

Eclipses. An eclipse is an obscuration of one of the heavenly bodies by the interposition of another, either between it and the spectator, or between it and the sun. The causes of eclipses, as suggested in this definition, are so simple and familiar that it is difficult for us to imagine how deeply eclipses affected men's minds before the dawn of astronomical science. To the ancients they were without the order of nature—terrible presages of dire events; and at Rome, at one time, it was blasphemy, and punished by law, to talk publicly of their being due to natural causes. So strong a hold had this superstition on the popular mind that even after it came to be generally believed that eclipses of the sun were caused by the moon coming betwixt us and that orb, eclipses of the moon were still referred to supernatural agency. When the moon was in eclipse, the people turned out and made a great noise with brazen instruments—the idea being that by doing so they gave her ease in her affliction. According to some, Luna, when in eclipse, was in the pains of labour; according to others, she was suffering from the arts of wicked magicians. Similar notions have prevailed among all barbarian tribes. The Chinese populace, as is well known, imagine eclipses to be caused by great dragons trying to devour the sun and moon, and accordingly they beat drums and brass kettles to terrify the monsters into letting go their prey. Several stories are told of these popular superstitions being turned to good account by knowing persons; among which are those which represent Thales as bringing about peace between the Medes and Lydians, and Columbus, when in a great strait, procuring provisions from the natives of Jamaica through the prediction of eclipses.

Stars, planets, and the satellites of planets may suffer eclipse. The principal eclipses, however, are those of the sun and moon, called the solar and lunar eclipses. The transits of the inner planets over the face of the sun are partial solar eclipses; but solar eclipses, properly so called, are those caused by the interposition of the moon between the sun and earth. They therefore always take place at the time of new moon, when the sun and moon are in conjunction—i.e. on the same side of the earth. In a partial eclipse the sun's disc loses its circular form; it becomes indented on one side, the indentation slowly increasing for some time, and then diminishing until it disappears altogether. In a total eclipse the indentation goes on increasing till the whole orb for a time disappears; after a short interval the sun reappears again, passing through the same phases of obscuration in an inverse order. In an annular eclipse the whole orb is obscured except a ring or annulus. Lunar eclipses always take place at full moon, or when the sun and moon are in opposition—i.e. on opposite sides of the earth—and are caused by the moon passing through the earth's shadow. Such eclipses are sometimes partial and sometimes total, but never annular, and in their general phases they resemble those of the sun.

In speaking of eclipses we shall have occasion to use certain terms which we will now define. The *duration* of an eclipse is the time of its continuance, or the interval between immersion and emersion. *Immersion* or incidence of an eclipse is the moment when part of the luminary begins to be obscured; *emersion* is the time when the luminary completely reappears or emerges from the shadow. The *magnitude* of the eclipse denotes the fraction of the diameter which is obscured at mid-eclipse. It was formerly indicated by *digits* from 1 to 12, but now a decimal notation is employed. The word *eclipse* is, through the old French and Latin, from the Greek *ekleipein*, to fail to appear; and the famous race-horse Eclipse was foaled on the day of a notable eclipse of the sun, 1st April 1764.

Having given this general explanation of the facts of observation on which the theory of eclipses turns, and of the language employed in speaking of them, we now proceed briefly to explain the theory itself, and how it is possible to predict the time of occurrence, and the duration and quantity of eclipses.

(1) *Eclipses of the Moon.*—It has been said that these are caused by the moon passing through the earth's shadow. Before this explanation can be accepted, it must be shown that that shadow extends as far as the moon. This is easily done. Supposing the earth to have no atmosphere, then the shadow is the cone marked in shade in fig. 1,

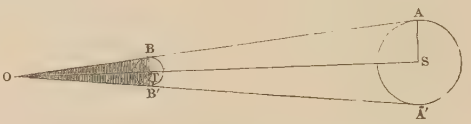


Fig. 1.

whose apex is at O; and the question is, whether the distance OT from the apex to the earth's centre exceeds the moon's average distance from the earth. In the diagram S is the centre of the sun, T of the earth. From the known values of the sun's diameter and distance, it follows that the distance OT is about 217 times TB (the earth's radius), while the moon's mean distance is only 60 times TB. At this distance the breadth of the shadow is about three times the diameter of the moon, and thus, if it is a direct line, the whole of the moon will be in the shadow.

In the foregoing explanation, we proceeded on the assumption that the earth has no atmosphere. If the assumption were correct, the earth's shadow would be darker and narrower than it is, and the phenomena of eclipses shorter in duration, but more striking. The effect of the atmospheric refraction (see REFRACTION) is to bend the rays which are incident on the atmosphere in towards the axis of the cone of the earth's shadow, those which pass through the lowest strata of the air being most refracted, and converging to a point in the line OT (see fig. 1), at a distance equal 42 radii of the earth from the earth's centre. Accordingly, the moon, which, as we have seen, crosses the shadow at a distance of about 60 radii, never enters that part of it which is completely dark; thus, she never loses her light entirely, but appears of a reddish colour resembling tarnished copper—an appearance caused by the atmospheric absorption (which is very great for blue light), in the same way as the ruddy colour of the clouds at sunset. There is another reason why the phenomena are less striking than might be expected from the explanation given. Every shadow cast by the sun's rays necessarily has a penumbra, or envelope, on both sides of the true shadow. In the case before us (fig. 2), suppose a

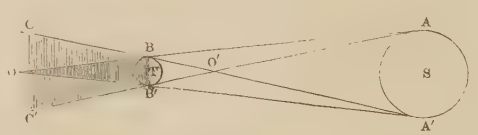


Fig. 2.

cone having its apex O′ between the sun and earth, and enveloping each of them respectively in its opposite halves, CO′C′ and AO′A′ (fig. 2). It is clear that from every point in the shaded part of the cone CO′C′, and without the shadow BOB′, a

portion of the sun will be visible—and a portion only—the portion increasing as the point approaches either of the lines CB, C′B; and diminishing as it approaches the lines BO, B′O. In other words, the illumination from the sun's rays is only partial within the space referred to, and diminishes from its extreme boundary lines towards the lines BO, B′O. When, then, the moon is about to suffer eclipse, it first loses brightness on entering this penumbra, so that when it enters the real shadow, the contrast is not between one part of it in shade and the other in full brilliancy, but between a part in shade and a part in partial shade. On its emersion, the same contrast is presented between the part in the umbra and the part in the penumbra. What we should expect on this geometric view of the earth's shadow actually happens. From the breadth of the penumbra, it happens that the moon may fall wholly within it before immersion in the umbra commences; and so softly do the degrees of light shade into one another, that it is impossible to tell exactly when any remarkable point on the moon's surface leaves the penumbra to pass into the umbra, or the reverse. Also, even when the moon is wholly within the penumbra, it is impossible by the eye to discover any diminution of her light. This is only appreciable over a part of her surface when she is just about to enter on the shadow.

(2) *Prediction of Lunar Eclipses.*—We said that lunar eclipses only happen at full moon. They do not happen every full moon, because the moon's orbit is inclined at an angle of 5° 9′ nearly to the ecliptic, on which the centre of the earth's shadow moves. (See the article ECLIPTIC below; also the articles MOON, EARTH). If the moon moved on the ecliptic there would be an eclipse every full moon; but, from the magnitude of the angle of inclination of her orbit to the ecliptic, an eclipse can only occur on a full moon happening when the moon is at or near one of her nodes, or the points where her orbit intersects the ecliptic. An eclipse can happen only when the centres of the circle of the earth's shadow and of the moon's disc approach within a distance less than the sum of their apparent semi-diameters; except when near the nodes, the moon, on whichever side of the ecliptic she may be, may pass above or below the shadow without entering it. (1) If, at the time of full moon, the distance of the sun's centre from the nearest node be greater than 12° 3′, there cannot be an eclipse; (2) if at that time the distance of the sun's centre from the nearest node be less than 9° 31′, there will certainly be an eclipse; (3) if the distance of the sun's centre from a node be between these values, it is doubtful whether there will be an eclipse, and a detailed calculation must be resorted to, to ascertain whether there will be one or not. Before the laws of the solar and lunar motions were known with anything like accuracy, the Chaldæans discovered how to predict lunar eclipses with tolerable correctness by means of the lunar cycle (see CYCLE) of eighteen Julian years and eleven days. Their power of prediction depended on the fact that in 223 lunations the moon returns *almost* exactly to the same position in the heavens. If she did return to *exactly* the same position, then, by simply observing the eclipses which occurred during the 223 lunations, we should know the order in which they would recur in all time coming. As it is, eclipses do recur in the same order during several such successive periods, and so can be predicted fairly well. Lunar eclipses, however, change their phase at each return. They appear at first as partial and very small, increasing at each cyclical return as the small defect of exactness in the period accumulates. Becoming at last total, they again diminish until gone. This process requires a considerable time. A lunar eclipse, beginning some centuries ago, was total in 1692, and last returned, as one of only $\frac{1}{5}\frac{1}{0}$th of the moon's disc, in 1872.

All lunar eclipses are universal, or visible in all parts of the earth which have the moon above their horizon, and are everywhere of the same magnitude with the same beginning and end; and this universality of lunar eclipses is the reason why it is popularly thought, contrary to the fact, that they are of more frequent occurrence than solar eclipses. The eastern side of the moon, or left-hand side as we look towards her from the north, is that which first immerges and emerges again. The reason of this is, that the proper motion of the moon is swifter than that of the earth's shadow, so that she overtakes it with her east side foremost, passes through it, and leaves it behind to the west. It will be readily understood, from the explanations given above, that total eclipses and those of the longest duration happen in the very nodes of the lunar orbit. But from the circumstance of the circle of the shadow being much greater than the moon's disc, total eclipses may happen within a small distance of the nodes, in which case, however, their duration is the less. The farther the moon is from her node at the time, the more partial the eclipse is, till, in the limiting case, she just touches the shadow, and passes on unobscured.

(3) *Eclipses of the Sun* are caused, as we have stated, by the interposition of the moon between the earth and sun, through which a greater or less portion of the sun is hid from view of the earth's inhabitants.

By a process similar to that used in ascertaining the length of the earth's shadow, it can be shown that the greatest value of the length of the moon's shadow is 59·73 semi-diameters of the earth; at the same time, we know that the least distance of the moon from the earth is about 55·95 semi-diameters. It follows that when a conjunction in line of the sun and moon happens at a time when the length of the shadow and the distance of the moon from the earth are, or are nearly, equal to the values above stated, the moon's shadow extends to the

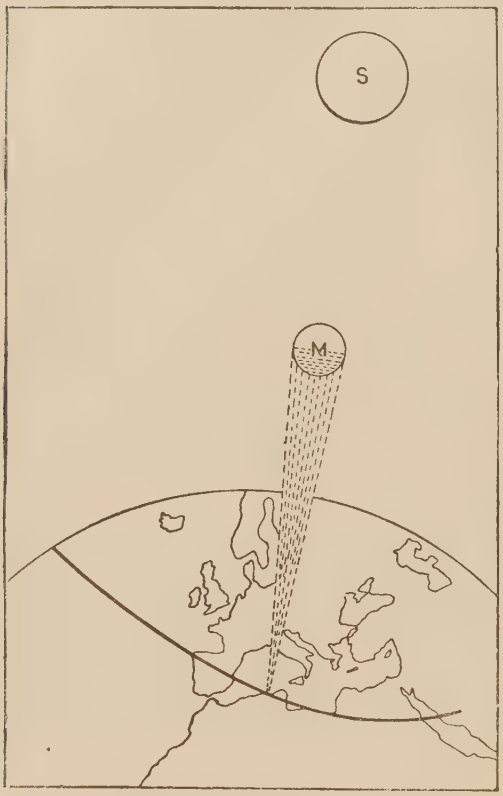
Fig. 3.

earth and beyond it. In this case there will be a total eclipse of the sun at all places over which the shadow moves (fig. 3). If L be the moon, T the earth, and *ab*L the moon's shadow cast by the sun, there will be a total eclipse of the sun at every point that is completely within the portion *ab* of the earth's surface. Again, the smallest value of the length

Fig. 4.

of the moon's shadow may be shown to be 57·76 semi-diameters of the earth, and the greatest distance of the moon from the earth is 63·82 semi-diameters. So that in reality the point of the shadow at O may be as much as 15,500 miles beyond the earth, or fall short of it more than 23,000 miles. In the latter case, the sun cannot

be altogether hid from any point of the earth's surface; but this case, or one approximate to it, is that in which there will occur an annular eclipse. In fig. 4, suppose O to be the apex of the shadow which falls short of the earth, and conceive the cone of the shadow produced earthwards beyond O into a second cone *Ocd*; then, from every point



Track of the Moon's Shadow in the Total Eclipse of the Sun of 1905, Aug. 30.

within the section *cd* of the earth's surface, the moon will be seen projected as a black disc on the bright disc of the sun, the portion unobscured forming a ring or annulus of light. While in the two cases just described the eclipse is total or annular at places within *ab* or *cd*, it will be partial at other places; the moon will appear projected against a portion of the sun's disc, making a circular indentation. To ascertain the places at which the eclipse will be partial, we have merely to form the cone of the penumbra of the moon's shadow in the manner explained in treating of lunar eclipses; at all places on the earth's surface within that cone there will be a partial eclipse. A simple calculation shows what is the observed fact, that the cone of the penumbra is not nearly large enough to embrace the whole of the face of the earth directed to the sun; in other words, solar eclipses are not universal, like those of the moon—i.e. they are not seen from all places that have the sun above their horizon at the time of the eclipse, which is the reason that though they are of more frequent occurrence than lunar eclipses, the latter are commonly supposed to occur more frequently.

The breadth of the belt traversed by the umbra, when the sun's distance is greatest and the moon's least, is estimated at about 180 miles; and in the same case the penumbra is estimated to cover a circular space of 4900 miles in diameter, the eclipse happening exactly at the node. If the eclipse does not happen at the node, it is clear that the axis of the shadow must be inclined to the plane of the ecliptic, that the shadow will be cut obliquely, and therefore that the part of the earth in shade will be oval. Astronomers usually calculate beforehand the motion of the shadow over the earth's surface, and prepare charts.

The commoner phenomena of an eclipse of the sun are perfectly analogous to those of lunar eclipses, save when the eclipse is annular; but there are other appearances, especially when the eclipse of the sun is total, that are very remarkable. The almost instantaneous darkening, even when expected, fills the mind with awe. The sudden darkness, further, resembles neither the darkness of night nor the gloom of twilight. The cone of the moon's shadow, though it completely envelops the spectator, does not enclose the whole atmosphere above his horizon. The mass of unenclosed air accordingly catches the sunlight, and reflects it into the region of the total eclipse, making there a peculiar twilight. Stars and planets appear, and animals are dismayed. De la Rue says of the total eclipse of July 1860, as seen in Spain: 'When the sun was reduced to a small crescent, the shadows of all objects were depicted with great sharpness and blackness, reminding one of the effects of illumination with the electric light. The sky at this period assumed an indigo tint, and the landscape was tinged with a bronze hue.' A total eclipse of the sun gives an opportunity of observing some solar phenomena which are invisible at all other times. As long as the total eclipse lasts, there appears round the sun and moon a luminous corona as in fig. 6, while at its base, and projecting beyond the dark edge of the moon, appear very brilliant prominences, generally red. These may be referred to in an observation noted in 334 A.D.; they were first certainly referred to by Stannyan in 1706. They are found to be constant attendants on eclipses, and methods have been invented of rendering them visible at any time without the interposition of the moon. The spectroscope shows

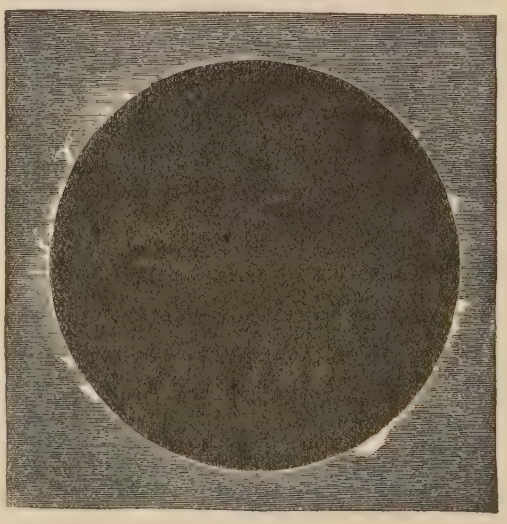


Fig. 6.—Total Eclipse observed in America, August 1869.

that they consist of hydrogen, calcium, iron, and other metals in an incandescent state. The prominences are sometimes seen to shoot up like flames, in wild fantastic shapes, with incredible velocity, and to

the height of tens of thousands of miles. Attempts have been made to photograph the corona without an eclipse. These have failed, and it is only on the rare occasions of eclipses that this remarkable solar appanage can be studied. Modern expeditions to observe solar eclipses are almost entirely devoted to the photography, spectrographic and polariscopic, study of the corona. See SUN.

The eclipses of 1919 and 1922 were utilised to verify a prediction by Einstein that the ray of light from a star to the earth would be bent in its passage near the sun, in accordance with the theory of gravitation put forward in the generalised theory of relativity. See SUN, RELATIVITY.

(4) *Prediction of Solar Eclipses.*—The period of 18 Julian years 11 days, referred to in treating of the prediction of lunar eclipses, applies to solar eclipses equally with lunar; but the ancients, who understood that fact, could find no law of recurrence of solar eclipses within that period, so as to predict them. The reason of the failure is obvious; for though solar eclipses recur in a fixed order within the cycle, they are not visible at the same places on their recurrence as when first observed. By modern methods similar to those applied in the case of lunar eclipses, however, eclipses of the sun may be predicted, with all their circumstances of time and places of observation, with the most perfect certainty. At the time of a solar eclipse the sun and moon are in conjunction; they are also in or near the same node; and no eclipse can happen if they are farther than 17° from the node, or if the latitude of the moon, viewed from the earth, exceeds the sum of the apparent semi-diameters of the sun and moon. When within these limits, detailed calculation is necessary to ascertain the nature of the eclipse, if any, which will happen.

The number of eclipses of the sun and moon together in a year cannot be less than two, or more than seven; the most usual number is four, and it is rare to have more than six. The explanation of this limitation is that the sun passes by both nodes but once in a year, except in the cases of his passing one early in the year, in which case, owing to the recession of the moon's nodes, he will again pass it a little before the end of the year. From the sun's thus passing *each* lunar node usually every year, it results that eclipses occur at particular periods, called *eclipse seasons*. In 1887 these occurred in February and August. They come about twenty days earlier every year, and last thirty-six days for solar, and twenty-three days for lunar, eclipses. Their annual change of date is due to the motion of the lunar node (see MOON). From the smallness of the cone of the moon's shadow, total solar eclipses are extremely infrequent in any one place, compared with the frequency of their actual occurrence. In London not one total eclipse was witnessed for the 575 years 1140–1715, nor will another be seen during the succeeding five centuries. There will be a total eclipse visible in the north of England on June 29, 1927. Total eclipses of the moon are more frequent; on an average, one may occur every two years. Oppolzer, in his *Canon der Finsternisse*, gives dates and paths of 8000 eclipses of the sun and 5000 of the moon extending from B.C. 1207 to A.D. 2161, on account of their astronomical and chronological interest. His work has been supplemented by Ginzel.

The following table gives the total eclipses from 1925 to 1940:

Date.	Duration.	Where Visible.
1925. Jan. 24.	2·4 minutes.	United States.
1926. Jan. 14.	4·2 ,,	E. Africa, Sumatra, Philippines.
1927. June 29.	0·7 ,,	Scotland, Scandinavia.
1929. May 9.	5·1 ,,	Sumatra, Philippines.
1930. Oct. 21.	1·9 ,,	Pacific, Patagonia.
1932. Aug. 31.	1·5 minutes.	Canada.
1934. Feb. 14.	2·7 ,,	Borneo.
1936. June 19.	2·5 ,,	Greece, Central Asia, Japan.
1937. June 8.	7·1 ,,	Pacific, Peru.
1940. Oct. 1.	5·7 ,,	Brazil, S. Africa.

For the identification of ancient eclipses of the sun, with references made to them in early writings, see Fotheringham, *Monthly Notices of the Royal Astronomical Society* for December 1920.

Eclipses of the moon, which can be seen from all places where the moon is above the horizon, occur on the following dates:

1925. Feb. 8; Aug. 4.	1934. Jan. 30; July 26.
1927. June 15; Dec. 8.	1935. Jan. 19; July 16.
1928. June 3; Nov. 27.	1936. Jan. 8; July 4.
1930. April 13; Oct. 7.	1937. Nov. 18.
1931. April 2; Sept. 26.	1938. May 14; Nov. 7.
1932. March 22; Sept. 14.	1939. May 3; Oct. 28.

See the articles MOON, SUN, EARTH, OCCULTATIONS, SATELLITES.

Ecliptic is the name given to the great circle of the heavens round which the sun *seems* to travel, from west to east, in the course of a year. It took its name from the early observed fact, that *eclipses* happen only when the moon is on or near this path. A little attention about sunset or sunrise shows that the sun is constantly altering his position among the stars visible near him, leaving them every day a little farther to the west; and that this motion is not exactly east and west, or parallel to the equator, becomes also evident by observing that the sun's height at mid-day is constantly altering. It is further observed that, twice a year, about March 21 and September 23, the sun is exactly on the equator. The two points of the equator on which the sun then stands are the equinoctial points, and are the intersections of the equator and ecliptic. Again, there are two days in the year on which the sun reaches his greatest and his least mid-day elevation: the first is the 21st of June, the second is the 21st of December. On these days the sun has reached his greatest distance from the equator either way, and the points in his course where he thus seems to pause or halt in his retreat from the equator are called the solstices (*solis stationes*). These four points are distant from one another by a quadrant of the circle, or 90°. Each quadrant is divided into three arcs of 30°, and thus the whole ecliptic is divided into twelve arcs of that length, called Signs of the Zodiac (q.v.). These arcs or signs have been named after constellations through which the ecliptic passes. As the equinoctial points are not fixed, but recede yearly westwards on the ecliptic about 50 seconds, and in a century about 1° 23′, the same constellations and signs that coincided when the division of the ecliptic took place, no longer coincide. The constellation of the Ram, for instance, which originally stood in the first arc or sign, now stands in the second, every constellation having advanced forward 30°, or a whole sign. This is due to a movement of the *equator* (see PRECESSION OF THE EQUINOXES). Modern astronomers, therefore, pay little attention to these constellations and signs.

Not only do the equinoctial points change, but the angle of inclination of the ecliptic to the equator, called the obliquity of the ecliptic, is also variable. It is at present nearly 23½°, and is diminishing at the rate of about 48 seconds in a century. The decrease, however, has a limit, the obliquity oscillating between two definite bounds. It has been calculated that it was at its greatest 2000 B.C., and was then nearly 23° 53′. Since then it has been decreasing, and will continue to do so till about the year 6600 A.D., when it will be at its least, and about 22° 54′. This is due to a real movement of the *ecliptic*.

The physical cause of this change of the obliquity is the action of the other planets, especially Jupiter, Mars, and Venus, on the mass of the earth. Its existence was known to astronomers in very ancient times; Herodotus mentions an old tradition of the Egyptians, that the ecliptic had formerly been perpendicular to the equator—a notion into which they were most probably led by observing, for a long series of years, that its obliquity was constantly diminishing. It is probable that the Chaldeans arrived at the epoch of 403,000 years before the entry of Alexander into Babylon, to which they proudly referred for their first astronomical observations, by computing the time when the ecliptic was perpendicular to the equator, on the supposition of its obliquity diminishing 1′ in 100 years. The first known measures of this obliquity were made in the East by Tcheou Kong, regent of China (1100 B.C.), and in the West by Pytheas (330 B.C.) and Eratosthenes (200 B.C.).

Eclogite, or EKLOGITE, a crystalline rock composed of the beautiful grass-green amphibole, called smaragdite, and red garnet. Another variety of eclogite is composed of omphacite, a grass-green granular variety of pyroxene, and garnet. Eclogite is not an abundant rock; it is usually associated with the older crystalline schists, but as a rule is not itself schistose.

Eclogue (Gr. *eklegein*, 'to select'), a short pastoral poem, in which the swains converse with one another in turn, as in the eclogues of Virgil, also called Bucolics (q.v.). The earliest modern bucolics were Petrarch's; the earliest in English were those of Alexander Barclay (q.v.).

Ecole Normale, Polytechnique. See POLYTECHNIQUE, EDUCATION.

Ecology, or ŒCOLOGY (*οἶκος*, 'a home,' and *λόγος*, 'a theory'). The living organism and its environment are so closely interlinked that the study of the one—Biology—cannot be disconnected from the other—Ecology. In its broader sense ecology takes account of all the environment or habitat, including physiographical factors relating to the air above and the earth or other substratum, and the biological factors involved through the presence of other organisms. The concentration of observation on the environment of living organisms is a comparatively recent development, and the earlier stages have reference mainly to plant ecology. Yet it is not difficult to foresee a wider extension into the animal world and into human economics. The elucidation of problems in plant-life underlies all animal ecology, because animals and non-green organisms depend ultimately for their nutrition on the activities of green plants containing chlorophyll. Thus the presence or absence of grazing-grounds for herbivorous animals will determine the existence of the carnivore, the parasite, and a long train of organisms, man included, that follow the green plant.

The definition of ecology as the branch of science concerned in the reciprocal relations of organisms and the external world was used by E. Haeckel (1866) and by Reiter (1885); see also ENVIRONMENT. The same decade also saw the beginning of the labours of the earlier plant ecologists, including E. Warming in Denmark, O. Drude in Saxony, C. Flahault in France, and C. Schröter in Switzerland. The investigations from the schools founded by these and other more recent ecologists refer mainly to plant-ecology, though many of the general principles are equally applicable on the animal side, and already there are signs of activity in this direction.

A fundamental principle of ecology is that the organism is the expression of its environment. A plant or animal inhabits a place because the habitat suits it, and because the organism is able to maintain its place by adaptations in form and mode of life conformable to the conditions of the habitat. Some examples may recall types of vegetation familiar to any one who wanders through Britain. The heather, or ling (*Calluna*), covers many miles of northern hill and southern heath, and it is the expression of its environmental conditions. The landscape is bleak and the soil so sterile that few attempts have been made to plough it, so that the dwarf, slow-growing heather (*Calluna*), bell-heaths (*Erica*), bilberry and its relatives (*Vaccinium*), wiry grasses, and other frugal species retain possession. The grouse finds here its food-supply and other conditions favourable to existence. In contrast, woods formerly occupied large areas in the lower valleys and plains, but the soil and situation were so favourable that the farmer has left only fragments of the original forest. Trees like oak and beech, by their larger size and deciduous leaves, indicate greater requirements, some of which are a better water-supply, deeper soil, and shelter from excessive wind. Under the trees are thin-leaved ferns and shade-plants of the taller undergrowth, or the delicate anemone, primrose, wood-sorrel, and mosses of the ground-carpet. An animal world of higher and lower organisms, mostly unknown on the heather moors, finds its environment in the woods. Other habitats for plants are provided through the erosion and deposition effected by streams. Amongst others, deposits of mud become the habitat of tall marsh plants, examples of the greatest annual production of vegetable matter found anywhere in Britain. Where such areas can be drained, as in the English fens, a fertile ploughland becomes available. The same mud deposited on the sea-coast (e.g. Norfolk and Lancashire), and frequently irrigated by tidal waters, bears a close carpet of fleshy plants expressive of an environment where excess of salt and wind-driven spray are dominant factors. The sea-shore golf-links with adjacent sand-hills and drifting sand-dunes furnish another typical coastal vegetation.

The evolution of an organised system of grouping plants according to their habitats is necessarily dependent on the progress of correlated branches of science. All recent advances in geography, climatology, soil-knowledge, and on the form, structure, and functions of plants and animals, have a bearing on ecology. The subject can thus be approached from several directions, and this has been the case in its development. Each worker tends to have his own points of view, often traceable to his environment, and several schools have arisen in Europe and America, rather to the confusion of the beginner, but of great advantage in the evolution of a new science.

Some of the fundamental concepts necessary to understand ecology will now be briefly indicated.

Plant-physiognomy.—One of the earlier attempts to systematise types of vegetation was made by A. Humboldt (1806; English edition, 1849). Utilising his own wide experiences and those of earlier botanist-explorers, he enumerated certain plant-forms prominent in various landscapes—e.g. the cactus-form of the desert, the broad-leaved banana-form of the tropical rain-forest, the grasslands of steppe and prairie, the tall pine-wood and the dwarf heath-shrubs of the northern hemisphere, and the evergreen laurel type of the Mediterranean. This physiognomic system marks the recognition of the influence of vegetation on the character of the landscape. Another important effort was that of Grisebach (1872), who outlined a larger series of types to meet the increasing knowledge of the plant geographer. He also suggested that the

physiognomic type is correlated with the environment, especially with climatic conditions. Thus the northern tundra of Europe owes its landscape features largely to the dwarf, small-leaved plant-covering, which, under similar climatic conditions, appears again on the Alps and near the summits of our higher mountains. In northern Siberia and northern Canada a similar type of vegetation appears, and yet not the same as regards the plant species composing it. Similar parallel series are presented in the physiognomy of the pine-forest zone of the three northern continents, and farther south by the deciduous forests of birch, poplar, and oak. This distribution, according to latitudinal climatic zones, is in a general way repeated in ascending any snow-topped range of mountains, even on those which have their base in the tropical plains of Central Africa. This comprehensive treatment of vegetation on a world-wide scale finds its more recent expression in A. Schimper's *Plant Geography upon a Physiological Basis* (English edition, 1903). Vegetation is here grouped primarily by climatic factors, secondarily by soil factors, and the treatment shows evidence of the great advances in experimental plant-physiology initiated by Sachs about 1866. Physiognomy is now an important feature in all recent works on the plant geography of foreign lands.

The Plant Community.—Grisebach (1838) recognised that the vegetation of any area is made up of units, which he called 'plant formations.' This unit group of plants is a feature of the landscape, such as a wood, a grassland, or a heath. It may be characterised by one social species, as in the case of a pine-wood, an oak-wood, or our northern heather moorland; on the other hand, there may be, as in grassland, several species dominant simultaneously or at different times of the year. Such a plant community is made up of (*a*) one or more dominant species; (*b*) secondary social species capable of taking the place left by removal of the dominant; (*c*) dependent species protected by the more dominant, or living upon the humus and other products formed. The ecological study of the vegetation of a country seeks (1) to ascertain the chief communities; (2) to outline the physiognomy of the vegetation and the landscape; (3) to investigate the special habit and habitat of each species and the reasons why the species become aggregated into communities. The importance of the concept of the plant community cannot be over-estimated. The earlier botanists of Europe perceived this vaguely, but there was little application of the principle because floristic botany—i.e. the discovering, naming, and classification of species—still prevailed. The recognition of the plant community as a unit of vegetation came in the last decade of the 19th century, when three important text-books on plant geography definitely adopted it: O. Drude, *Pflanzengeographie* (1890); Warming, *Œcology of Plants* (1895; English edition, 1909); and Schimper, *Plant Geography* (1898 and 1903). The term 'plant community' is used here to indicate any natural aggregation of species on the same habitat, but even a limited experience will show that there are grades of communities. The present tendency is to call the larger units plant formations, such as those traceable to climate or some distinct soil condition; in Britain, oak-forest, calluna-heath, moor on deep peat, coast salt-marsh and coastal sand-dune may be called formations. Smaller units which together make up the formation are plant associations, while still smaller units of gregarious species, like anemone or dog's mercury (*Mercurialis*) in a wood, or marram-grass (*Ammophila*) on a sand-dune, may be called plant societies. Exactly where each begins and ends is still a subject of academic debate, but the idea is that they should be in ecological botany what genus, species, and variety, respectively, are in taxonomic botany.

Growth-forms.—This reveals itself in the habit of growth, the duration of life, and in the form and structure of the leaf and other vegetative organs, but it is less evident in the reproductive organs. E. Warming, the pioneer of the Danish school, was the first to demonstrate how even the commoner plants had been imperfectly studied, especially as regards leaf-form, underground parts, and mode of passing the winter or other resting period. Warming's work, begun in 1884, was almost neglected because published in Danish, and it was not till his *Plantesamfund* appeared in German (1896) that his influence was felt; an English edition was issued in 1909, and a new German edition (1918) extends to 800 pages, with a complete bibliography of Ecology. Recent literature includes the results of much intensive study on external form, internal anatomy, and vital function, mainly relating to the vegetative organs. A natural order in systematic botany is a group held together by features of flower and fruit common to all the species. From the ecological standpoint the recognition of growth-forms is an element of training quite as essential as the distinguishing of natural orders. The deciduous type of British tree has a growth-form distinguished by woody stems and branches bearing buds through the winter, and by summer leaves relatively broad, thin, and with a distinct upper and lower surface. Similar features characterise the deciduous trees of all temperate climates with summer rains. One growth-form of the British moorland is the short needle-like leaf on low, dwarf, woody bushes, such as the ling (*Calluna*) and its floristic relatives the bell-heaths (*Erica*); it can be recognised again in the Crowberry (*Empetrum*), which is not a true heath. The moorland and heath grasses present a growth-form with tufts of bristle-like leaves, and this is seen again in moor sedges (*Carex*, *Scirpus*, and *Eriophorum*) and rushes (*Juncus*). The floating leaves of aquatic plants, the cactus-form with fleshy stems, and the leafless, green-twigged switch-form of our broom (*Cytisus*) and furze (*Ulex*) will recall other prominent growth-forms. The first edition of Warming's *Ecology* (1895) was based on a simple classification of growth-forms; hydrophytes or water-plants, xerophytes adapted to periodic drought, halophytes living in desert or maritime saline habitats, and mesophytes with an environment where moisture is relatively constant. His later classification (1918) includes sixteen classes, mainly the result of subdividing the xerophytes. The outstanding feature is the importance assigned to water-supply, and this has had a widespread influence on subsequent work on ecology. The limits of a plant are not determined by so many inches of rainfall per annum, but by the recurrence of drought-periods which must be survived if the plant is to exist. Nor is the mere presence of water any criterion, because plant-life is determined by the availability of the water. A coastal salt-marsh is submerged by the higher tides of each month and is generally wet underfoot, but the plants are small in comparison with the tall reeds on the wet mud-banks beside a fresh-water lake. They are more like xerophytes than hydrophytes; and the reason is that the presence of excessive salts interferes with the absorption of water. Another wet area in Britain is the peat-bog, and here again the plants are xerophytes, because, though water is abundant, it is not available for plants in soils consisting mainly of humus. Peat-deposits are also liable to surface drought in summer and during periods of frost. Northern climates are especially prolific in growth-forms, and in recent ecology the investigation of these occupies a promi-

nent place. The classification by growth-form, important though it be, does not lend itself to regional survey in a country like Britain, because mesophytes and plants with xerophytic adaptations frequently occur in the same plant community—for instance, in an upland oak-wood and in some types of marsh. C. Raunkiaer, another Danish ecologist, has utilised the growth-form to express the relation between vegetation and climate. His view is that the plant itself must be the biological record of climate, and that any physical standard such as rainfall or temperature is insufficient. It has already been pointed out that physiological drought may arise from different combinations of physical factors, such as cold and actual absence of moisture. Raunkiaer's classification of 'life-forms' is into trees and shrubs (phanerophytes), dwarf plants with buds near the surface of the soil (chamæphytes), herbaceous perennials with dormant buds in the upper crust of the soil (hemicryptophytes), plants with deeply buried bulbs and rhizomes (cryptophytes), and annual or once-flowering plants (therophytes). The basis of this grouping is the condition of protection of buds during the critical period. In tropical regions with a high rainfall, phanerophytes will be found to dominate if a census of the flora be made; therophytes are characteristic of deserts and highly cultivated lands; chamæphytes and hemicryptophytes are the dominant groups in northern lands. (A summary of Raunkiaer's publications will be found in *Journal of Ecology*, vol. i. 1913.)

Colonisation and Succession.—The history of every plant community begins on bare soil or some other open substratum. This period may be very ancient or it may be as recent as the last ploughing of a field or the making of a railway. In Britain many habitats had their origin when hills and slopes were left bare after being eroded and cleared of vegetation by ice-action during the Glacial Period (q.v.), and the same ice-agencies left wide tracts of newly deposited soil. Through all time coasts, stream-banks, and inland cliffs have been eroded, thus exposing fresh surfaces, while the eroded material, spread out as coastal and river deposits or as cliff-screes, provides other soils. Wind-action is also a denuding and depositing agent, as on our sand-dunes and over wide areas of continental loess-soils (see GEOLOGY). Such surfaces present a wide range as regards situation, exposure, water-supply, soil-texture, fertility, &c., and these factors have a profound influence on the future vegetation. This aspect of plant ecology has received attention from the American schools initiated by H. C. Cowles and F. E. Clements, also from C. B. Crampton and C. E. Moss in Britain. The plants occupying new land pass through the phases of migration by seeds or otherwise, and settlement. There must always be considerable distribution by seeds, but colonisation will rarely succeed except where the soil is devoid of a closed plant-covering. Given the opportunity, many organisms may effect a landing, and begin life, but a sorting out will take place. Some will die as seedlings; others will leave no progeny. The survivors will include many species that can flourish only while the habitat remains open and competition is not intense. This is the case so long as the substratum is in a mobile or unstable condition, but sooner or later the water or other dynamic agent becomes ineffective, the sand-dune or coastal mud-flat becomes protected by newer deposits seawards, or the stream is forced into new channels, or the material from crags comes to rest. Thus the plant-covering evolves along with the habitat, and the vegetation itself is an important factor in the preparation of the habitat for later phases. A plant succession is the series of communities which in turn occupy the habitat until a 'climax formation' occupies it and excludes the invasion of another dominant. The successional series leading up to a climax formation is called a 'sere' (F. E. Clements, 1916). In Britain climax formations are represented by deciduous forest (oak, beech, &c.), birch-pine forest, some grasslands such as the chalk Downs, and upland northern moors. The succession of plant communities may be more evident if a specific case is quoted—that of lowland peat-moss. These often begin their history as shallow lakes at first occupied by colonies of submerged and floating hydrophytes. Later the reed-swamp of the margin may invade the middle of the lake, and suppress the earliest colonists. Marsh plants of lower form in turn oust the reed-swamp. Then the whole may become a peat-bog with plant communities characteristic of wet peat. Still later phases may be seen—e.g. *Calluna* on dry peat, birch-wood, and finally pine-wood. That such successions have occurred in the past is proved by numerous investigations on plant remains in the peat-bogs of northern Europe and America.

Plant Ecology in Britain.—The first direct influence came from France, where R. Smith, a Scottish botanist, studied at Montpellier under Ch. Flahault, then engaged in carrying out agricultural and forestry surveys. Between 1897 and 1900 R. Smith published *Plant Associations of the Tay Basin*, and two parts of a Botanical Survey of Scotland—Edinburgh and northern Perthshire. These papers are primary or reconnaissance surveys intended to demonstrate the major plant-communities, and to outline their relation to environmental factors. The maps (scale, two miles to one inch) show types of farmland, forest, moorland, &c., over considerable areas, so that deductions may be drawn as to their distribution in relation to physiography and other factors.

The primary survey has become a conspicuous feature of British ecology, and the published material includes: West Yorkshire (W. G. Smith, C. E. Moss, and W. M. Rankin, 1903), Westmorland (F. J. Lewis, 1904), Forfar and Fife (W. G. Smith, 1905), Dublin District (G. H. Pethybridge and R. L. Praeger, 1905), Somerset (C. E. Moss, 1906), Caithness (C. B. Crampton, 1911), and the Peak District (C. E. Moss, 1913). The methods have an obvious application to agriculture and forestry. The primary surveys have formed a nucleus for more detailed investigations on special plant communities and habitats, especially on woodlands, fen, and lake vegetation. An active school of research on the ecology of coastal plants has been founded at Blakeney point, Norfolk, by F. W. Oliver, a pioneer worker on the vegetation of shingle-beaches and salt-marshes. The work done on British ecology has been conveniently systematised in text-book form in *The Types of British Vegetation*, edited by A. G. Tansley. The study has attracted the attention of many of the younger botanists, and a British Ecological Society has been formed.

Ecology has received a considerable impetus in recent years through the support of the Carnegie Institution of Washington (see the Year-books from No. 16, 1919). F. E. Clements and a number of associates have thus been enabled to carry on extensive investigations bearing on the utilisation of the western United States from the outlook of agriculture and forestry, and important publications have already been issued.

Animal Ecology.—This has advanced more slowly than plant ecology, probably because of the greater difficulty in obtaining a proper viewpoint, and in securing enough data for first principles. In zoology, as in the earlier botany, great attention has been given to the structure of individuals or genetic groups, to comparative

anatomy, and to isolated physiological phenomena, but little has been systematised as regards relation to habitat. The chief ecological effort has been made in America. Thus C. C. Adams, besides publishing numerous observations, has issued a *Guide to the Study of Animal Ecology* (1913), and V. E Shelford, in *Animal Communities in Temperate America* (1913), has provided a model for future work in regional survey with reference to animals. The latter outlines a classification beginning with simple groups of organisms, often a single species, in full agreement as regards life-history and environment. Following on this are increasingly complex groups, including strata and associations leading to extensive formations or groups influenced by climate or topographic age of the habitat. Animal succession on a given habitat is recognised as comparable to plant succession. Considerable importance is naturally ascribed to food-relations, and charts have been prepared illustrating these. The subject is still in its infancy, but the experience gained in plant ecology is evidently being utilised with success.

The Place of Man in Ecology.—In ecological studies it generally simplifies the problem to begin on an area as free as possible from interference by man, but sooner or later this difficulty has to be met. Forest regions everywhere are more or less affected by fire, and wide areas have been exploited for timber or destroyed to make way for farmland. Grasslands in America, Africa, and Asia have been burned since ancient times, mainly to provide food for stock and game, as are our native heather-moors to-day. Thus the ecologist soon becomes an observer of agricultural systems, forestry, game preservation, and rural economy in general. Disforesting means not only the removal of the dominant trees, but also the destruction of the whole forest community, plant and animal, except, perhaps, a few survivors adapted to the new conditions. It is probable that many miles of northern heather-moor were formerly forest supporting a forest population, but now they bear a meagre flora suited for hardy sheep, grouse, the red deer, with the scanty population dependent on these. The forest on the more fertile lowlands has given place to arable fields continuously disturbed and in a state of primary succession, or to areas maintained as grassland by continuous grazing of stock. In more congested districts new problems arise, including the colonisation of roadside and railway banks, waste heaps from mining, and other habitats directly due to man. Again, the distribution of towns and villages is largely ecological. The greater agricultural population follows the more productive soil, and the inland market-town often occupies a place where the corn-grower of the lowlands meets the wool-grower and stock-raiser of the uplands to exchange products. Problems like these can be more easily approached if general principles exist; the discovery and systematising of these is the aim of ecology.

Literature.—The following text-books are provided with full lists of literature: E. Warming, *Œcology of Plants* (1909); A. F. W. Schimper, *Plant Geography upon a Physiological Basis* (1898); F. E. Clements, *Research Methods in Ecology* (Lincoln, Nebraska, 1905) and *Plant Succession* (Carnegie Institution, 1916); A. G. Tansley, *Types of British Vegetation* (1911). New papers are published or fully reviewed in the *Journal of Ecology*.

Economics. See POLITICAL ECONOMY.

Economy (Gr. *oikonomia*, 'household management') is etymologically equivalent to what is usually called Domestic Economy (q.v.); Political Economy (q.v.) is the usual but somewhat inconvenient name for economics or economic science. We speak also of the vegetable economy, the animal economy, the social economy; and theologically the Jewish economy is equivalent to the Jewish dispensation. Economic botany is discussed at PLANTS (*Uses of*).

Écorché (Fr., 'flayed'), a figure in which the muscles are represented, stripped of the skin, for purposes of artistic study.

Écraseur, the name of an instrument invented by M. Chassaignac, and consisting of a stem with a fine chain passed through it, which, passed round any tissues, gradually constricts them, and finally crushes its way through them by means of a screw or rack for tightening it, which is worked at the end of the handle. Other forms of the instrument are arranged for a single wire, or a cord of twisted wires, instead of the chain. The advantage of this instrument over the knife is that it causes little or no bleeding, the torn vessels spontaneously contracting and closing. It is specially applicable to pedunculated growths, such as piles and polypi, but has been used extensively in removal of the tongue for cancer. In the galvanic écraseur the general arrangement is the same; but the wire noose is insulated and connected with a battery, that it may be heated to redness during its passage through the tissues, and may cauterise as well as crush them. As the pain which is caused by this instrument is very great, the patient should be placed completely under the action of an anæsthetic before it is applied.

Ecstasy (Gr. *ekstăsis*, 'displacement,' 'trance'), a word applied to those states of mind which, without amounting to Insanity (q.v.), in respect of the temporary character of the affection, are marked by mental alienation, and altered or diminished consciousness. The varieties of this affection are infinite. In some physical states, as catalepsy, hysteria, mesmerism, a true ecstasy is one of the phenomena, inasmuch as the proper consciousness of the individual is temporarily abolished, or so much changed in character as to lead almost to the loss of the sense of personal identity; and probably the same may be said of the mind in many dreams and visions, and also in somnambulism. Religious ecstasy, in which a man, 'being withdrawn from the senses, is raised to the contemplation of supernatural things,' and may receive the beatific vision, has been recorded of very many modern saints, notably St Teresa. It is represented as accompanied by such phenomena as being raised several feet from the ground (St Philip of Neri, St Ignatius, &c.), and bilocation or double personality. It might be produced by diabolic agency as well as by God. For the literature of the subject, see CANONISATION; and see CONVULSIONARIES, DANCING MANIA. The word ecstasy is loosely used for paroxysms of love, fear, hate; and it has a special sense in the philosophy of Neoplatonism (q.v.).

Ecthy'ma is a pustular disease of the skin, in which the pustules often reach the size of a pea, and have a red, slightly elevated, hardish base. In the course of two or three days after the appearance of the pustule it is replaced by a scab, which adheres firmly to the base, and is somewhat concave. On its removal, a deep red mark, a new scab, an ulcer, or a healed scar remains. The disease may be acute or chronic. The acute form is ushered in by slight constitutional, not amounting to febrile, symptoms, and by a burning or pricking pain at the seat of the eruption, which is most commonly the back and shoulders. The disease runs its course in ten days or a fortnight. In chronic ecthyma, the pustules which follow in crops (often for several months) are usually scattered over the extremities. This form of eruption indicates a low state of the system. It sometimes follows the acute disease, and not infrequently is a tertiary symptom of syphilis. Pustules, which

in no respect seem to differ from those of ecthyma, are produced by various local irritants. Thus the affection of the hands popularly known as *the grocer's itch* is produced by the irritation of brown sugar, perhaps by the *acari* which are so often present in it. Stone-masons are said occasionally to suffer from a similar disease. With regard to *treatment*, the acute form would in most cases doubtless disappear in the course of a fortnight if left entirely to itself; but as the bowels are usually disordered, an occasional alterative aperient, as a few grains of gray powder with a little rhubarb, may be prescribed, and tepid water applied locally gives great relief. The patient should, moreover, be kept on a moderately good, nutritious diet. In the chronic form of the affection a liberal diet is necessary; the use of wine or porter is sometimes desirable; while tonics, such as a combination of bark and nitric acid, are called for. Tepid baths are often useful, and if there is sleeplessness, an opiate should be taken at or shortly before bedtime.

Ectoderm, or EPIBLAST, the external germinal layer of the embryo, giving rise especially to the outer skin, nervous system, and the essential parts of the sense organs in the adult. See EMBRYOLOGY.

Ectozoa, external parasites—e.g. lice, ticks, various crustaceans. See PARASITIC ANIMALS.

Ectropion (Gr., from *ek*, 'out,' and *trepō*, 'I turn'), eversion of the margin of the eyelid, so that the red inner surface (conjunctiva) is exposed. It is generally caused either by chronic inflammation of the conjunctiva, or by scars in the skin near the eye, following wounds, burns, or disease. It is the converse of entropion, and, like it, usually requires an operation for its cure. Recent and slight inflammatory cases, however, may yield to milder measures.

Ecuador', a republic of South America, so named from its position on the equator. Its general outline is cuneiform; bounded on the west by the Pacific, it is inserted like a wedge between Colombia and Peru. It has a seaboard of some 400 miles. Most of the frontier east of the Andes was long disputed, and no two maps agreed in the limits they assigned to the state in this direction. In 1832, however, Colombia's claims to the plateau of Pasto were recognised, and since 1876 the same state has held the river Putumayo; and by the treaty of 1917 Ecuador is now separated from Colombia on the north-east by the watershed between the Putumayo and the Napo. The whole of the Marañon valley is occupied by Peru, but the Peruvian frontier is still disputed. Thus narrowed, the territory of the republic embraces some 100,000 sq. miles, or about half the area of Spain, and barely two-fifths of that usually claimed for it. The state consists of 17 provinces and the territory of Colón—that is, the Galápagos Islands (q.v.), which have an area of 2400 sq. miles. The population was estimated in 1920 at 1,500,000, of whom 400 belonged to the Galápagos. The savage and heathen Indians (*Infieles*) of the east are estimated at from 100,000 to 150,000, but their number is really unknown. The principal cities are Quito, the capital (100,000 inhabitants), Guayaquil, the chief port (100,000), Cuenca (50,000), Riobamba (25,000), Latacunga, and Ambato, the last three names associated with earthquakes of unusual force; good authorities, however, question the accuracy of the returns of population.

Ecuador may be regarded as consisting of three divisions—the lowlands west of the Andes, the mountainous plateau of the interior, and the less elevated forest-country to the east. Besides the main range of the Andes, forming the backbone of the country, there is an outer range extending for about 40 miles, with peaks rising to 15,000 feet; from the cordillera proper numerous long spurs, attaining a height of 14,000 feet, are thrown out towards the east, between which rise great affluents of the Amazon, while the coast-range possesses only short and very precipitous spurs, contributing to the comparatively unimportant Pacific streams. The plateau is cut up by short and broken cross-ridges; on one of these tablelands lies Quito. For the heights of the principal peaks, see ANDES; but it should be noticed that the parallel structure commonly ascribed by geographers to this section of the cordillera has hitherto had an exaggerated importance attached to it, and, as a matter of fact, scarcely exists. The principal mountains of Ecuador either are or have been volcanoes. Tunguragua (16,690 feet) broke out in 1887; Pichincha is by no means extinct; Cotopaxi (q.v.) and Sangai (17,465) are constantly active. In mineral wealth Ecuador has been ranked amongst the poorest states of South America; gold, however, is obtained in the beds of the Amazonian tributaries, and the ore is mined at Zaruma, in the south-west; emeralds, silver, quicksilver, iron, lead, platinum, copper, zinc, salt, asphalt, sulphur, and petroleum occur, as well as an inferior graphite, and fine veins of anthracite have been found in the mountains. Of the coast-streams the principal are the Guayas, or Guayaquil River, and the Río Esmeraldas; east of the Andes the most important rivers are the Napo, with its affluents the Curarai and Coca, the Tigre, and the Pastaza, all flowing into the Marañon. It is estimated that at least 2500 miles of the river-system on the Amazon side are suitable for steamboat navigation, and probably as much more for boats, besides some 500 miles on the western side.

Ecuador is an agricultural country. The dry winds which leave the African coast become saturated as they pass over the Atlantic and up the Amazon; and their moisture is almost ceaselessly precipitated as they approach the snowy peaks of the Andes, producing a dense growth of vegetation on the eastern foot-hills. On the other side also, where the rain-clouds of the Pacific are caught, the gorges of the western spurs become very hot-houses, and most of the land is covered with dark-some forest. Natural *sabanas* or open plains are, however, found on the western lowlands, such as are not met with to the east. Here, in the most prodigal luxuriance of tropical vegetation, valuable trees and plants wage endless war for existence against the stifling embraces of mosses, orchids, parasites, and creepers. With increasing elevation, the sugar-cane *haciendas* and the cacao and orange groves give place to fields of inferior wheat, barley, clover, lucerne, beans, and in some places maize and agave plants, until in the higher stretches of the sierra nothing is met with but lichens and the bare *páramo* grass. The agricultural implements employed are often of the rudest, including in the mountains wooden ploughs, and in the lowlands the *machete* or cutlass; American machinery, however, is imported for the sugar-mills. Sarsaparilla, balsams, rubber, vegetable ivory and wax are collected, and coffee, rice, cotton, tobacco, &c. are grown, but in smaller quantities; while the trade in cinchona, for which bark the world was first indebted to the province of Loja, promises soon to be a thing of the past, owing to the reckless destruction of the trees. The coast rainy season usually extends from December to May, but on the Amazon slope, as already noticed, it rains nearly all the year round. The plateau region and large tracts to the east are comparatively healthy, in spite of the absence of all sanitary measures in the towns and wretched villages; the valleys on the Pacific side

are commonly full of disease. In the interior there is a very small thermometric range, and in temperature a perpetual spring reigns in the uplands; to which much-admired equality of climate, which renders it certain that to-morrow will be like to-day, the incomparable laziness and procrastination of the Ecuadorians has been attributed. The fauna is rich: the mammalia include the jaguar, puma, ounce, ocelot, deer, tapir, peccary, capybara, and several species of monkeys and bats; fish abound, both in the rivers and along the coast; and among reptilia are the boa constrictor, turtles, and alligators, which swarm in the streams, especially on the Pacific side. Chiefly, however, is Ecuador the paradise of birds and insects. The former range from the condor to the humming-bird, and include parrots, partridge, pheasants, snipe, wild turkeys, geese and ducks, herons, and pigeons, as well as the flute-bird and many other song-birds; of the insects and arachnida, besides butterflies innumerable, mosquitoes, scorpions, the tarantula spider, the microscopic 'red tick,' and the maddening Pium-fly are met with, whilst a traveller in the sierra has remarked emphatically that there 'every kind of domestic insect pest known in England exists with the addition of further infinite varieties.' The live-stock includes cattle, sheep, horses, mules, donkeys, and llamas; but cattle do not thrive in the Amazon section—chiefly, perhaps, from the immense number of bats which bleed or otherwise irritate them.

The whites have been estimated, in round numbers, at 100,000 or 150,000, the mixed races at 500,000; the rest are pure Indians, with a small proportion of negroes. The whites, who are the landholders and merchants of the country, are hospitable, courteous, and generally intelligent, but extravagant and innocent of habits of industry; they form a governing class. The half-breeds are the true savages of the country, the Christianised Indians, who belong to the Quichua group, being as a class docile and contented, although till 1918 the law which permitted the Indian who could not otherwise satisfy his creditor to sell himself into slavery reduced great numbers to the unhappy conditions of serfs. The uncivilised tribes inhabit the vast region to the east of the Andes; their chief stems are the independent and warlike Jívaros and Záparos. All religions are now (since 1904) on an equal footing. Till then the state religion was Roman Catholic. The hierarchy includes an archbishop of Quito and six bishops. In no country in the world have the Jesuits had such a paramount influence as in Ecuador, or employed it, on the whole, so well. There are numerous convents, monasteries, and seminaries. Education is compulsory, but still at a low ebb. Quito, however, possesses a university (18th century) and an institute of sciences (1884), and there are universities at Cuenca and Guayaquil, and a college of law at Loja. Public instruction, considering the difficulties the government has had to grapple with, has made creditable headway, hundreds of primary schools, in particular, having been established throughout the country. Technical schools and literary societies also have been founded. The manufactures are sugar, beer, chocolate, timber, coarse cloths, kerosene, ice, spirits from the sugar-cane, and flour or starch from the yuca or cassava root. Guayaquil is famed for its hammocks and Panamá hats, made from the fibre of the 'pita' plant (see AGAVE, CYCLANTHACEÆ). Commerce is sadly handicapped by the want of roads. About 400 miles of railway are open, but there are 4400 miles of telegraph, as well as wireless installations, and there are telephones in Guayaquil, Quito, and elsewhere. A few steamers are in use, but around Guayaquil rafts also are much employed to-day as in Pizarro's time; and, generally, communication is carried on by means of tracks almost impassable in the rains, and goods are conveyed by mules. East of the cordilleras, moreover, the line of route is often not marked even by bare tracks; the road must be forced through pathless forests, along the rough beds of rivers, and over swollen streams, either bridgeless, or spanned by such frail erections as existed when Humboldt visited the country. Nearly two-thirds of the exports, of which the principal are cocoa, vegetable ivory, coffee, hats, hides, and rubber, come through Guayaquil. The imports from Great Britain are chiefly cotton goods.

Constituted as an independent state on the dissolution of Bolívar's Colombia (q.v.), the Republic of the Equator has passed through a succession of violent political changes that would render its history equally difficult and profitless to follow; in his report to congress in 1888 the Minister of the Interior sorrowfully confessed 'our historical tradition is —revolution.' The turbulent career of the despotic little republic, with its complicated series of presidents, supreme chiefs, provisional commissioners, and dictators, has been almost one long insurrection, amid which the nearly equally constant loss of territory has passed unheeded by the factions and their leaders. Under its constitution of 1906 the executive is vested in a president, elected for four years, with a cabinet of five ministers, and a council of state; the legislative power is entrusted to a senate and house of representatives, elected by male citizens who can read and write. There is no vice-president. The state forms six military districts, containing seventeen provinces, which are administered by governors, and subdivided into cantons; and one territory. The standing army numbers some 5000 or 6000. Military service was made compulsory in 1921. There is a navy of three vessels. Of the financial position of the country it has always been difficult to obtain exact and trustworthy information, although evidence has at all times been forthcoming of its chronic and apparently hopeless embarrassment. The expenditure sometimes considerably exceeds the revenue. The liabilities of the republic are heavy, even disregarding unpaid interest; from time to time it is announced that the country is not yet in a position to make any practical offer to its foreign creditors.

See Velasco, *Historia del reino de Quito* (Quito, 1789; French by Ternaux-Compans, Paris, 1840); Humboldt, *Voyage aux Régions équinoxiales*, especially the 'Vues des Cordillères;' Villavicencio, *Geografía de la República del Ecuador* (New York, 1858); Hassaurek, *Four Years among Spanish Americans* (Cincinnati, 1881); Kolberg, *Nach Ecuador* (3d ed. Freiburg, 1885); Stübel, *Skizzen aus Ecuador* (Berlin, 1886); Simson, *Travels in the Wilds of Ecuador* (Lond. 1887); Whymper, *Travels amongst the Andes* (1892); Teodoro Wolf, *Geografía y Geología del Ecuador* (1893); Stanford's *Compendium* (1909); Enock, *Ecuador* (1914); Sievers, *Reise in Peru und Ecuador* (1914); and the Foreign Office reports of Great Britain and the United States.

Ecumenical, from Gr. *oikoumenikos*, 'of' or 'from the whole earth'—*oikoumenē* (*gē*) meaning 'the inhabited (world)'—is a term applied to the general councils of the *universal* church from that of Nicæa onwards (see the article COUNCIL). The 'Apostles' Creed,' the creed of Nice and Constantinople, and the creed of Athanasius are distinguished as the 'ecumenical symbols' of the Christian church. Though the title 'Ecumenical Bishop' was one that originally in the Eastern church might be applied to any patriarch, yet Pelagius II. and his successors in the Roman see persistently protested against its being given in imperial documents to the patriarchs of Constantinople, who had adopted it since 587.

Ec'zema (Gr., from *ekzeō*, 'I boil over') is in this country by far the commonest of all diseases of the skin, and also the most variable in its manifestations. It may be acute or extremely chronic, may affect any portion of the skin, and may occur at any age from infancy to old age.

In typical acute eczema the affected portion of skin is red, and is covered with numerous small papules, which speedily turn into vesicles. These may quickly dry up, but more commonly break, and discharge a clear, glutinous secretion, which hardens and forms scabs or crusts, or if copious keeps the surface in a moist 'weeping' condition. In some cases the vesicles are replaced by pustules, and the discharge is partly purulent. Chronic eczema may follow the acute form, or may arise without an acute stage. Here the skin is thickened and hard, and covered with crusts or scales; deep cracks are sometimes present, especially where the skin is subjected to much movement, as near the joints.

One of the most prominent and important symptoms is itching of the part affected; it is never entirely absent, and in some cases intolerably severe, but in the acute stage is often replaced by a burning sensation; it may precede any visible sign of the disease, and may persist after the skin has resumed its natural appearance. The scratching which it occasions always aggravates the disease, and is often very difficult to prevent. Except in extensive acute attacks, there is no fever and very little constitutional disturbance. The disease is not contagious. When cured it leaves no scar.

Causes of Eczema.—In many cases it is very difficult, perhaps impossible, to assign a definite cause for an attack. Generally speaking, however, the constitutional or predisposing cause is some defect in the digestion or assimilation of the food; diabetic and gouty individuals are particularly subject to the disease. The local or exciting cause may be anything whatever which irritates the skin—e.g. great heat or cold, rough underclothing, handling of certain plants—e.g. the Chinese primrose, bad soap, hard water, arsenical dyes, lice or other parasites, and the scratching they occasion.

Treatment.—There is no specific for eczema; different cases and different stages of the disease require widely different management. Usually both local and constitutional treatment are required to effect a cure. It is of the greatest importance to seek for and attend to any cause which may have given rise to it. The diet must be nutritious, but as simple and unirritating as possible; digestion may require aid from medicines; the bowels should be regularly evacuated, by aperients if necessary; a gouty or any other unhealthy tendency must be counteracted. In obstinate chronic eczema small doses of arsenic are often useful. The use of soap on the part affected must be discontinued, and strained oatmeal gruel, or rice water, or white of egg with boiled water, used for cleansing purposes, but even these as seldom as possible. Thorough removal of scales and crusts by these means, or by oil, or simple bread poultices, is the necessary preliminary to satisfactory local treatment. In the acute stage, where the swelling is great or the discharge profuse, a sedative lotion applied on lint and kept moist by a waterproof covering is generally most useful—e.g. thin starch with a teaspoonful of boracic acid to the pint, soft water with a similar proportion of baking-soda, or dilute lead lotion. In the later stages, when the skin is moist, soothing ointments are preferable—e.g. zinc ointment, zinc and boracic ointments mixed in equal parts, or Lassar's paste, consisting of 10 grains of salicylic acid, 2 drachms of starch, 2 drachms of zinc oxide, and half an ounce of vaseline. The ointment should be evenly spread on linen rag, and kept in close contact with the affected skin. If dry chronic forms do not yield to similar treatment, tar ointment should be cautiously tried; but they sometimes require the use of a strong irritant, as a solution of caustic potash.

Edam, a town in North Holland, 13 miles NNE. of Amsterdam. Its specialty is cheese. Pop. 5000.

Edar (IDAR), a Rajput state of Guzerat in the Mahi Kantha agency within the boundary of the presidency of Bombay, is under a maharaja. Area, 1668 sq. m.; pop. 226,000, mostly Hindus. Its capital is Ahmadnagar (pop. 4000), which has superseded Edar, some 12 miles farther north.

Edda (etymology unknown), the name of two very different collections of old Scandinavian literature. Of these the 'Younger' or prose *Edda* was written by the Icelander Snorri Sturluson (q.v.) about 1230, and was discovered by Arngrim Jonsson in 1628. It consists of three parts: (1) *Gylfaginning* ('the deceiving of Gylfi'), mythological stories told by Odin to Gylfi, a Swedish king, forming the chief source of our knowledge of the Scandinavian theogony; (2) *Skáldskaparmál*, or the Art of Poetry; and (3) *Háttatal*, a system of prosody. Prologues and epilogues are added by later hands. The work contains quotations from about seventy early poets. It is found in three great MSS.—the *Codex Regius* (about 1300), discovered by Brynjulf Sveinsson in 1640; the *Codex Wormianus* (about 1330), so called because it was sent to Ole Worm in 1628; and the *Codex Upsalensis* (about 1300), where the name 'Edda' first occurs. Editions of the prose Edda were published by Resenius (Copenhagen, 1665), Rask (Stockholm, 1818), and Egilsson (Reykiavik, 1848). The most complete is that of the Arne-Magnæan commission (3 vols. Copenhagen, 1848–87), with Latin translation and notes. Finnur Jónsson edited both Eddas, with German notes (1880–90). There is an edition of *Háttatal* by Möbius (Halle, 1879–81); and Bergmann (1861) furnishes a French translation of *Gylfa-ginning*, with prolegomena and critical commentary. There are English translations by Dasent (1842), R. B. Anderson (a selection, 1880), and A. G. Brodeur (1916).

The 'Elder' *Edda* is a collection of lays which contain legends of Scandinavian gods and heroes, and are productions mainly of Iceland, and of different periods from the 9th to the 11th century. It was discovered about 1643 by Brynjulf Sveinsson, who applied the name 'Edda' to this collection also, which he attributed to Sæmund Sigfusson (who lived in Iceland about 1055–1132). The poems belonging to the Elder Edda are thirty-three in number, with prose passages interpolated here and there by the collector. They are on subjects partly of Scandinavian mythology, partly of heroic and legendary history. A few of the latter are derived from legends purely Scandinavian, the remainder treat of heroes common to the Teutonic races. They are written in two forms, distinguished as *kvidhuháttr* (epic metre) and *ljódhaháttr* (didactic metre). The first of these consists of strophes of eight lines, every two of which are connected by alliteration, each line having two (usually two-syllabled) feet, with an accent on each foot; the alliterative initial sounds in the accented syllables being regularly three in number—two in the first, and one (the most emphatic of the three) in the second of each pair of lines, as in Old English poetry (see ALLITERATION). The peculiarity of *ljódhaháttr* is that in it the strophe (*Vísa*) has regularly only six lines, of which the first, second, fourth, and fifth are constructed exactly as in the other form (i.e. they have

two accents, and are connected in pairs by alliteration). The third and sixth lines, however, have each three accents and alliteration of its own, the alliterating sounds in each of these lines being two (sometimes three) in number, and different from those in the two preceding it. The collection now called the Elder Edda was unknown to Snorri, yet almost all the lays are paraphrased or quoted by him in his own work from the oral tradition of his time. The earliest complete editions were those of the Arne-Magnæan commission (3 vols. Copenhagen, 1787–1828), Rask (Stockholm, 1818), and Munch (Christiania, 1847), which were followed by those of Lüning (Zurich, 1859) and Möbius (Leip. 1860). These were superseded by Bugge's edition (Christiania, 1867), on which those of Grundtvig (2d ed. Copenhagen, 1874) and Hildebrand (Paderborn, 1876) are based, now embodied in Vigfusson and Powell's *Corpus Poeticum Boreale* (2 vols. Oxford, 1883). Later editions are Neckel's *Edda* (1914) and Miss Martin Clarke's *Hávamál* (with translation, 1923). There are English translations by Thorpe (1866), R. B. Anderson (Chicago, 1879), and Olive Bray (with text, 1909), H. A. Bellows (with introduction and notes; New York, 1923).

Eddington, Arthur Stanley, astronomer, born at Kendal, 28th December 1882, studied at Manchester and Cambridge, became first assistant at Greenwich (1906) and professor at Cambridge (1913). His writings deal with relativity and gravitation.

Eddoes. See Cocco.

Eddy, Mrs. See Christian Science.

Eddystone, a group of gneiss rocks, daily submerged by the tide, in the English Channel, 9 miles off the Cornish coast, and 14 SSW. of Plymouth Breakwater. The rocks lie in 50° 10′ 54″ N. lat., and 4° 15′ 53″ W. long., and have 12 to 150 fathoms water around. The frequent shipwrecks on these rocks led to the erection of a lighthouse on them by Winstanley, 1696–1700. It was

The New Eddystone Lighthouse.

a wooden polygon, 100 feet high, with a stone base; but the great storm of 20th November 1703 completely washed it away, with the architect. Another lighthouse was built, 1706–9, also of wood, with a stone base, and 92 feet high, by Mr Rudyerd, a silk-mercer. This erection was burned in 1755. The next, noted for its strength and the engineering skill displayed in it, was constructed by Smeaton in 1757–59, on the model, it is said, of the trunk of the oak-tree. It was built of blocks, generally one to two tons weight, of Portland oolite, incased in granite. The granite is dovetailed into the solid rock, and each block into its neighbours. The tower, 85 feet high, had a diameter of 26¾ feet at the base, and 15 feet at the top. The light, 72 feet above the water, was visible at a distance of 13 miles. As the rock on which this tower was built is undermined and greatly weakened by the action of the waves, the foundation of another was laid on a different part of the reef in 1879. The new lighthouse, completed in 1882 by Sir James N. Douglass, F.R.S., is, like its predecessor, ingeniously dovetailed throughout. Owing to the state of the foundation, Smeaton's lighthouse was taken down to the level of the first room as soon as the new one was completed. The removed upper portion was re-erected on Plymouth Hoe, while the lower portion, as shown in the picture, remains intact. See Lighthouse.

Edelinck, Gerard, a celebrated engraver, born at Antwerp in 1649, died in Paris in 1707. He was patronised by Louis XIV., taught the Gobelins tapestry-workers, and produced over 420 plates. See Engraving.

Edelweiss (*Leontopodium alpinum*) is a small but pretty composite found growing in damp places at considerable altitudes (5000 to 7000 feet) throughout the Alps. Its characteristic appearance, due to a covering of long white woolly hairs, is not unfamiliar in English rock-gardens. It became an article of minor commerce, dried as a book specimen made up into little tufts, so that measures were found necessary in Switzerland to prevent its total extirpation from its native haunts. It can be cultivated without much difficulty, and can be seen in many collections of Alpine Plants (q.v.).

Eden, the name given by the Old Testament to the garden or Paradise in which Adam and Eve lived before the Fall. It is described in Genesis ii. 8–15 as a particularly fertile region, containing every tree that is pleasant to the sight and good for food. Many attempts have been made to identify the locality in which Eden was situated. The only assistance which the Old Testament affords us is the description of the river which watered Eden, and its tributaries. After flowing through the garden, the river was parted and became four heads. The names of these four heads are Pishon, Gihon, Hiddekel, and Euphrates. Hiddekel is generally identified with the Tigris. There is much more difficulty about the identification of the other two rivers—the Pishon and the Gihon. The connection which seems obviously to exist between them and the Euphrates and Tigris suggests that they are two tributaries of these rivers, and this is the view that is commonly adopted, though diversity of opinion exists as to their exact counterparts in modern geography. If this theory be deemed satisfactory, the site of Eden must be placed in Babylonia, near the confluence of the Euphrates and the Tigris. Further corroboration of this view is often found in the fact that the plain of Babylonia is called in the Sumerian language *Edinu*—a name which at once suggests Eden. There are two serious difficulties about this theory: (1) There are no rivers as important as the Euphrates and the Tigris which we can identify with the Pishon and the Gihon; (2) the description of the countries through which the Pishon and the Gihon flowed is difficult to reconcile with this hypothesis. The Pishon is described as the river which 'compasseth the whole land of Havilah.'

The term 'Havilah' is used to describe the 'sandy desert' of North Arabia, which extends from Ophir to the neighbourhood of Edom. According to Genesis, Gihon 'compasseth the whole land of Cush,' and the term Cush is usually applied to Ethiopia. From the time of Josephus there has been an unbroken stream of tradition which identifies the Gihon with the Nile. There seems to be less justification for another tradition, also preserved by Josephus, which makes the Pishon equivalent to the Ganges. Those who are anxious to maintain the Babylonian site of Eden urge: (1) That Cush and Havilah need not be used here in their later sense. There is evidence to connect the former name at any rate with Babylonia. (2) We are dealing with prehistoric times, when the configuration of the country was different, and the Persian Gulf extended 80 miles farther inland than it does to-day. Possibly the Persian Gulf, which was originally regarded as a river, may be identified with the Pishon. (3) Possibly there was a Semitic myth which regarded Babylonia as the source of all the important rivers of the world.

Other theories as to the locality of Eden: (1) in the extreme north-east, towards the Altai Mountains (Josephus); (2) in Armenia, between the sources of the Euphrates and Tigris (Bunsen, Keil); (3) in Chaldea (Calvin); (4) in the neighbourhood of Damascus (Le Clerc); (5) in Udyâna, near Kashmir (Renan).

There are similar myths in Babylonian and Indian literature.

Eden, a river rising in the east of Westmorland, in the Pennine Chain. It runs north-north-west through the east of Westmorland and Cumberland, past Appleby and Carlisle, and ends in a fine estuary at the upper part of the Solway Firth, after a course of 65 miles. There is another Eden in Sussex and Kent, a third in Fifeshire, and a fourth in Berwickshire.

Eden, RICHARD (*c.* 1521–76), translator and compiler of geographical and other works, born in Herefordshire, studied at Cambridge under Sir Thomas Smith. He was dismissed for heresy from the English treasury of the Prince of Spain.

Eden, WILLIAM. See AUCKLAND.

Edenhall, the ancient seat of the Musgraves in Cumberland, 4 miles NE. of Penrith, now a school. On the famous 'Luck of Edenhall,' an old painted glass goblet said to have been snatched from the fairies, the welfare of the house depends. It is supposed to have been a chalice, and its leathern case bears the sacred monogram. Uhland's well-known ballad, *Das Glück von Edenhall*, has carried its fame beyond the British Islands.

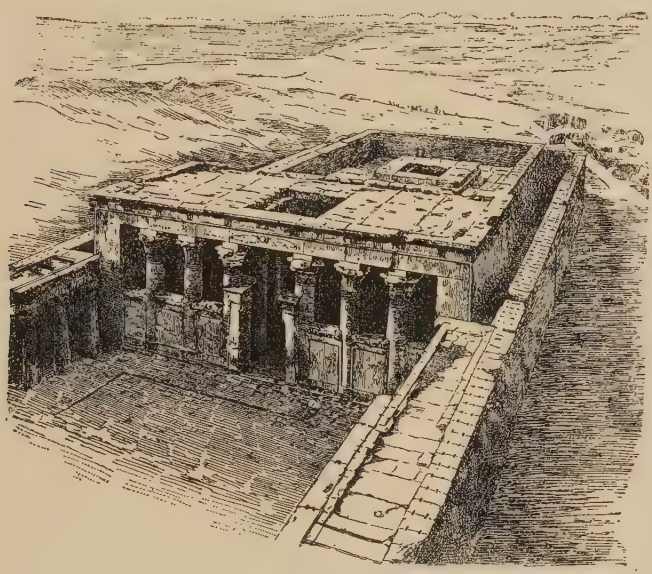
Edentata (Lat., 'toothless'), a primitive order of placental mammals, probably including at least two distinct orders—(*a*) the New World Sloths (q.v.), Ant-eaters (q.v.), Armadillos (q.v.), and extinct types like Megatherium (q.v.) and Glyptodonts; (*b*) the Old World Pangolins (q.v.) and Aard-varks (q.v.). Almost the only general characters that can be given concern the teeth. These are quite absent in ant-eaters, and rudimentary in pangolins. In the other types they are uniform, usually simple, without roots, with no more than hints of enamel, and never present in the front of the mouth.

Edessa, earlier known as Aigai, was, till superseded by Pella, the capital of ancient Macedonia, and continued long afterwards to be the burial-place of the Macedonian kings. Little remains of the city, whose site is occupied by Vodena (q.v.).

Edessa (Arabic *Er-Ruha*, called by travellers *Urfa*), a very ancient city, fabled to have been founded by Nimrod, in the north of Mesopotamia, between Aleppo and Diarbekir, 78 miles SW. of the latter town. Of its early history we know little, but with the conquest of Persia by the Greeks the history becomes less obscure. Seleucus, in particular, is said to have done much for the improvement of the city. Christianity was introduced into Edessa at an early period. In the reign of Trajan, the city was made tributary to Rome, and in 216 A.D. became a Roman military colony, under the name of *Colonia Marcia Edessenorum*. During this period, its importance in the history of the Christian church continued to increase. More than 300 monasteries are said to have been included within its walls; it was the seat of Ephraem Syrus (q.v.) and his school, and played an important part in the Arian and other controversies. Here, moreover, the famous portrait of Christ, supposed to have been painted by St Luke, and sent by the Saviour himself, with a letter, to Abgar (q.v.), king of Edessa, was preserved, till it was carried in 944 to Constantinople, and thence to the church of St Bartolommeo in Rome. Edessa was conquered by the Moslems in the seventeenth year of the Hegira, 638 A.D. Christianity declined, and wars at home and abroad during the khalifate destroyed much of its temporal splendour and prosperity. It was long held by the Arab tribes of Hamdân and 'Okeyl. The Byzantine emperors succeeded in recovering Edessa for a time in 1031, but the Seljuk Sultan, Melik Shah, retook it in 1086. There was always a strong Christian element in the population, and it was due to this that the city opened its gates to Baldwin, the brother of Godfrey of Bouillon in 1097, who made it the capital of a Latin principality and the bulwark of the kingdom of Jerusalem. Under the Frankish princes, Edessa held out valiantly against the Mussulmans, till at length 'Imâd-ed-dîn Zengi, ruler (*atabeg*) of Mosul, succeeded after a siege of a month, and several unsuccessful assaults, in taking the town and citadel in the year 1144, when the conqueror was so struck with the beauty and magnificence of the city that he withheld his men from sacking it. An attempt, however, of the Christian section of the inhabitants to betray the place to Joscelin in 1147 brought about the ruin of Edessa; the Christians were defeated by Nûr-ed-dîn; the city was laid waste; and all who were not massacred were sold as slaves. In 1182 Saladin added Edessa to his already extensive empire, and it was passed on to his kinsmen. After many vicissitudes, in the course of which Edessa fell successively into the hands of sultans of Egypt, Mongol emperors, Turkomans of the White Sheep, and Persian shahs, the city was finally conquered by the Ottoman Sultan, Selîm I., in 1515, and has ever since formed a portion of the Turkish dominions. It now contains perhaps 40,000 inhabitants. The large Armenian Christian population has been much reduced by massacre; the rest are Turks, Arabians, Kurds, and Jews. Edessa has numerous mosques and bazaars; manufactures of cotton and silk goods, goldsmiths' wares, and morocco leather, and a large trade in corn, wool, horses, &c. Easterns, to whom it is the residence of Abraham, regard it as a sacred city.

Edfu (Coptic *Atbô*, Egypt. *Teb*, Lat. *Apollinopolis Magna*), a town of Upper Egypt, is situated on the left bank of the Nile, in 24° 56′ N. lat., and 32° 53′ E. long. It contains the remains of two temples, the larger of which is the best preserved monument of its kind in Egypt. It was founded by Ptolemy IV Philopator rather more than two centuries before Christ, and added to by his successors down to Ptolemy XIII Dionysus, a period of 170 years. The general plan of the temple resembles that of Dendera (q.v.). Its length is 451 feet, the breadth of its façade is 250 feet. Its

entrance is by a gateway 50 feet high, between two immense truncated pylons, 37 feet wide at the base, and 115 feet high, the whole surface covered with sculptures and inscriptions in low relief. This splendid façade is visible from a great distance, and is one of the most commanding sights in the Nile valley. Passing through this entrance, a court is reached; it is 161 feet long, and 140 feet wide, inclosed by a splendid colonnade of 32 columns of every variety of capital, and surrounded by walls, between which and the pillars there is a stone roof, forming a covered portico. The interior of this



View of the Temple at Edfu, from the top of the pylon.

court was to a great extent filled up with rubbish, and occupied by wretched dwellings, many of which also were built upon the roof of the temple; but these were all cleared away by Mariette in the khediviate of Ismail, and now the effect of the whole is grand and imposing, impressing the mind with the harmony and beauty of the design. From this court opens a hypostyle hall of 18 columns, joined by an intercolumnal screen, through which access is obtained to an inner hall of 12 columns, leading to the sanctuary, where a great monolith of gray granite was evidently intended to encage the hawk, the sacred emblem of Hor-Hud, the local Horus (q.v.), to whom the temple was dedicated. The sanctuary and surrounding chambers, together with the outer and inner halls, are separated by an open corridor from the outer wall of the temple, and both sides of this passage are covered with elaborate but monotonous reliefs and numerous inscriptions which present a sort of encyclopædia of ancient Egyptian geography, ritual, and ecclesiastical topography, with calendars of feasts, lists of divinities in the various names and cities, and even a species of church directory, including the names of singers and other temple officials. The smaller temple, erected by Ptolemy Physcon and Lathyrus, consists only of two chambers. Edfu has at present a population of about 20,000. Its manufactures are blue cotton cloths, and earthenware similar to the ancient Egyptian pottery.

Edgar, king of Scotland (1097–1107), born in 1072, son of Malcolm Canmore, fled to England from Donald Bane (1093). See SCOTLAND.

Edgar, or EADGAR, king of the English from 959 to 975, was born in 944, the younger son of Edmund the Magnificent. After his elder brother's accession to the throne, Edgar in 957 was made ruler over Northumbria and Mercia, and two years later, on his brother Eadwig's death, became king of Wessex in addition. His reign, the policy of which was largely shaped by Dunstan (q.v.), was one of almost unbroken peace and prosperity; the Danes were conciliated, the monastic system was reformed, and the laws were strictly administered. Thus the epoch of Edgar the Peaceful was one which greatly favoured the work of national consolidation, the fusing together of the Danish, Saxon, and Mercian elements existent in the country.

Edgar the Atheling, grandson of Edmund Ironside, was born probably before 1057 in Hungary. His life may be epitomised as a series of abortive attempts. Selected by Edward the Confessor as his prospective heir, he was kept out of the throne by William the Conqueror (1066); having twice engaged in the northern revolts against the Norman, he was twice compelled to take refuge in Scotland, with Malcolm Canmore, who married Edgar's sister Margaret; then, embracing the cause of Robert, Duke of Normandy, against William Rufus, he was driven away (1091) from the duchy to Scotland; then he embarked (1099) in a bootless crusading expedition to the East; and finally was taken prisoner at Tenchebrai (1106) fighting for Duke Robert against his brother Henry I. Almost the only successful achievement of his life seems to have been that of reseating his nephew Edgar on the throne of Scotland (1097), which had been usurped by Donald Bane. His last days were spent in obscurity; the date of his death is not precisely known.

Edgehill, a hill-ridge on the border of Warwick and Oxford shires, 14 miles SSE. of Warwick. A tower, erected in 1760, marks the scene of the first great battle of the Civil War, which was fought on Sunday, 23d October 1642, between 12,000 royalists under Charles I. and 10,000 parliamentarians under the Earl of Essex. It was the intention of Charles, who had been lying at Shrewsbury, to march upon London; and Essex, who had thrown himself into Worcester, marched forward to intercept him, and entered the Warwickshire village of Kineton on the evening of the 22d. Next morning, the royalist army was discovered a little in advance, and drawn up in order of battle on the elevation of Edgehill, 3 miles to the south-east. The king's forces had the advantage in numbers and in cavalry, as well as in position; Essex, however, had the more formidable train of artillery. The royalists began to descend the hill about two o'clock, and Prince Rupert, who led the right wing, charged with his cavalry the left wing of the parliamentarians, broke it, and pursued it to Kineton. This was the fatal movement of the day. The right wing of the parliamentarians had charged and recharged with the greatest success, until, after some stubborn fighting around the royal standard, the royalist infantry broke and retreated toward the hill, and Rupert's cavalry were not available. The result was indecisive, the royalist loss being heaviest, but the advantage on the whole was with the king's forces.

Edgewater, a former village of Staten Island, since 1897 has been included in Richmond Borough of New York City.

Edgeworth, Henry Essex, the 'Abbé Edgeworth,' was born in 1745. His father then was the Protestant rector of Edgeworthstown, but three years later turned Catholic, and, quitting Ireland, settled at Toulouse. There and at the Sorbonne young Edgeworth was trained for the priesthood; at his ordination he assumed the surname De Firmont from Firmount, the family property. Having declined preferment in Ireland that he might continue to minister to his countrymen in Paris, in 1791 he became confessor to the Princess Elizabeth, in 1793 to her brother, Louis XVI., just sentenced to death. He bravely attended him to the very foot of the scaffold; but the 'Son of St Louis, ascend to heaven,' was an invention, it seems, of the journalist Lacretelle. After many escapes he got safely to England (1796), and presently became chaplain to Louis XVIII. at Mitau, where he died of a fever, caught attending French prisoners, 22d May 1807. See his Memoirs by C. Sneyd Edgeworth (1815), and his Letters (1818).

Edgeworth, Richard Lovell, Miss Edgeworth's father, was born at Bath, 31st May 1744. He came of a family that for 160 years had been settled in Ireland, at Edgeworthstown, County Longford. After nine years' schooling at Warwick, Drogheda, and Longford, then five months of dissipation at Trinity College, Dublin, in 1761 he was removed to Oxford, where, as a gentleman-commoner of Corpus, he passed two 'delightful, profitable' years. At Blackbourton, 14 miles distant, lived a friend of his father's, Paul Elers, a squire whose quiver was fuller than his purse: with one of his daughters Edgeworth eloped to Scotland (1763). The young couple spent a twelvemonth at Edgeworthstown, and finally settled at Hare Hatch, near Reading, Edgeworth meanwhile keeping terms in the Temple, till his father's death (1769) allowed him to give up all thought of the bar. As a boy of seven he had become 'irrecoverably a mechanic' through the sight of an electrical machine; and his whole life long he was always inventing something —a semaphore, a velocipede, a pedometer, and so forth. One of his inventions brought him across Dr Darwin; and at Lichfield, the Christmas-tide of 1770, he conceived a passion for lovely Honora Sneyd. His wife was away in Berkshire ('she was not of a cheerful temper'); but Thomas Day (q.v.) was with him, and urged him to flight. So with Day and his eldest boy, whom he was educating on Rousseau's system, he did fly to France, and at Lyons diverted himself and the course of the Rhone. Then his wife died, and four months afterwards he wedded Honora (July 1773), to lose her in 1780, and the same year marry her sister Elizabeth. She too died of consumption (1797); but the next wife, Miss Beaufort (1798), survived him by many years. In all he had nineteen children. 'I am not,' he observed, 'a man of prejudices. I have had four wives. The second and third were sisters, and I was in love with the second in the lifetime of the first.' Of his life besides not much more need be told. He advocated parliamentary reform and Catholic emancipation; his house was spared by the rebels (1798); and in the last Irish parliament (1798–99) he spoke for the Union, but voted against it, as a measure 'forced down the throats of the Irish, though five-sixths of the nation were against it.' He died 13th June 1817. Masterful, versatile, brilliant, enlightened, he stands as a type of the Superior Being; 'cocksureness' his principal foible. He was the idol of his own womankind, the friend too of Watt and Wedgwood and many more better and greater than himself.

Maria Edgeworth, novelist, was born at Blackbourton, on New-year's Day 1767, and in 1775 was sent to a school at Derby, in 1780 to a fashionable establishment in London. As quite a child she was famed for her story-telling powers, and at thirteen wrote a tale on Generosity. 'Excellent,' said her father, 'and extremely well written; but where 's the generosity?' She accompanied him to Ireland in 1782, and thenceforth till his death the two were never separate. For his sake and that of her other dear friends and her country she sacrificed her one romance—refused the Swedish count, M. Edelcrantz, not without much suffering then and long afterwards. This was in 1802 at Paris, where, as again in 1820, and during frequent visits to London, she was greatly lionised. She was at Bowood (Lord Lansdowne's) in 1818, and at Abbotsford in 1823, Scott two years later returning the visit at Edgeworthstown. For the rest, her home life was busy and beneficent, if uneventful. Her eyesight often troubled her; but at seventy she began to learn Spanish, at eighty-two could thoroughly enjoy Macaulay's History, and even mount a ladder to take the top off the clock. She died in her stepmother's arms, 22d May 1849.

To the literary partnership between Mr and Miss Edgeworth we are directly indebted for *Practical Education* (2 vols. 1798), and the *Essay on Irish Bulls* (1802). But most of her other works, though they do not bear the joint names, were inspired by her father, and gained or (it may be) lost by his revision. Published between 1795 and 1847, they filled upwards of 20 volumes. Besides the *Tales from Fashionable Life* and *Harrington* (an apology for the Jews), there are her three Irish masterpieces, *Castle Rackrent* (1800), *The Absentee* (1812), and *Ormond* (1817). These, Scott says, 'have gone so far to make the English familiar with the character of their gay and kind-hearted neighbours of Ireland, that she may be truly said to have done more towards completing the Union than perhaps all the legislative enactments by which it has been followed up. Without being so presumptuous as to hope to emulate the rich humour, pathetic tenderness, and admirable taste which pervade the works of my accomplished friend, I felt that something might be attempted for my own country of the same kind with that which she has so fortunately achieved for Ireland.' The praise from Scott is extravagant; but Turgenief, too, has recorded how he 'was an unconscious disciple of Miss Edgeworth in setting out on his literary career. . . . It is possible, nay probable, that if Maria Edgeworth had not written about the poor Irish of County Longford and the squires and squireens, it would not have occurred to me to give a literary form to my impressions about the classes parallel to them in Russia.' Yes, her novels are too didactic; the plots may be poor, the *dramatis personæ* sometimes wooden; the whole may have too much the tone of a moral Lord Chesterfield; but for wit and pathos, for lively dialogue and simple directness, for bright vivacity and healthy realism, as a mirror, moreover, of the age when they were written, and of that 'most distressful country' in which their best scenes are laid, they still deserve to be read, by subscribers even to Mudie's. And her children's stories—'Lazy Laurence,' and 'Simple Susan,' and the other delightful old friends—are worth all the unchildish books about children which a mawkish sentimentality has brought into recent vogue.

The *Memoirs of Richard Lovell Edgeworth* (1820; 3d ed. 1844) are autobiographical up to 1782; the completion, less interesting, is by Miss Edgeworth. Of herself there is a Memoir (privately printed, 3 vols. 1867; edited by Aug. J. C. Hare, 2 vols. 1894), on which are founded the Life by Helen Zimmern ('Eminent Women' series, 1883) and the exquisite sketch by Miss Thackeray [Lady Richmond Ritchie] in her *Book of Sibyls* (1883). See, too, the monograph by the Hon. Emily Lawless (1904).

Edgings are indispensable to neatness in garden ing, except where parterres are cut out of a lawn,

but more especially to separate gravel-walks from cultivated ground. They are sometimes made of stone, or of deal, of ornamental wire and cast-iron work, and very frequently now of terra-cotta tiles in elegant patterns. Living edgings are, however, always to be preferred where they can be adopted, because they are almost invariably most pleasing and characteristic of gardening. For this purpose many low-growing evergreen shrubs are used in Britain, such as dwarf box, Cotoneaster, Pernettya, Erica, ivy, and latterly some remarkably neat and pretty dwarf Veronicas from New Zealand. Among herbaceous plants commonly used for edgings may be noted double-flowered daisies, thrift or sea-pink, gentianella, saxifrages, and many others which when in flower are highly beautiful. The only drawback in connection with these is that they require frequent, almost annual renewal. Turf-edgings are sometimes employed for wide flower-borders.

Edgware, a village of Middlesex, 11¼ miles NW. of King's Cross station, stretching for about a mile along the highway. In a forge here, where he had taken refuge from the rain, Handel conceived his 'Harmonious Blacksmith.'

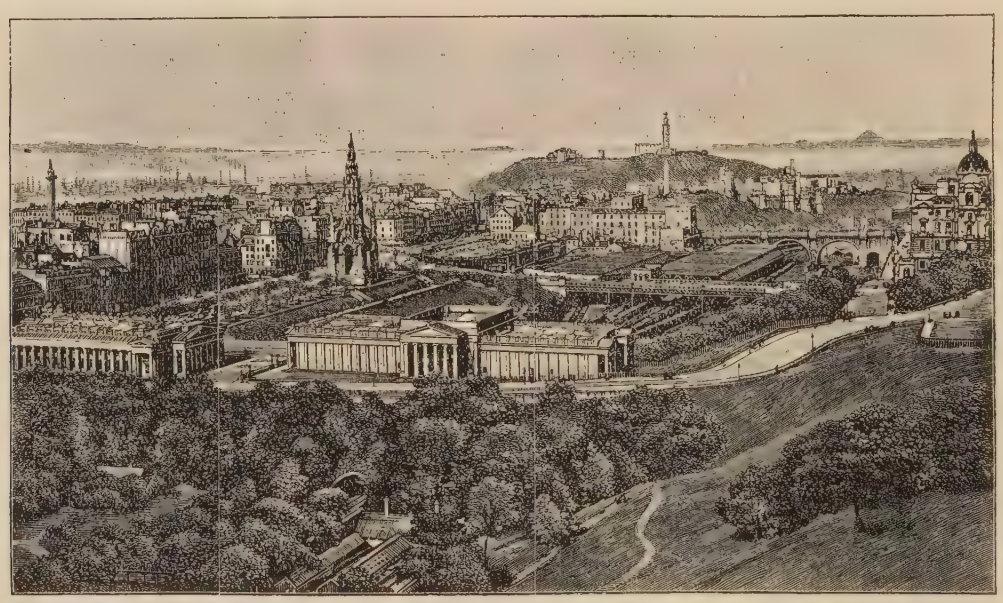
Edicts were issued by all the higher magistrates of Rome, especially by the Prætors (q.v.), and ultimately contributed its most valuable element to Roman Law. For the Edict of Nantes, see HUGUENOTS, NANTES.

Edinburgh, capital of Scotland and county town of Midlothian or the county of Edinburgh, has since 1482 been itself a county of a city. It stands 393 miles NNW. of London by rail, and 46 E. of Glasgow (43 direct distance), in 55° 57′ N. lat. and 3° 11′ W. long. More than most capitals, Edinburgh has concentrated in and around itself a large part of the national history, and is the pride of the country in virtue of beauty of situation, the romantic events that have taken place within its walls, the fame of its citizens in literature, science, and art, and the glamour shed on place and people by the writings of its most faithful son and citizen, Sir Walter Scott, and added to by another native, Robert Louis Stevenson. Edinburgh has been called the 'Modern Athens' in reference partly to the situation on hills near the sea and to its literary distinction in the 18th century. The town stands on a series of ridges looking down upon the Firth of Forth, and is overlooked by Arthur Seat (q.v.), and by the north-eastern end of the Pentlands (up to 1617 feet), and other hills (see EDINBURGHSHIRE), now within the city boundaries. Of hills within the area of streets the highest are the Castle Rock (437 feet) and the Calton (349). Although the Castle Rock, which for centuries was considered an almost impregnable fortress, must have been a place of refuge and of arms from the earliest times, the city is not conspicuous very early in the history of this part of the country, which in Roman times was unquestionably occupied by a British or Welsh (not Gaelic) people, the Otadini, apparently a branch of the Brigantes. On the removal of the Romans it was no doubt exposed to the incursions of the Picts from the north, and may have been occupied by them. But about 617 it was conquered and held by Edwin, king of Northumbria, was doubtless fortified as an outpost against the northern raiders, took its name from the Anglian king, and for centuries formed an integral part of the great Northumbrian kingdom. It is doubtful if during the Danish troubles in the 10th century Edinburgh was taken possession of by the Scoto-Pictish kings; it did not formally become part of the northern kingdom till after the battle of Carham in 1018, when the Northumbrian kingdom had been destroyed by the Danes and Cnut was king in the south. Lothian was ceded by the Northumbrian earls to the king of Alba, but remained then and since Anglian in speech and population. The Gaelic name Dun-Edin is merely a Gaelic translation of Edwinesburg or Edwinesburch, the name we find in the charters of David I. (1128–47) and the history of Symeon of Durham. The old British name seems to have been Dyn Mynedd or Mynyd Agned; the late tradition that the castle was called *Castrum Puellarum*, and was a place of safety for Pictish princesses, is a fable. Christianity is believed to have been introduced, as into other parts of Lothian, in the reign of Oswald (634–642); the first church of the oldest Edinburgh parish is said to have been built about the end of the 7th century on the site where St Cuthbert's Church now stands. In the end of the 11th century, its castle figures in the story of St Margaret, queen of Malcolm Canmore, and the little Norman chapel on the summit of the rock, dedicated to her memory, is the oldest building connected with the city. Excavations below it have disclosed remains of earlier buildings. In 1128 David I. founded the abbey of Holyrood, about a mile east of the castle, on the site of a much earlier church, whose foundations have been discovered, and round it grew up the little burgh of the Canongate, which maintained its separate municipality until 1856, when it was incorporated with Edinburgh.

To the east of the castle, where the ground slopes down from the rock in a narrow 'hog's-back' (see the article CRAG AND TAIL, and the cut there), grew up the town of Edinburgh. In 1329 it was made a burgh by Robert the Bruce, by a charter which also granted the town the right of establishing a port at Leith, 2 miles distant. Thus began the vassalage of the port to the capital town, which continued until 1833, when Leith was by Act of Parliament made a burgh, thereafter enjoying independence till it was annexed in 1920 (see LEITH). It was, however, during the 15th century, under the Stewart dynasty, that Edinburgh began to be recognised as the capital, and parliament regularly met here; at first within the great hall of the castle, and afterwards in the City Tolbooth, until in 1631 the Parliament House, which still stands, was erected. James IV. and James V. confirmed its choice as the capital by building a palace within the abbey of Holyrood; and by establishing in it, in 1532, the Court of Session (q.v.) as a supreme court of justice for Scotland. In 1450 the first wall was built; and in 1513, after the defeat at Flodden, an extended wall was erected to include the suburb of the Cowgate, which had meantime arisen in the valley to the south. For two centuries and a half the town remained stationary in size, consisting of two long streets, the High Street (which was continued without the walls by the Canongate) and the Cowgate; while from these branched off numerous narrow lanes, called 'wynds,' which were also lined with houses. The town was defended on the west by the castle; on the north by a morass, called the 'Nor' Loch;' and on the east and south by the city wall. As the population increased, the houses rose higher and higher, being built of the splendid freestone of the surrounding country, until the town abounded in great 'lands' of houses, which, being erected on the steep sides of the 'hog's back,' had entrances from two levels, and rose to ten, twelve, and even fourteen stories in height. This is the historic city; and it entered on the most remarkable period of its history with the birth of Queen Mary. In 1544 it was burned to the ground by the English under Hertford, scarcely a building outside the castle, save St Giles' Kirk, escaping. In 1560 the drama of the Reformation began in Edinburgh, and John Knox became the city minister; in 1561 Queen

Mary returned a widow from France, and there was acted, chiefly in Edinburgh, the striking tragedy of her short reign, which has given subject-matter to historian, poet, dramatist, and novelist. It was at Holyrood Palace that Rizzio was murdered, and in the castle James VI. was born; in the Kirk-of-Field, where the university now stands, Darnley was killed, and in the Chapel Royal of Holyrood Mary was married to Bothwell. In 1582–83 the university was founded, and the town which George Buchanan had already made known to the learned began its academic life. In 1603 James VI. left Scotland to ascend the English throne, and although parliament still continued to meet in it, the town was shorn of much of its importance. In literature the successors of William Dunbar and Gawin Douglas died out. Edinburgh was the scene of many of the fiercest episodes in the long ecclesiastical struggle of the 17th century; and its Cross witnessed the execution of Montrose in 1650, and of Argyll and his brother Covenanters after the Restoration.

The Union of 1707, which emptied the Parliament House of its legislators, and drew away the Scottish nobility from their Edinburgh mansions, was very unpopular, and the citizens long remained discontented. The Porteous mob, which Scott has made famous in the *Heart of Midlothian*, showed the spirit abroad, and many of the townsmen welcomed the Pretender, and rejoiced for a brief season in the glories of the court which he held at Holyrood Palace, in 1745. But the Rebellion was followed by the inroads of modern enterprise. Shortly after the middle of the century the Town Wall was broken down in every direction, until but little now is left, save one of the towers built into the west boundary wall of Heriot's Hospital; the Nor' Loch was drained; and when the North Bridge was erected, in 1763, access was given to the northern slopes, on which arose the New Town



Edinburgh in the later 19th Century.

(a new iron North Bridge was built in 1895–96). In 1785 the valley to the south, in which lies the Cowgate, was bridged, and the town spread southwards. In 1815–19 another bridge was thrown over a deep hollow on the north-east, and the Calton Hill was connected with the city; while a few years later a bridge was built across the Cowgate parallel to the one already erected. Thus the city connected the country on north and south with the narrow ridge topped by the castle, on which she had stood for centuries. Meanwhile a greater intellectual revolution had awakened the deadness of the early 18th century. There spread northwards the wave of scientific research which rose in England in Charles II.'s reign, and resulted in the establishment of the Scottish school of medicine, of which Alexander Monro was the founder. In this important movement the town assisted materially by the foundation, in 1738, of the Edinburgh Royal Infirmary, the joint work of Monro and Lord Provost Drummond. Closely following the scientific came the mainly literary revival which has made the town known over the world. In the 18th century lived Allan Ramsay and Robert Fergusson, the forerunners of Robert Burns, and then followed Robertson the historian, David Hume and Adam Smith, James Hutton, Professors Dugald Stewart and John Playfair, Sir Henry Raeburn, and many lesser celebrities, such as Henry Mackenzie and Tytler, Lord Hailes and Hugh Blair. But her greatest literary period was reached when Walter Scott was writing his novels, and when the *Edinburgh Review* was started by Jeffrey, Sydney Smith, Brougham, and Horner, and *Blackwood's Magazine* by the brilliant coterie led by John Gibson Lockhart and John Wilson (Christopher North). Carlyle and De Quincey carry the succession to Stevenson.

The old historic houses of the Old Town have been largely cleared away. The New Town is regularly laid out; it contains many handsome streets and squares, ornamented with gardens; and its houses are mostly lofty and built of fine freestone. The suburbs, especially the southern, contain a great extent of villa-houses, and much rural country is included within the boundary, so that the town covers a wide space for its population—has, in fact, a greater area than Glasgow. It is also especially fortunate in its open spaces and public parks. Princes Street Gardens occupy the site of the old Nor' Loch, at the foot of the Castle Rock; the range of the Meadows and Links—the remains

of the once extensive Burgh Muir—divides the town proper from the southern suburbs; the old royal hunting-ground attached to Holyrood—the King's Park and Arthur's Seat—is open to the citizens; while on the north is the Botanic Gardens, with the Arboretum; on the south Blackford Hill and the Braids have been added to the town property devoted to recreation; and on the west the Zoological Society of Scotland has its park on the wooded Corstorphine Hill. The view obtained from the top of either Arthur's Seat or Blackford Hill is very noble and extensive; that from the latter is finely described in *Marmion*.

Edinburgh is still in some measure the capital of Scotland: it is the seat of the Supreme Courts and of some of the departments of government; in it are held the General Assemblies of the Scottish churches; and the military headquarters for Scotland are also stationed in it. It contains the head-offices of the principal Scottish banks; of some of the largest of the Scottish insurance companies, which are among the greatest institutions of their kind; and of many other financial companies trading in Scotland and even more largely in the colonies. It is the centre of much of the intellectual life of Scotland, being the home of the Royal Society of Edinburgh, of the Royal Scottish Academy of Fine Arts, of the Scottish Society of Antiquaries, and of many other literary and scientific societies. Its leisured class, which is a large one, is partly composed of Scottish landed proprietors, but much more extensively recruited from those who have returned from abroad after acquiring affluence; while the tone of its society is in great measure given by the legal bodies which practise before its Supreme Courts, and by the staff connected with the university. At the head of its legal bodies is the Faculty of Advocates or barristers, which has always included many of the most distinguished Scottish writers and politicians; then come the Society of Writers to the Signet, and the Solicitors before the Supreme Court. There are also important societies of Accountants and Actuaries. Since the middle of the 18th century it has been celebrated for its physicians and surgeons, many of whom have been known for strong character as well as scientific knowledge. These and other circumstances tend to make Edinburgh very much a place of residence, with a large well-to-do population.

It has been long known for its educational institutions, and these draw many inhabitants to the city for the benefits they offer. At the head of these is, of course, the university, and there are besides various colleges for instruction in medicine, theology, art, teaching, veterinary science, agriculture, &c., and a City Observatory. The High School and the Academy, and many of its private schools, have also attained a high reputation; but the most noteworthy feature perhaps is the exceptionally large sum which is annually derived for educational purposes from bequests left by citizens. These endowments were largely diverted for secondary education in the last third of the 19th century. Among the principal are the trust founded by George Heriot in Charles I.'s time, whose income is applied by the Act of 1885 to the maintenance of the Heriot-Watt Technical College and of George Heriot's School; the trusts under the charge of the Merchant Company of Edinburgh, applied principally to middle-class education; and the Fettes endowment, applied to higher-class education on the English model. In Libraries (q.v.) Edinburgh is rich, having besides the University Library, the magnificent national collection of over 700,000 volumes taken over in 1925 from the Faculty of Advocates, and the valuable library of the Society of Writers to the Signet, amounting to about 100,000 volumes; a free public library was erected in 1887–89, the building being a gift of Mr Andrew Carnegie of Pittsburg. The city is known for its many religious, charitable, and philanthropic societies and institutions. Perhaps the greatest of these is the Royal Infirmary, 'open to the sick and hurt of all countries.' It has received great sums from gifts and legacies, and may almost be said to be the *ultimus hæres* of all connected with the city who die without immediate heirs. It is a necessary adjunct to the great medical school, and is considered one of the most admirably appointed hospitals in Europe.

The city ranks as a county in itself, and is under the management of a corporation of seventy-one members, who elect from their number a Lord Provost and ten magistrates, called bailies. The Lord Provost, who serves for three years, takes the title of 'Right Honourable,' is Lord-lieutenant of the city and Admiral of the Firth of Forth, and nominates deputy-lieutenants and justices for the city.

Edinburgh, as a residential town, is probably the most important shopkeeping centre out of London; it is not in any great measure a manufacturing town, its most important industries being brewing and publishing. It has been known for its printers since the early years of the 16th century, when Walter Chepman, under the patronage of James IV., set up the first Scottish printing-press. The publishing of books, with the subsidiary businesses of printing, lithography, bookbinding, and type-founding, is now a most important industry; and much printing is done for London houses. It is a centre for the paper-trade, as there are many important paper-mills in the immediate neighbourhood. See BOOK-TRADE. There are also very important distilleries, and large india-rubber manufactories, biscuit, chemical, and glue works, and extensive nurseries for trees and shrubs.

Edinburgh has many buildings famous in history, or important from their architectural merit. The Palace and Abbey of Holyrood (q.v.) are a memorial of the old Scottish monarchy. The castle comprises David's Tower, the old Parliament Hall, restored (1889–92) by the late Mr William Nelson, publisher, and the Queen Mary portion containing the Scottish regalia. The garrison was withdrawn in 1923 to make way for a war memorial. St Giles' Church, the old parish church of Edinburgh, dating most of it from the 15th century, was restored by Dr William Chambers (q.v.), the work being completed in 1883. The Parliament House, erected in 1633 for the Scottish parliament, is now used as the 'Outer House' of the Supreme Courts, and adorned with many fine portraits and statues belonging to the Faculty of Advocates. 'John Knox's House' was perhaps occupied by the great Reformer whilst minister of the town. George Heriot's Hospital (or School) is a beautiful 17th-century building. Many of the modern buildings are fine. The Episcopal Cathedral of St Mary's, opened in 1879, is one of the largest churches built in Britain since the Reformation. Buildings in the Greek style are numerous, and include the National Gallery, the Royal Scottish Academy, and the National Monument, all by W. H. Playfair. The Usher Hall (1911–13) is the gift of Mr Andrew Usher (d. 1898). The Medical Schools and the Infirmary occupy a noble range; while many of the museums, banks, insurance-offices, clubs, hotels, and public schools are fine buildings. Among many monuments stands out the Gothic cross in memory of Sir Walter Scott. The water-supply, first brought from Comiston in 1674, was wholly derived from the northern slope of the Pentlands, till in 1905 a copious source at Talla in Peeblesshire was made available. The municipal slaughter-houses were removed to Slateford (then without the city) soon after. Pop.

(1831) 136,548; (1881) 236,002; (1911) 320,318; (1921) 420,264. Edinburgh is divided, for municipal purposes, into twenty-three wards, Portobello (q.v.) having been incorporated in 1896, Granton in 1900, and Leith in 1920, when Cramond, Corstorphine, Colinton, Liberton, Gilmerton, and other villages, with much rural country, were also added, bringing Edinburgh's area from 10,877 to 32,401 acres. The parliamentary burgh, including since 1918 Musselburgh and Portobello, has five divisions, with five members. Leith remains a parliamentary burgh with one member; and the districts added in 1920 remain part of the parliamentary county of Midlothian and Peebles (northern division). The university combines with the other Scottish universities to elect three members.

See Histories by Maitland (1753) and Arnot (1779); Sir D. Wilson's *Memorials* (1847; new ed. 1892) and *Reminiscences* (1878); Chambers's *Traditions* (1825, 1912); Drummond's *Old Edinburgh* (1879); R. L. Stevenson's *Edinburgh: Picturesque Notes* (1878); Grant's *Old and New Edinburgh* (1880–82); Lees' *St Giles'* (1889); Mrs Oliphant's *Royal Edinburgh* (1890); Harrison's *Edinburgh Houses* (new ed. 1898); Geddie's *Romantic Edinburgh* (new ed. 1911); Bone's *Edinburgh Revisited* (1911); and the many volumes of the Old Edinburgh Club.

THE UNIVERSITY OF EDINBURGH, the youngest of the Scottish universities, is in a very special manner the child of the Reformation. In 1561 the town council moved in the matter, and erelong obtained from Queen Mary a grant of the ruins of the Kirk-of-Field, an old collegiate church. Civil war retarded the project, but in 1582 the town council obtained a charter from King James authorising it to establish a college; it was at the same time empowered to recover a sum of 6000 merks Scots, which had been left as far back as 1558 by Robert Reid, Bishop of Orkney, for the purpose of founding a college in Edinburgh. The college was opened in 1583 in very humble buildings and on a very small scale, its staff consisting of one regent, Robert Rollock, a young scholar brought from the college of St Andrews, with one assistant. In 1587 the staff was increased, Rollock becoming principal and professor of Divinity, with four regents, who each taught all the subjects of the curriculum, and conducted students through their four years' course. Such the college continued, without much material change, until the beginning of the 18th century; it was principally a school for training the Scottish Presbyterian clergy, although many of the Scottish nobility also attended its classes. In 1708, however, under the enlightened guidance of the principal, William Carstares, the regents became professors, teaching but one subject, and a possibility was opened up for a great extension of the scope of the college. In 1724 a beginning was made of a medical faculty, when Alexander Monro became professor of Anatomy; other chairs in the same faculty rapidly followed, and with such teachers as Monro, Cullen, and Gregory, the fame of the school soon rose. The reputation of the university was extended when, towards the close of the 18th century, Dr Robertson became principal, and Dugald Stewart and John Playfair drew students in crowds. Before the end of the 19th century the number of students had reached 3500, and declined to about 3000; in 1912 there were again 3500; in 1923 about 4400, 1600 each in arts and medicine. There are some 15,000 members of the General Council.

The great influx of students during Principal Robertson's time rendered an increase of college accommodation absolutely necessary, the growth of numbers having been met up to this time by buildings erected from time to time by the town council from city funds, or by the generosity of private donors. In 1789 the foundation of the present university buildings on the South Bridge was laid. The French war led to a withdrawal of government grants and consequent delay. Robert Adam's plans were modified by W. H. Playfair, who in 1828 completed the building but for the dome, added in 1887 by Sir R. Rowand Anderson. Augmented numbers, especially of the medical classes, called for a further increase of buildings, and a separate medical school was built in 1878–88, with a Physiological Laboratory (1901). In 1887–1906 a students' union was built; and in 1888–97 a college hall was erected at the expense of Mr M'Ewan, M.P. for one of the divisions of the city. Other university buildings are the Reid Music School (1858) and the John Usher Public Health Institute (1902). In 1906–7 the old High School (later a fever hospital) and the old Surgical Hospital were converted into Engineering and Natural Philosophy Departments. The Agriculture, Forestry, and Entomology Departments are in George Square, the Department of Mathematics in Chambers Street. A site for scientific departments has been acquired near Liberton, and chemical and other laboratories and lecture-rooms have been erected from 1919.

From its foundation in 1583 down to 1858 the university was entirely controlled by the town council, which in its early days was much guided in its choice of teachers by the city clergy. It was felt, however, that it had outgrown its original constitution, and after a Royal Commission had reported, the Universities (Scotland) Act, 1858, made the university of Edinburgh a corporation 'consisting of chancellor, rector, principal, professors, registered graduates and alumni, and matriculated students.' Its government was vested in a Senatus Academicus, subject to the review of a University Court representing the university authorities and the town council of Edinburgh. The powers of the court have since been increased. The patronage of chairs was in some cases vested in the crown; so far as it remained with the town council, it was transferred to seven curators, four appointed by the town council and three by the University Court. The Lord Rector is elected by undergraduates. A Students' Representative Council was founded in 1884 as a means of expressing the opinion of the body of students on university matters. Since 1918 the General Councils (chancellors, professors, members of the University Courts, and graduates) of Edinburgh and the other Scottish universities conjointly elect three members of parliament.

Among the alumni of the university are numbered Drummond of Hawthornden, Samuel Rutherford, Hume, Blair, Akenside, Goldsmith, James Thomson, John Home, Boswell, Thomson of Duddingston, James Bruce, John Leyden, David Mallet, Mungo Park, Lord Dundonald, Hutton the geologist, Walter Scott, Brougham, Cockburn, Lord Palmerston, Earl Russell, Carlyle, Darwin, Sir Richard Owen, Balfour Stewart, Clerk Maxwell, Cooke the electrician, Robertson of Brighton, J. F. McLennan, Joseph Thomson, Barrie, Crockett, R. L. Stevenson, and Sir James Dewar; while of its famous principals and professors may be mentioned Leighton, Carstares, Robertson, Maclaurin, Dugald Stewart, Adam Ferguson, Hugh Blair, Thomas Brown, Joseph Black, Robison, Leslie, J. D. Forbes and Edward Forbes, Charles Bell, John Playfair, Sir William Hamilton, John Wilson, J. F. Ferrier, Thomas Chalmers, the Monros, David and James Gregory, Cullen, Christison, Syme, Simpson, Lord Playfair, Goodsir, W. E. Aytoun, Brewster, Lister, Masson, the Geikies, P. G. Tait, Sir W. Turner, D. F. Tovey.

The university comprises the Faculties of Arts, Science, Divinity, Law, Medicine, and Music. The university recognises as qualifying for its degrees the lectures of a large body of distinguished

extra-mural lecturers; distinct degrees are granted by the Royal Colleges of Physicians (q.v.) and Surgeons (q.v.).

Libraries, Museum, Societies.—The University Library originated in a bequest of books made in 1580 by Clement Little to the town and church of Edinburgh. This little library, consisting of about 300 volumes, was transferred by the town-council to the college on its opening. It has gradually increased. From 1709 it enjoyed the right of receiving every book entered in Stationers' Hall, but a composition of £575 per annum in lieu of the privilege was accepted in 1837. The University Library contains about 300,000 printed volumes, and 8000 volumes of MSS. The university also contains subsidiary libraries, such as the Theological Library, the Humanity Class Library, &c. The Natural History Museum was established in 1812, and received a government grant of £200 per annum. It was in 1854 transferred to the new Museum of Science and Art, now the Royal Scottish Museum, where it forms a Natural History Department. The Anatomical Museum, now exhibited in a fine hall in the new Medical School, was founded by the town council and the Senatus Academicus in 1826. The Botanical Museum is stationed in the Botanic Garden, which is in connection with the university, as is the Royal Observatory on Blackford Hill. The numerous societies for literary or scientific discussion play an important part in the training of the students. The Speculative Society was founded in 1764, and the Royal Medical in 1737. The Dialectic, Scots Law, Diagnostic, Philomathic, and Celtic constitute the Associated Societies of the university. Apart from the Carnegie Trust, the university has some 100 bursaries, about 80 scholarships, and several fellowships.

There are histories by Bower (1817–30), Dalzel (1862), Sir A. Grant (1884), and John Harrison (1886).

Edinburgh Review, the great Whig 'buff and blue' quarterly, was started in October 1802 by a knot of young men living in the northern capital, the principal of whom were Jeffrey, Sydney Smith, Horner, and Brougham. So much was secrecy felt or believed to be necessary to the success of the undertaking, that, according to the account which Lord Jeffrey gave to Mr Robert Chambers in 1846, 'the dark divans' of the reviewers were held for some time 'in a dingy room of Willison's printing-office in Craig's Close,' to which each repaired alone, and 'by back approaches or different lanes.' Of the first number, 750 copies were printed: the demand exceeded this limited supply; 750 more were thrown off, and successive editions followed. In 1808 the circulation had risen to about 9000, and it is believed to have reached its maximum—from which it has declined—in 1813, when 12,000 or 13,000 copies were printed. The pay of contributors was at first ten guineas a sheet, but shortly after 'the *minimum*,' says Jeffrey, 'was raised to sixteen guineas, at which it remained during my reign. Two-thirds of the articles were, however, paid much higher, averaging, I should think, from twenty to twenty-five guineas a sheet on the whole number.' The original publisher was the well-known Constable. To Sydney Smith, editor of the first three numbers, succeeded Jeffrey (1803–29), Macvey Napier (1829–47), Empson (1847–52), Cornewall Lewis (1852–55), Henry Reeve (1855–95), Arthur Elliot (1895–1912), and Harold Cox. The influence of the *Edinburgh Review* in developing and strengthening the political convictions of the Whig party cannot be overestimated; but its power was even more visible, certainly more immediately palpable, in literature. Amid the feeble and effete periodicals of the day it burst like a bombshell. The keenness of criticism, the sharpness of wit, the brilliancy of style, the vigour of mind and comprehensiveness of knowledge exhibited by the writers excited amazement and fear in the world of letters; and although, in the case of Wordsworth, Southey, and other writers of a certain school, unfairness of a flagrant kind was undoubtedly exhibited and persevered in, yet impartial justice was, on the whole, administered. Since Jeffrey's day the most brilliant contributor was Lord Macaulay. The *Edinburgh Review* is now published in London. See *Correspondence of Macvey Napier* (1879).

Edinburghshire, or MIDLOTHIAN, a Scottish county, extending 12 miles along the low southern shore of the Firth of Forth. The greatest length from east to west is 36 miles; its greatest breadth, 24; and its area, 367 sq. m. The surface has a general southward rise to the Pentlands, culminating in Scald Law (1898 feet), and the Moorfoot Hills, whose highest point is Blackhope Scar (2136). Intermediate eminences are Arthur's Seat (822), Blackford Hill (500), Corstorphine Hill (520), Craiglockhart (550), the Braid Hills (698), and the Dalmahoy Crags (800). The streams—Esk, Water of Leith, and Almond—all flow to the Forth, with the exception of Gala Water, which runs to the Tweed. The geology is most interesting, the rocks of the Moorfoots being Lower Silurian; of the Pentlands, Upper Silurian and Lower Old Red Sandstone, the latter consisting chiefly of volcanic rocks; and of the plains, Carboniferous, with contemporaneous and subsequent or intrusive igneous rocks. Coal has been largely mined for three centuries; and ironstone, oil-shale, and fireclay are also raised. There are large quarries of sandstone at Craigleith (q.v.) and elsewhere. Agriculture is highly advanced, though only 57 per cent. of the entire area is in cultivation. Near Edinburgh are large market-gardens; and on the Esk and the Water of Leith there are paper-mills. The county, with Peeblesshire, returns two members to parliament, and contains the burghs of Edinburgh and Musselburgh, besides the police-burghs of Dalkeith, Bonnyrigg, Lasswade, Loanhead, and Penicuik. Pop. (1801) 122,597; (1841) 225,454; (1881) 389,164; (1911) 507,666; (1921) 506,378. Midlothian's four battlefields are Roslin, Pinkie, Carberry Hill, and Rullion Green; its antiquities include the Catstane, the Roman remains of Inveresk and Cramond, Roslin Chapel, and the castles of Borthwick (q.v.), Crichton, Craigmillar, &c. It is rich, too, in fine and interesting mansions, described in Small's *Castles and Mansions of the Lothians* (2 vols. 1883).

Edison, THOMAS ALVA, a notable American inventor, was born at Milan, Ohio, 11th February 1847, but his early years were spent at Port Huron, Michigan. His father was of Dutch, and his mother of Scottish descent; the latter, having been a teacher, gave him what schooling he received. Edison was a great reader in his youth, and at the age of twelve he became a newsboy on the Grand Trunk Line running into Detroit, and began to experiment in chemistry. Gaining the exclusive right of selling newspapers on this line, and purchasing some old type, with the aid of four assistants he printed and issued the *Grand Trunk Herald*, the first newspaper printed in a railway train. A station-master, in gratitude for his having saved his child from the front of an advancing train, taught him telegraphy, in which he had previously been greatly interested; and thenceforward he concentrated the energies of a very versatile mind chiefly upon electrical studies. He invented an automatic repeater, by means of which messages could be sent from one wire to another without the intervention of the operator. He developed his system of duplex telegraphy while a telegraph operator in Boston, but it was not entirely successful until 1872. In 1871 he became superin-

tendent of the New York Gold and Stock Company, and here invented the printing-telegraph for gold and stock quotations, for the manufacture of which he established a workshop at Newark, N.J. He removed to Menlo Park, N.J., in 1876, to West Orange, N.J., in 1887. His inventive faculties getting full play, he took out over fifty patents in connection with improvements in telegraphy, including the quadruplex and sextuplex systems; the carbon telephone transmitter; the megaphone, for magnifying sound. Thence also emanated his Phonograph (q.v.), a form of telephone, and various practical adaptations of the electric light. His kinetoscope (1894), a development of the Zoetrope (q.v.), led in turn to the Kinematograph (q.v.). His plant for the magnetic reduction of lean iron ores, successful as an invention, was a commercial failure. He then turned his attention to Portland cement, the casting of houses in moulds, and a storage battery, and later to various kinds of chemical plant. The number of his patents runs into thousands. He is a Commander of the Legion of Honour. See Lives by W. K. L. Dickson (1894) and by Dyer and Martin (1910), and the articles PHONOGRAPH, TELEPHONE.

Edmonton, now an urban district of Middlesex, 10½ miles NNE. of Liverpool Street Station. Lamb spent his last years here; here, too, is the 'Bell,' where John Gilpin did not dine. Pop. 67,000.

Edmonton, capital of the Canadian province of Alberta, stands on both sides of the Saskatchewan, and is on the Canadian National Railway and the Canadian Pacific, 793 miles NW. of Winnipeg, and 945 E. of Prince Rupert. Its population grew from 4000 to 58,821 (1921). It has, besides handsome parliament buildings and the university of Alberta, numerous churches, banks, and schools. The city owns its electric light and power, street railway, telephones, waterworks, incinerator, sewerage, and gas-system. There are 20 coal-mines in the neighbourhood, and the town is the centre of the fur-trade and of a vast area of magnificent agricultural land. See ALBERTA.

Edmund, king of the English from 940 to 946, conquered Mercia and the five towns of the Danish confederacy in 941 or 944, and also Cumbria, which he entrusted to Malcolm of Scotland, on condition that he should be 'his fellow-worker by sea and land.' He was slain by an outlaw.

Edmund, for his bravery surnamed IRONSIDE, king of the English for seven months of 1016, was a son of Ethelred the Unready, and a half-brother of Edward the Confessor. He was chosen king by the Londoners on his father's death (1016), while Cnut was chosen king at Southampton by the Witan generally. Edmund hastily levied an army in the western shires, twice defeated Cnut, raised the siege of London, crossed the Thames, and again twice routed the Danes. But at Ashingdon (q.v.), after a desperate battle that raged all day, he was utterly defeated, and an arrangement was entered into by which England was divided between the two kings, Cnut obtaining possession of Mercia and Northumbria, while all the south and the headship fell to the share of Edmund. It was also agreed that on the death of either the survivor was to succeed him. A few weeks after this agreement Edmund died, November 30, 1016—by foul play, many thought.

Edmund, ST, the last king of the East Angles, was born about 841, and reigned from 855 to 870. Of Continental Saxon birth, it is said he was adopted by Offa, king of the East Angles, as his heir. Scarcely anything is recorded of his reign until the Danish invasion of 866–870. After his men had been defeated by the Danes, he was slain because he refused to abjure his faith. Thirty-three years after, his remains were translated from Hoxne to Bury St Edmunds. See Life by Thompson (1891).

Edmund, ST (EDMUND RICH), Archbishop of Canterbury, was born at Abingdon about 1175, studied and taught at Oxford and Paris, acquired fame as a preacher, was commissioned by the pope to preach the sixth crusade throughout England, and in 1233 was appointed Archbishop of Canterbury. He attached himself closely to the national party, and though personally gentle and self-denying, even threatened Henry III. with excommunication if he did not dismiss his foreign favourites. But Henry managed to nullify Edmund's authority by a resident papal legate; and the archbishop retired in 1240 to France, where he died in the same year. See Life by Wallace (1893).

Edmunds, GEORGE FRANKLIN, senator, born at Richmond, Vermont, in 1828, sat in the state legislature in 1854–59, in the state senate in 1861–62, and in 1866–91 in the United States senate, of which he was president *pro tempore* after Mr Arthur became president of the United States. He took part in the prosecution of President Johnson, and was author of the 'Edmunds Act' (1882) for the suppression of polygamy in Utah.

Edom (Heb., 'red') is given in Genesis as the surname of Esau, who, after leaving his father's house, went with his family to 'Mount Seir,' which he took from its earlier inhabitants, the troglodyte Horites. The name Seir or Edom was applied to the whole country extending from the Dead Sea southwards to the Gulf of Akaba, and bounded on the NE. by Moab. The mountains of Edom are steep, bare masses of chalk and porphyry, but to the east stretched a plateau favourable to vine-growing and tillage. On this side of the country lay the chief town, Petra or Sela, on the eastern slope of Mount Hor, and also Maon (Maan), Bozrah (Buseirah), and the seaports Elath and Ezion-geber on the Gulf of Akaba. The Edomites, recognised by the Israelites as near of kin, had attained to settled life and independence before them. The Edomites were conquered by Saul and subdued by David, and were repeatedly subject to Judah. After the fall of the kingdom of Judah they became masters of southern Palestine, but were defeated by Judas Maccabæus, and subdued by John Hyrcanus about 126. From about 300 B.C. the eastern part of Edom, with the capital Sela (Petra), had been in the hands of the Nabateans. After 120 the western part (Idumæa) was held by Jewish governors, one of whom, Antipater, an Idumæan, through Cæsar's favour, became procurator of all Judæa; his son was Herod the Great (q.v.). See PETRA.

See Palmer, *The Desert of the Exodus* (1871); De Luynes, *Voyage d'Exploration à la Mer Morte* (1874); Libbey and Hoskins, *The Jordan Valley and Petra* (1905); Forder, *Petra, Perea, Phœnicia* (1923).

Edriophthalmata, a section of higher Crustacea (q.v.), including the simpler and more primitive forms, in which the eyes are sessile, not stalked.

Edrîsî, or IDRISI, Arab geographer, born at Ceuta in 1100, of a family that had governed Malaga, traced his pedigree up to Fatima, the daughter of Mohammed. He travelled in Spain, Barbary, and Asia Minor, and settled at the court of the enlightened king of Sicily, Roger II., for whom he made a silver map of the world and a celestial sphere. Roger invited him to write a description of the earth founded upon direct observation, sending travellers on journeys of exploration for the purpose. The Description of the World, or 'Book of Roger,' was not completed till 1154. Unequal in its execution, and better for Western than for Eastern lands, it nevertheless stands in the very first rank of medieval geographies. An abstract of

it was first edited in Arabic, very inaccurately, at Rome in 1592; the parts on Africa and Spain were edited in 1796–1818, and some parts (by Dozy and others) since 1866. The French translation of the whole (1836–40) by Jaubert is not very satisfactory. Edrîsî wrote also on medicine and morals, and made verses. He died about 1165.

Education. The three essential elements included under the concept of education may be expressed in the following statements: (1) it deals with an organism; (2) it is deliberate and systematic; (3) it uses an organon or instrument—knowledge. Most of the definitions of education contain the word *development*. Now development implies an organism, for only an organism can develop. The first datum of education, then, is that the person to be educated—whom, for the sake of convenience, we shall call the *educand*—is an organism, and accordingly must develop after the laws of his own nature. It would almost appear, therefore, as if the educator were balked at the very threshold. If the educand must develop according to the laws of his own nature, what is the use of an educator? The usual answer is given in the form of a metaphor. The educand is compared to a plant, and it is pointed out that while the acorn cannot develop into any other tree than an oak, it may be turned into either a sound and well-developed oak, or into a stunted and decrepit one. Seeds must develop according to the laws of their own nature, and there is still room for the gardener. The educand is born into the world a bundle of potentialities which demand certain conditions before they can realise themselves. The educator can see that these conditions are presented, and by varying the conditions he can, within limits, determine the nature of the resulting reactions between the educand and his environment; can, in fact, modify the development of the educand. He cannot interfere with the laws of development inherent in the educand, but he can so manipulate the environment that these laws shall lead to results different from those that would follow were the conditions left unchanged. There are the two elements in the problem—the educand's original endowment, and the environment into which he is born. The educator must take the first as given; the second he can manipulate to a certain extent. This is the usual procedure of the educator: he modifies the environment in which the educand lives.

The possibility of modifying the original endowment of the educand introduces the problem of heredity. It would appear that this is a force that cannot be manipulated directly by the educator. The more he knows of the laws of heredity, and the greater knowledge he can acquire of the hereditary endowments of the educand, the better; but the present state of scientific opinion on this subject is strongly against the view that the educator can manipulate heredity in dealing with the educand here and now before him. The balance of evidence is certainly strongly against the transmission of characteristics acquired during the life of the individual; so education cannot hope to have the cumulative power that it might have claimed had the decision of the biologists been otherwise. Sir E. Ray Lankester tells us that 'educability can be transmitted—it is a congenital character; but the *results* of education cannot be transmitted.' Still, he adds the comforting words: 'To the educable animal the less there is of specialised mechanism transmitted by heredity the better. The loss of instinct is what permits and necessitates the education of the receptive brain.' In fact, the educator finds compensation in discovering that it is now generally recognised that many of the traits that were formerly supposed to be transmitted by what may be called bodily heredity are really transmitted by what it is becoming usual to call social heredity. The power that was supposed to reside in heredity is now transferred to the environment. We act like our fathers not because we have inherited from them, but because we live with them and under the same conditions. With regard to congenital qualities, no change has taken place; the accepted view is that characteristics acquired during the life of the individual are passed on not by bodily heredity but by social. What is taken from the educator with the one hand is restored to him with the other, since he is able to a considerable extent to manipulate the environment.

In the state of nature the development of plants and animals is determined by external conditions, so that Nature herself may be regarded as an educator. There is a substratum of truth in Mark Twain's whimsical view that a cauliflower is only a cabbage with a college education. But here we come to our second essential in the connotation of education. It must be deliberate; in other words, there must be a clear intention to educate. Mere evolution is not education. We do not educate the tadpole into the frog, nor do we speak of Nature as educating a particular piece of elevated land into a watershed. In a wide sense, the term education may be made to include all the processes and all the influences of social life, in so far as these modify human development; but in this case we assume a purpose behind nature and society. The human race may be said to have been undergoing education from the palæolithic period, and even from an earlier stage. But in using the term in this sense we imply that Nature herself is the educator, or represents the educational purpose of some cosmic power. So with the ordinary education that results from the mere process of living in society, the licking into shape that comes from ordinary experience. We do not usually call this education, because there is no deliberate intention in the process. When the millionaire's son in Kipling's *Captains Courageous* was carried off by accident for a long experience of the hardships of deep-sea fishing, he was certainly educated; but the process could hardly be correctly called education, since neither millionaire nor fishermen had any educational purpose. The term might be rightly applied had the millionaire deliberately contrived to send his son away into this wholesome environment. In this case the millionaire would have been the educator, the son the educand, and the fishermen merely the means of carrying out the educator's purpose. In point of fact, education is always a bipolar process, the educator being at the active pole and the educand at the passive. From this it is not to be inferred that the educand is to be intrinsically passive. Indeed, one of the chief functions of the educator is to stimulate the activity of the educand. Still, so far as the process is regarded as educational, the educator always stands at the active pole. It is true that in the educative process between a given educator and educand there may be, and usually is, a gradual interchange of activity between the two poles. In so far as the educand merely reacts to the educator's stimuli in such a way as to be educated, he is educand and nothing more. But in so far as the educand comes to take a share in the educative process, to see what the educator is aiming at and to help deliberately to secure that aim, he becomes to that extent his own educator, and thus reduces the educational activity of the external educator. The really successful educator is he who by thus leading the educand to take up the work renders himself unnecessary. It is clear that even in self-education the process does not cease to be bipolar. When the educand takes himself in hand and be-

comes his own educator, using teachers and others as means towards his ends, he has still within himself the two aspects : from one point of view he is still educand, though the educator happens to be himself. The process remains bipolar.

The third essential element in the connotation of education is the use of knowledge as an instrument. That we use knowledge for this purpose has been long recognised, for the work of the school is very generally regarded as the communication of knowledge. The teacher has been, and is, generally accepted without question as an educator. This is strikingly illustrated by the fact that for so long we have been content to use one term *pupil* as the correlate of the two distinct terms *teacher* and *educator*. It is only now, when we are beginning to analyse educational processes with some degree of care, that the need for an accurate correlate to *educator* has driven us to adopt the term *educand*. But in the development of educational theory the view of the function of knowledge has materially changed. Originally the communication of knowledge was regarded as the supplying of the educand with information that was essential to him. He had to know certain things in order that he might conduct himself wisely in the environment in which he found himself. This is what is implied in the somewhat esoteric definition of education as the process by which the educand absorbs and is absorbed by the environment. As a result of this process the educand adapts himself to his surroundings, which lends some justification to those writers who regard education as a means of adjustment to varying conditions. By-and-by, however, knowledge began to be valued for its own sake, apart from any use to which it could be applied, and this disinterested view has much to recommend it. But it gradually led to a curious misunderstanding of the relation between knowledge and power. Obviously knowledge of our environment is power. But when studies had become greatly elaborated, their subject-matter ceased to have any connection with the practical affairs of life, and therefore the studies lost their *prima facie* claim to rank as power-givers. Naturally, the school people who spent their lives in acquiring and communicating this abstruse knowledge did not see their way to admit the practical worthlessness of their acquirements. They therefore hit upon the theory that subjects have to be studied, not for the intrinsic value of the knowledge they supply, but for the training effect on the mind. Certain subjects are to be studied for the intrinsic value of the subject-matter, and certain others for the training to be obtained in the process. This view is usually known as the doctrine of 'formal training.' It has had its day, but is now generally discredited. Herbert Spencer used the law of parsimony as an argument against it, maintaining that it is contrary to the laws of nature that we should have to learn one set of subjects for the sake of acquiring knowledge, and another for the sake of training the mind. This is hardly convincing ; but the careful investigations of such writers as E. L. Thorndike have made it clear that while there is a certain amount of transference of power from one subject to another, the amount of this transference is in direct proportion to the number of elements that are common to both subjects. It cannot be denied that the careful study of any subject will to some extent train the mind, but it is no longer a tenable position that certain subjects should be chosen for the sake of training alone, quite irrespective of the value of the subject-matter. The old faculty psychology gave some support to the 'formal-training' theory ; but with the recognition of the essential unity of all mental process, it has become clear that it is not reasonable to set apart special studies in order to cultivate special faculties of the mind. On the other hand, it is admitted that there are certain general ways of regarding things that may be transferred from one kind of mental activity to another. Professor W. C. Bagley, for example, maintains that certain ideals of such things as neatness, accuracy, perseverance, may be acquired in dealing with one subject, and yet be applied to others. In this attenuated form the doctrine is generally accepted.

What gave a certain strength to the 'formal-training' doctrine was the unreasonable faith many people showed in the power of mere knowledge. Facts were regarded as of value merely as facts. 'If cramming means the acquiring of facts, then cram, cram,' said a distinguished teacher, with a full knowledge of the opprobrium attached to cram. Opposed to this view was that of 'drawing out,' largely based upon etymological grounds. Considerable confusion sometimes prevails in educational writing with regard to this drawing-out process. Sometimes it is rightly confined to the drawing out of latent powers, but not infrequently it is applied to the elicitation of knowledge. It is forgotten that we cannot draw out what is not there. The mind must be nurtured as well as exercised.

Education may be regarded from many points of view. It may be considered in connection with various categories. With regard to the incidence of the personality of the educator, we have *direct* or *indirect* education. When the personality is exercised without the intervention of books, or studies, or the manipulation of environment, we have obviously the direct form. When we have education classed as *material* and *formal*, we are dealing under the category of the value of knowledge as intrinsic and as means of training. The distinction between *positive* and *negative* education is based really on Rousseau's view that we must not interfere with the course of nature. We must learn how wisely to lose time. He regards as positive education all those forms that seek to modify the development of the educand at the will of the educator, apart from considerations of the natural development of the human being. The Froebelians, with their definition of education as 'a passivity, a following,' are clearly exponents of negative education. One is apt to think of Comte in connection with the positive form, but the Comtist view of education is represented by the term *integral*. It is difficult to suggest an inoffensive correlate to *integral*. The obvious term *fractional* represents an ideal that no one would be willing to accept. Perhaps *sectional* is the least irritating term. Integral education does not mean that everybody should be taught everything, though this is the only meaning that M. Jules Simon can take out of the term ; but that the body of knowledge presented to the educand should be thoroughly organised. Instead of being a thing of shreds and patches, it is to be worked up into a whole, in which each part is organically related to all the others. The ideal is excellent, but the Comtists have gone but a little way towards its realisation. *Specific* and *general* are the two terms that result from the consideration of education under the category of the use to be made of it. In some cases the purpose of education is to produce a certain type of man. Thus seminarist education is specific. On the other hand, education may have as its aim the production of a mere all-round man—one who is prepared in a general way in all directions, without any bias for any particular walk in life. The non-professional parts of education at the universities illustrate the general form. A very interesting category under which education may be considered is that of the agent by whom it is

conducted. Huxley speaks of 'artificial' education, meaning the education that is given deliberately by men as opposed to that given by nature. All education would thus be either natural or artificial. But as the term *natural* is often used in educational writings to indicate artificial education when carried on in accordance with the laws of nature, there is a certain danger of confusion; so it is sometimes suggested that the terms *human* and *cosmic* should be substituted, the second term covering all cases of education carried on by nature, the world-spirit, God, apart from any deliberate share in the work by human beings. Lessing's curious little book on *The Education of the Human Race* is a treatise on cosmic education in this sense.

We must distinguish between education and educational theory. Even in the form of human education, in the sense defined above, there must have been education long before there was any theorising about it. Letourneau devotes a whole chapter to *Education in the Animal Kingdom*, in which abundant evidence is given of more or less purposive training of the young. This stage corresponds to cosmic education, and the same is true of the earlier stages of the education of man. It is only when men begin to take themselves in hand, when they deliberately set about making themselves different from what they are, that true human education may be said to begin. In the course of evolution man gradually becomes aware of the nature of the process, and begins to take a hand in helping it forward. So soon as he begins to intervene in the evolutionary process he becomes an educator, and introduces the elements of educational theory. For long the theory is very crude, and consists mainly in speculations regarding the most satisfactory mode of producing the best sort of man to fulfil certain necessary functions in society. All education begins as specific education.

This preparation for specific work introduces a permanent struggle between the educational ideals of the individual and of society. No doubt when viewed from the point of view of eternity the two ideals coincide, but at the short range of ordinary life it is sometimes hard to reconcile them. Mr Benjamin Kidd assures us that the interests of society and of the individual are inherently opposed to one another; so we need not be surprised to find that there is trouble in meeting the demands of the individual and the state with regard to education. In the old Greek states, where the theory of education practically began, so far, at any rate, as concerns written records, we find the claims of the state predominant. In Sparta the individual was entirely subordinated to the state; and though in Athens there was greater scope for the individual, he was always made to feel that in the ultimate resort he belonged body and soul to the city. Of the thinkers of that time Socrates was more individualistic in theory than Plato; but Socrates recognises the supremacy of the state, since he consented to die in obedience to the laws, even while recognising their injustice. Plato regards the state as supreme, and goes the length of holding that the happiness of the whole may be gained at the expense of the parts. Here Aristotle vigorously opposes him, and practically sets up the organic ideal in which the parts and the whole can reach full development only when both have free play. In his famous paradox, 'The state is prior to the individual,' he emphasises the interdependence of the individual and the state. But though man is so constituted that he cannot be himself except in a state, it does not follow that he exists for the sake of the state. The truth is that the state exists for him. If man be regarded by the statesman as a mere means to attain public ends, then the state can never get the best out of the individual. Though in the *Republic* the citizen is throughout subordinated to the state, from the lowest grade to the highest, yet in the Athens of Plato's time the free citizens certainly regarded themselves as ends and not as mere means. The wise educator must take full account of the need to recognise every educand as an end, though it may be necessary also to keep in view his function as a means. In the Aristotelian system the educator has to take his orders from the statesman, since education is a practical science that produces materials to be used by another science. Politics is architectonic to education. In modern states it cannot be denied that this is the principle on which education is conducted. In sober truth, the educator is subordinated to the statesman. But this does not by any means imply that the determination of the aim of education is to be settled by another science. In so far as the statesman interferes with the aim or method of education he ceases to be a statesman, and to that extent becomes an educator.

In the ultimate resort true education and true statesmanship cannot but agree that the final aim of all education is the self-realisation of the individual. Many other aims have been put forward—to prepare for complete living; to secure a sound mind in a healthy body; to produce perfect citizens; to develop children as imperfect human beings into perfect human beings; to secure the harmonious development of all the faculties; to secure the adjustment of the individual to his environment. Yet each and all of these may be fairly claimed as a part of self-realisation. There is, indeed, only one of the recognised views of the aim of education that cannot be said to be included under the wider term, and this is the Herbartian view that the aim of education is the cultivation of many-sided interest. It will be shown that this aim is necessary in order to give content to the other.

Self-realisation recognises the independence of the individual, and at the same time does not deny the need for a social environment. The individual is educated not so much by the state as in the state. We must get rid of the idea that in a healthy state there can be any antagonism between the self-realisation of the citizen and the best development of the state. Confusion sometimes arises, because it is assumed that self-realisation means the removal of all external restraint. This error is implicit in the term that is sometimes used as if it were an equivalent—*self-expression*. Both self-realisation and self-expression imply the existence of a self; but the first regards the self as a potentiality to be developed; the second, as something ready-made, and only seeking a mode of expressing itself. Those who are pertinaciously claiming the right to 'lead their own life' are really working on the self-expression ideal. Self-realisation does not necessarily imply freedom from restraint. Often restraint is of the essence of the process that aids in the development of the true self, and should be welcomed by the educand who understands his own ideals.

It is for metaphysicians and psychologists to discuss the possibility and nature of a self; the educator is entitled to assume its existence and to busy himself about its development. Here arises one of the difficulties of self-realisation as the educational ideal. There is the implication that all selves are either neutral or are inherently good. If we are merely to aid the educand in realising the potentialities of his self, we must help the bad self to become a perfectly bad self, just as we help the good self to become a perfectly good self. Self-realisation must therefore be limited by the proviso that it is confined to the development

of the higher or better self that is possible to each educand. This implies that the educator has to take a stronger line in education than at first sight appears. He must not only aid the self of the educand in its development, but must select those elements in it that are worthy of encouragement, and do all he can to suppress the others. It is here that the need for the supplementary ideal of many-sided interest becomes manifest. Self-realisation is a somewhat empty ideal. 'Realise thyself' is not a helpful exhortation by itself. It needs to be supported by a reference to the environment in which the realisation is to be carried out. The presentation of content in an ordered way is an essential part of the work of the educator. The communication of knowledge and the manipulation of the environment are integral parts of the educator's function. The knowledge communicated is valuable for its own sake and also as a means of training; but the ideal on which Herbart laid stress was the effect upon the self of the subject-matter dealt with. The result is a sensitiveness to certain cognitive and affective impressions: the self has acquired a permanent interest in certain worthy elements that have been selected by the educator. Interest which in the educative process has been a *means* becomes as an educational ideal the *end*. Self-realisation remains the final goal of education, but many-sided interest supplies the wider ideal with the content necessary to make it effective.

History of Education.—As in prehistoric and early historical times all knowledge was in the hands of the priests, it is natural to suppose that the beginnings of education would be in their hands too. At first education would be confined to the priestly class themselves, and to those young people who were marked out by their birth for high estate. It would certainly be to the advantage of the priestly class to acquire influence thus early with those who were to be the leaders of the tribe or nation. With regard to the common people, the only education they required was the education of life. They learnt by the mere process of living. Imitation and convention were the forces that moulded them into the shape required by the society in which they lived. Education would be purely specific—the learning of a trade or occupation of some sort, with the ordinary social customs that went with the corresponding social grade. In the ordinary histories of education we usually find at the beginning some vague generalities on the state of education among the early Chinese, Egyptians, Indians, and Persians. But we really know remarkably little about education among those early peoples. It is probable that in the case of China that 'cake of custom' of which Walter Bagehot speaks proved too strong to allow of the freedom necessary for further development, and that education was one of the instruments used in the hardening process. The education rapidly became literary, and has remained so throughout the ages. In India, and especially in Egypt, the history of education is really inferred from the progress of the nation in actual knowledge. While the Egyptians were learning astronomy and geometry, as testified by the evolution of the pyramid into a time-measurer, they must have passed on from generation to generation the knowledge as it was acquired. There must therefore have been practical education, and it is unlikely that among such intelligent people there should be no theory of education at all. It has to be remembered that the priests owed their power to their skill in manipulating the warrior-class; so it is exceedingly likely that they studied human nature with great care, and it is only natural to suppose that the experienced priests would communicate their knowledge of human nature to their successors, and this would amount to a theory of education since it included a system of manipulating knowledge in order to produce certain definite effects upon individual human beings. With regard to Persia we have a few vague notes, gathered together by Xenophon and strung out into his *Cyropædeia*. The schools of justice sufficiently indicate the general ideal of the education attempted, and the saying that among the Persians the young were taught to ride, to tell the truth, and to use the bow indicates that there was already a discrimination between moral and physical training. It is not till we come to Greece, however, that we have a full record of both theory and practice of education. In Sparta and those states that followed this type, the education was specific both for slaves and for citizens. Each of the slaves had to learn his particular trade; while the citizens were all trained to the same trade—that of soldiering. In states of the Athenian type the education of the citizens was still to a certain extent specific, since every man had to be able to bear arms and to take his share in the government of the state. But there was greater freedom of individual action. All had to learn gymnastics for the body and music for the soul. But into the term 'music' much or little could be read. In Sparta it was confined to the uses that could be made of it in warfare and the things connected with warfare. In Athens it was made to include poetry and literature, and even a certain amount of science. Education was public in both types, began at the age of seven, and was continued to eighteen; though the period from eighteen to thirty might not unfairly have been also called a period of educational probation. In Athens the Sophists arose to meet the demand for individual instruction. They were regarded with great disfavour by the more conservative statesmen, as tending to sap the old authority of the state. Aristophanes and Xenophon had no sympathy with them, and did all they could to favour a return to the simplicity of the olden times. It is because he had this thesis to maintain that we regard Xenophon's *Cyropædeia* with a certain amount of suspicion as a record of what actually was the state of affairs in Persian education. In Plato's *Republic* and in Aristotle's *Ethics* and *Politics* we have the first recorded systematic statements of educational theory. In both cases we have the current state of Greek education taken as the basis of the theory; though in the case of Plato we have this used with great freedom as the mere material for an imaginative reconstruction, whereas in the case of Aristotle we have the experience of the past used as a guide in the logical development of a general theory.

Among the Romans education was essentially specific. The citizen was trained to fulfil his duties as citizen whether in peace or in war. While the great nobles had private tutors for their sons, the ordinary citizens sent their boys to schools that bore very clearly the impress of Greek influence. On the theoretical side, Roman education is best represented in Quintilian's *Institutes of Oratory*, in which an account is given of the education of an orator. By profession Quintilian was a trainer of orators. But among the Romans an orator was not a mere maker of speeches. He was a man of affairs, both civil and warlike. Before a man could hope to be an orator he had to become an all-round well-trained man. Accordingly the education of an orator resolved itself into general training and special. Quintilian considered the educand in all his relations and not merely as an orator, though no doubt oratory was the goal of the specific education up to which the general led. Thus it is that his *Institutes* is regarded as one of the classics of education. With the introduction of Christianity

a different view was naturally adopted. Instead of seeking to train men who would be useful to the state and capable of governing other men, it turned to the spiritual development of the individual. Men were still to be trained as citizens, but of a city not made with hands. The beginnings of Christian education are to be found in the catechumenal schools, where neophytes were instructed in the doctrines of the faith before admission to membership of the Church. These schools, at first very informal, gradually developed into definite institutions, and are commonly known as catechetical schools, from the question-and-answer form of the instruction. The natural development followed. As Christian dogma became more firmly established and more logically elaborated it demanded more and more intellectual skill to understand it. Accordingly, there was a differentiation between the mere lay pupil and the pupil who had capacity and inclination for deeper study. An intellectual atmosphere was cultivated, and those who aspired to office in the Church had to give evidence of power to deal with the new body of doctrine. Gradually the schools became the repositories of whatever learning was available at the time. As the Roman empire decayed, the distinction between the pagan schools and the Christian would become more marked, and the increasing organisation of the Church would give the Christian schools an advantage. Gradually schools became attached to all the great churches and cathedrals, and the concentration of whatever learning there was into church connections became more and more marked. Parallel with this bookish learning went on the practical education of life. There was an education of the castle as well as of the cloister. The soldier, the artisan, and the merchant found education for themselves. The boy of common birth but warlike connections received instruction in arms in the castle courtyard; as page and as squire, the well-born was prepared for the duties of knighthood; the apprentice was trained to his craft, and the son of the merchant to business.

The further development of the bookish side of Christian education led to the establishment of the universities, which were to a considerable extent free institutions so far as teaching went, though the influence of the Church is manifest in the limitations within which the schoolmen did their ingenious thinking. It was after five centuries of this over-elaborate refinement of thinking that the reaction came in the form of the Renaissance. The rediscovery of the classical literatures must be regarded as merely one of the important elements of a great movement that signified the bursting of the fetters of human thought. It is at this stage that the 'isms' of education begin—the first, very naturally, being *humanism*. As a philosophy of life it resolves itself into the claim for free development of the individual; each is to be entitled to develop the humanity that is within him. The joy of living is to be recognised, and artificial restraints are to be removed. In its essence humanism is not necessarily a bookish movement. In fact, part of its creed is a protest against the limitations of books, and a plea for more life and fuller. In education, however, the humanistic movement naturally depended upon books to bring back the ideas of the old classical times which, seen through the haze of centuries, seemed to offer a freer and happier medium of life-realisation than could be found in the present. But while the early humanists made an extensive use of books, it was for the sake of the matter they contained. Their aim was not the study of languages as such, but the use of language in order to get at the thoughts of the writers of the classical times. It was not till humanism had lost its early enthusiasm, and had hardened into a complicated system of education, that the claim was put forward that the mere classical languages as such were the best educational instrument. Scholarship in the narrower sense of that word did not form an essential part of the original humanistic ideal. The Renaissance schools began in the true spirit of humanism. Vittorino da Feltre's (1378–1446) school at Mantua realised the older humanistic ideals, and justified them by the very name it adopted—'The pleasant house.' The same cannot be said for John Sturm (1507–89), whose *gymnasium* at Strasburg exemplified the mechanical degeneration of the humanistic ideal. With him education was mere linguistic. The school course was divided up into the work of the ten classes. Each pupil had to fit into the Procrustean limits of each class, for it was as great an offence to be in front of the work of the class as to be behind it. Yet, such as it was, Sturm's *gymnasium* has proved the type on which the German system of secondary education has been modelled. It is sometimes said that our own English public schools are the lineal descendants of the Strasburg institution; but while there may be an element of historical truth in the assertion, it must be borne in mind that our English schools have developed another side on which they justly pride themselves. While the Continental schools surpass ours in regard to instruction, ours claim precedence in so far as education is involved. Old Sturm would certainly not acknowledge the present English public school as approaching his ideal.

What is called realism in education is usually regarded as a reaction from humanism. Its usual cry is, 'Things, not words.' It is easy to show that it is possible to over-emphasise things quite as much as words. The truth naturally is that we must not—in fact, cannot—separate things and words. The real motto ought to be, 'Things and words in their proper relations.' Nothing else is of any value. Realism is, therefore, a protest against verbalism, rather than against humanism. As a matter of fact, the humanists are as keen about the realities of life as are the professed realists. It is only a degenerate humanism that lays itself open to attack on the grounds of verbalism. John Amos Comenius (1592–1670), for example, is usually classed as a realist, yet most of his text-books are little more than collections of words. It is true that he makes a special point of correlating, as far as possible, words and ideas. His *Orbis Pictus*, for instance, consists of a series of words and phrases directly connected with a set of pictures, the more complicated of which have careful reference-marks. It may be just as truly said that he approaches things through words as that he approaches words through things. The truth is that there is the greatest difficulty in classifying educational theorists as humanists and realists. We have humanistic-realists like Erasmus, sense-realists like Mulcaster and Bacon, social-realists like Montaigne. In modern times, however, there is a more definite meaning attached to the terms humanism and realism. The subject-matter of a school course determines whether it is humanistic or realistic. Matters dealing *directly* with human interests, and, in particular, languages and the fine arts, are marked off as humanistic; while the natural and physical and mathematical sciences are set apart as the *real* of realism. The distinction is most strikingly made in the contrast between the German *gymnasien* and *realschulen*.

Naturalism as a form of educational theory does not concern itself specially with instruction at all, whether in the form of words or of things, but rather with the process of living. Rabelais (1483–1553) is sometimes classed as a humanistic-realist,

but he may be equally well ranked with the naturalists. The most striking example of naturalism, however, is Rousseau (1712–78), who in his *Émile* (1762) gave the world a book that has probably had more influence on education than any other that has ever been published. His principle is that man is born good, but is gradually corrupted by society. Education consists, therefore, in keeping the child free from contamination till such times as his character is fully formed. Education is thus *negative*. The educand is to be allowed to develop naturally without any external influence. The only book he is to be allowed to read is *Robinson Crusoe*, and the only people he is to be allowed to have communication with are his tutor and the people of the house and village, from whom it would be impossible to isolate him without making him practically a prisoner. But the tutor is to do all the manipulation of life, and a thoroughly artificial system is the result of this naturalistic scheme. Naturalism in education is now mainly associated with reactions against an over-bookish tendency. The athletic side of our English schools represents the naturalistic movement, and several private schools in England have been established on professedly naturalistic lines.

There is a good deal of confusion in educational theory about the meaning of the term *nature* in connection with naturalism. It may mean either the nature of things or the nature of the educand. Obviously the two meanings run into each other, and it may not unreasonably be maintained that the nature of the educand must necessarily be included in the nature of things. But it is of some consequence where the incidence of the emphasis occurs. It has been claimed, for example, that Rousseau is the first writer who has adopted what Dr Stanley Hall calls the paidocentric point of view—that is, the view that regards the whole problem of education from the standpoint of the nature of the educand. He must, however, share this honour with John Locke (1632–1704), who in his *Thoughts on Education*, an unsystematic but very practical treatment of the educational problem, gave us the first book that makes the child the centre of the problem. The Jesuits, too, in their educational system made a very definite application of the paidocentric view. The idealist writers on education, who were powerfully influenced by Rousseau, are very much inclined to adopt the policy of following nature without analysing too closely the connotation of the term. Pestalozzi (1746–1827) and Froebel (1783–1852) both base their theories on a more or less clear appreciation of the idealist philosophy prevalent in their time. There is no doubt that if Froebel had been questioned whether he proposed to follow the nature of the child, or nature in the sense of the nature of things, he would have replied that it did not matter, as it would be impossible to follow the one without following the other. Pestalozzi's influence was that of a prophet rather than a philosopher. He knew little about psychology, and produced his remarkable results by the sheer force of personality and native insight. Froebel was much more systematic —too systematic, some of his critics maintain. His kindergarten system is built up on a metaphor. The school is regarded as a garden and the children as the plants. The teacher has the office of gardener. The plant-metaphor is excellent so far as it goes; but it necessarily breaks down, because children, in plain English, are not plants, but something much higher. The introduction of the idea of self-consciousness must modify the whole position. However, as a stage in the development of true educational theory, Froebel's work was of the first importance, and the later developments of his system are on the whole satisfactory.

The Froebelian position tends to become too negative. 'A passivity, a following,' comes to be a rather depressing ideal; so the more positive doctrine of Johann Friedrich Herbart (1776–1841) was very generally welcomed. Founding on an atomistic psychology that cannot be defended, he erected a system of educational theory in which the value of nurture is emphasised as opposed to the paralysing view that everything depends upon original endowment. It is hardly too much to say that Herbart regarded as possible a process that would be named by the older philosophers 'an implanting of faculty' in the educand. The Froebelians and the Herbartians each over-emphasise one aspect of the truth. Between the two comes Dr Maria Montessori, who gives the Froebelian self-activity a practical turn, and applies to the education of normal children the lessons she learnt in using the motor methods that have proved so successful in training defectives.

The materialists, as represented by La Mettrie (1709–51), D'Holbach (1723–89), Helvétius (1715–1771), and Huxley (1825–95), treat the human being as a machine, and in this way simplify a great many of the problems of education for those who can accept their premises. Herbert Spencer (1820–1903) represents the evolutionary-utilitarian point of view, and his little book on *Education*, in spite of the criticisms to which it has been subjected by educational experts (or perhaps because of these criticisms), has probably exercised more influence than any other book on education published in English during the 19th century. At the present moment educational theory has become more consolidated than it has ever been before. There is now a large body of views that are generally accepted, however much opinions may differ in other particulars. The most promising line of advance at present appears to be in the quantitative analysis of educational problems, and in the experimental work associated with such names as Meumann, Dewey, Claparède, and Nunn. The correlation formulæ of Pearson and Spearman hold out great hopes. Expert psychologists are at present collaborating with experienced students of education all over the world, and there is every prospect of valuable results.

ENGLAND.—By the Education Statute of 1406 the English parliament had proclaimed the right of every man and woman 'to set their son or daughter to take learning at any school that pleaseth them within the realm.' Then in 1410 the Court of Common Pleas decided that by the common law of England any one had a right to teach. There was thus in England freedom of learning and freedom of teaching. The law did not recognise the right of the Church to monopolise the licensing of teachers. Yet, as a matter of fact, it was for centuries practically impossible to teach in schools without a license from some church official. The history of national education in England, from the 14th century onwards, is largely a record of the struggles between different religious parties for the control of the schools. It has been shown by recent investigations that in the last quarter of the 14th century there was a much more complete system of primary, secondary, and university education than had been generally supposed. Through the struggles with Lollardy the system as a system was broken down, though the effect of the Lollard spirit on the education actually given was good. The increased use of the vernacular and the greater freedom of thought were gains for education. A similar movement marked the great Reformation, of which the Lollard movement was the precursor. There was an advance in the national ideal of education, but this was accompanied by an actual set-back to the national system. The new learning

was just what was needed to revive the somewhat barren teaching of the pre-Reformation schools; but, unfortunately, a great many of these schools were killed off by a misuse of the legislation of 1547. Henry VIII., and still more Edward VI., used to get the credit of founding a great many new schools. But Mr A. F. Leach seems to have proved in his *English Schools at the Reformation* that in the times of these monarchs many more schools were suppressed than founded, and that many of their foundations are, in reality, merely readjustments of foundations that were already in existence. Leach tells us that in 1535 there were in England about 300 grammar-schools, and that most of them were swept away through the plundering of the ministers of Henry VIII. and Edward VI. It is likely that this is somewhat exaggerated, and that many of these schools had been already ruined by the storm and stress that accompanied the breakdown of medieval learning before 1535. In any case, there appears to have been a sufficiently large number of schools suppressed by Henry and his son to justify Leach in describing them as spoilers of schools rather than as founders. In 1563 the Speaker of the House of Commons made a striking statement of the lack of schools, and yet in 1581 Richard Mulcaster gave the assurance that there was no cause of complaint regarding the number of schools. In point of fact, the Elizabethan period includes no fewer than 148 new foundations, and 34 additional foundations. James I. followed a liberal policy in education, but the troubles of the succeeding reign stopped progress; and though Cromwell inaugurated a progressive policy, it was cut short at the Restoration, and the various restrictions culminating in the Act of Uniformity of 1662 brought the grammar-schools to low-water mark. It has been said, with some truth, that from 1662 to 1870 the grammar-schools of the country were totally inefficient. At this point we come to a very peculiar phenomenon. Of the 3000 endowed schools now existing in England and Wales, no fewer than 1100 were founded between 1660 and 1730. The fecundity of these seventy years is traced to the result of *Bate's case*, in which it was decided that a schoolmaster presented by the founder of the school or by a lay patron could not be ejected because he had not a bishop's license. This was a direct encouragement to dissenting founders, and to those churchmen who wished the Church to keep to her proper sphere. During the 18th century higher education in England was practically dormant, but the period was marked by a quickening of the public conscience with regard to the education of the poorer classes. This became more marked towards the end of the century, and resulted in the payment of the education of the poor at the expense of the parish, and in an extended founding of charity schools.

Real popular education was greatly favoured by two movements, that marked the passage from the 18th century to the 19th. The first of these is the establishment of the Sunday-school, which in its beginnings was not merely a religious institution, and was not confined to children. Secular subjects were taught (the school meetings lasted two or three hours, not merely one as at present), and sometimes evening-classes during the week were included as part of the system. The other movement was the application of the monitorial system, claimed as an invention by both Dr Bell and Joseph Lancaster; though it was developed in Paris by the Chevalier Paulet in 1790, and is found explicitly described in John Brinsley's *Ludus Literarius* in 1612. Bell belonged to the established Church, and was concerned with the foundation of the National School Society in 1811. Lancaster was a dissenter, and worked under the British and Foreign School Society, formed in 1814 after having existed in other forms for some years previously. These two societies became the educational powers that dominated the administration of education through a great part of the 19th century. So strong had public opinion become on the education question that parliament began to take it up. There was an abortive Education Bill in 1820; in 1828 Lord Brougham made his famous 'schoolmaster-is-abroad' speech, and following on the Parliamentary Reform of 1832 came the earliest grant in aid of education. The parliament's first grant towards 'educating our masters' amounted to £20,000, and was to be spent in building schools (not including teachers' houses), half the cost having to be provided in each case from local contributions. The amount was quite insufficient; many schools for which the local contribution was forthcoming had to remain unbuilt, though the parliament made another dole of £20,000. In all cases the application for a share in the grant had to be made with the approval of one of the two great educational societies. In the allocation of the grant there was a discrimination in favour of large schools, and also a bias towards town schools. The depressing effect on rural education has been felt ever since. In 1834 a grant of £10,000 was made for founding model schools for the purpose of training teachers, but was not expended till 1839, when it was handed over to the two societies. In that year a Committee of Council was appointed to superintend the spending of parliamentary grants for education, and accentuated that violent religious, or, rather, ecclesiastical, dispute about the control of education, that has lasted to the present day. From 1850 to 1870 there was an uphill battle fought by those who wished to see a state system of education established. In 1856 the Education Department was founded under the control of the Vice-president of the Committee of Council, who could sit in the House of Commons. Along with the Education Department was the Science and Art Department. This had originated in the parliament's desire to further technical education by the foundation of the Government School of Design in 1837. In 1853 parliament made its first grant to the Science and Art Department. In 1856 this department was removed from the control of the Board of Trade, and worked as a more or less independent organisation alongside of the Education Department. It was not till 1899–1900 that the two departments were officially made one, under the name of the Board of Education.

The final struggle to establish compulsory education began in 1859, and resulted in success in 1870; though it should be noted that the Education Act of that year does not make education compulsory, but only gives the right to local authorities to make it compulsory if they please. During this period of struggle was introduced that system of individual examination and 'payment by results' that did so much to deaden the educational work of the elementary schools. For this system we have to thank Robert Lowe (Lord Sherbrooke), whose Revised Code of 1861–62 marks its establishment. At the beginning its influence was probably for good. It introduced a certain amount of order and method where there had been nothing but confusion, and it certainly braced up the teachers. It was when it had settled down into dead routine that it laid its chilling hand on all initiative, and imposed a mechanical ideal upon all. In 1890 it was substantially modified, but it was not till 1897 that it was completely abolished. As the Elementary Education Act of 1870 did not define elementary education, there was room for the school boards to give as advanced instruction as they thought desirable. In 1900,

however, this right was challenged, and by the Cockerton judgment it was decided that 'a school board out of money raised by rates might not provide for any instruction which was outside the curriculum prescribed by the code issued by the Education Department for elementary public schools.' This decision effectually prevented the school boards from continuing to compete with the endowed schools; but immediately afterwards the boards themselves had to make way, under the Education Act of 1902, for the education committees of the County and Borough Councils, which were authorised to control both elementary and secondary education. The London area was provided for by a special act in 1903. With the school boards went the technical education committees that under the Technical Instruction Act of 1889 were empowered to aid technical or manual instruction out of the rates. Thanks to certain customs and excise duties that were made available for educational purposes, these committees were able to do much good work, which is now being carried on with considerably less difficulty by the one educational authority that is responsible for all sorts of education in each district.

With the act of 1902 came the distinction between provided (council) schools and non-provided (the old voluntary) schools. In the words of the act, the former are 'schools provided by the local authority;' the latter are not provided by the local authority, but by some organisation (usually religious) that provides the buildings, and makes all necessary repairs other than those involved in fair wear and tear. Subject to the conscience clause, denominational religious instruction may be given in the 'non-provided' schools, but not in the 'provided' schools. The council appoints four of the six managers of its own schools, the other two being appointed by the borough council or parish council. In 'non-provided' schools four of the managers are appointed by the organisation that provides the school, and the other two are appointed by the council in whose area the school is situated. The council has the power to direct the secular instruction of a 'non-provided' school, and to inspect it. But the managers have the right to regulate the religious instruction, and to appoint and dismiss teachers, subject to the approval of the council—which, however, can intervene only on educational grounds. The Nonconformists were strongly opposed to certain of the provisions of the 1902 act, and the government that came into office in 1906 made several attempts to carry a bill that might serve as a compromise between the two parties. But the bill of 1908 was dropped at the last moment because the two parties could not agree on the contracting-out clause. These failures left the Church uneasy, the Nonconformists indignant, and the administrative authorities unsettled.

Mr Fisher practically ignored the ecclesiastical question in the Act of 1918. By this act education was made compulsory up to the age of fourteen, and all exceptions were swept away. After fourteen the pupil may either continue full-time attendance at a suitable school till he attains the age of sixteen, when he becomes quite free from further compulsion, or he may take part-time instruction at a continuation school from fourteen to eighteen, this instruction to be received in the daytime. The minimum amount of instruction is fixed at 320 hours per annum, the arrangement of these hours to be left, within reasonable limits, to the local authorities. 'Works' are allowed to have their own schools, under suitable conditions, that include government inspection. Special attention is paid to the health and social welfare of the young persons under this act. The recreative side is to be developed. Playing fields, baths, holiday camps, and other amenities find a place in the schemes that are to carry out the terms of the act. All manner of manual arts for both boys and girls are to be introduced into the continuation schools, but the aim is to be educational rather than vocational. An important innovation is the permission to the local education authorities to provide nursery schools for children below the ordinary school age.

The 'whisky money,' as the grants under the Local Taxation (Customs and Excise) Act of 1890 were called, was continued to the councils, but with the condition that it must be spent entirely upon education 'other than elementary;' though the restriction to technical education was now removed. The power was also granted to levy a rate, which in the case of the counties must not exceed twopence, but is unrestricted in the case of the county boroughs.

The tendency of all this educational activity since 1902 is clearly towards centralisation of power in the Board of Education, modified by a very healthy local interest in the schools. The difficulty of distinguishing between secondary and elementary education has been surmounted by defining secondary education as 'other than elementary,' where by elementary is meant what is taught in a public elementary day-school during school-hours. All evening-schools are therefore technically secondary, whatever the subjects taught. The education other than elementary includes first of all what are called the 'great' public schools. Those are, in alphabetical order, Charterhouse, Cheltenham, Eton, Harrow, Marlborough, Merchant Taylors', Rugby, St Paul's, Shrewsbury, Wellington, Westminster, Winchester. In the next group are the endowed schools of the type of the City of London School and the Manchester Grammar School. Many of these are independent of public aid, and thus stand outside the control of the Board of Education. But many of the less well endowed schools now receive state aid, and are thus subject to inspection by the Board. Then come the proprietary schools, that work under a scheme that guarantees that they are not carried on for private profit. To this class belong schools like those of the Girls' Public Day Schools Company. Another and an increasing group is made up of schools actually founded and entirely financed and controlled by the local authority. It is getting customary to call these 'municipal secondary schools.' Some of them are doing excellent work, but just at present they do not have quite the status that will certainly come to them in a few years. In some cases they are regarded as nothing but the old 'higher grade' schools under a new form. The final group of secondary day-schools is made up of what are called private schools, the official *differentia* being that they are carried on 'for private profit.' In the case of the weaker schools this profit is gradually being turned into a loss, through the competition of the state-aided schools, and none but the thoroughly efficient private establishments are likely to survive; though for these there will probably always be found a clear scope, particularly in the case of girls' schools.

The Training of Teachers.—The national system of training teachers is a development of the monitorial system, and the pupil-teacher system that arose out of it in 1846. There is some dispute as to which was the first training-college in Great Britain, which is only natural, since no institution of this kind springs into being fully formed. The plan of using schools to give teachers a training for their future work was in operation in many directions in the early part of the 19th century, and out of these experiments were evolved such institutions as David Stow's college at Glasgow and the training-college at Battersea. The building grant in 1839 was the beginning of the government sub-

sidising of the training of teachers, and this rapidly developed into a system of maintenance that practically paid all the expenses of training the students apart from the provision of premises. The ordinary course was for the pupil-teacher to serve a five years' apprenticeship—afterwards reduced to four years—and thereafter, if successful in what was called the Queen's Scholarship Examination, to pass into one of the colleges under one or other of the two great societies. There the student obtained further instruction in general subjects, and also a careful practical training in the work of teaching; passed an examination at the end of each year of training; and was then certified as a competent teacher of the second, third, or fourth class. This certificate could be raised to the first class only as the result of at least ten years' successful teaching. The pupil-teacher system has now given way to the student-teacher system, under which the intending teacher begins by a course of, at least, three years as a pupil at a secondary school, usually, but not necessarily, as a county scholar. This is followed by another year, during which the candidate remains at the secondary school as a 'bursar.' The next year may be spent either as a 'second-year bursar' at the secondary school, or as a 'student-teacher' attached to an elementary school, where he (she) has opportunities for observing good methods of teaching, and for practising a little on his (her) own account. During the student-teacher year the candidate attends at a secondary school (usually the one in which he (she) was educated), for one whole day per week, or two half-days, in order to keep up his (her) private studies. A qualifying examination must then be passed, and the candidate is admitted to a two years' course at a training-college as before, but the certificate obtained on leaving is not classed; it is merely a permission to practise as a certificated teacher. Certain of the better qualified students are allowed to combine a university course with their practical training. This course formerly covered three years, but by a regulation made in 1911 the course has been extended to four years—the first three to be spent mainly in academic work, the last year entirely in professional training. Hitherto there has not been much opportunity of training provided for teachers who intend to work in secondary schools. But there are now several separate colleges for secondary women teachers, and almost all the universities have courses of training and teaching diplomas to correspond. A Register of Teachers was established by the government in 1902, with a Registration Council to administer it. But the scheme miscarried, and by the Education (Administrative Provisions) Act of 1907 was abolished. The Regulation of the Order in Council constituting the Registration Council ceased to be operative on 31st July 1906, and the council was not reappointed. A new Teachers' Council was authorised in 1911, which, with 73,000 registered teachers, parallels the General Medical Council.

The universities of England fall naturally into two classes: Oxford and Cambridge on the one hand, and all the new universities on the other. Durham is a connecting link between the two groups. It is difficult to find a name for the new group. They resent being called 'provincial' or 'municipal.' Perhaps 'modern' or 'civic' may turn out to be an acceptable term (see UNIVERSITIES).

WALES.—With regard to elementary education, Wales has always been included in legislation that affected England. On the secondary side, following the recommendation of Lord Aberdare's Committee of the Education Department (which sat in 1881), the Welsh Intermediate Education Act was passed in 1889, and placed Wales ahead of England in secondary educational legislation till the changes of 1902. The intermediate schools, established as a result of the act of 1889, varied greatly in the range of their curriculum. Some were little more than higher elementary schools; others were quite able to supply the Welsh university with students straight from their benches. The three university colleges—Aberystwith (1872), Bangor (1884), and Cardiff (1883)—were united to form the University of Wales in 1893. In the struggle for secondary and higher education, Wales has shown great public spirit and has made great sacrifices.

SCOTLAND.—What gave Scottish education its special characteristics was the parish school. This originated in the admirable ideal of Knox set out in the first *Book of Discipline*. His scheme implied, 'first, a school in connection with every kirk or parish, in which the ordinary branches and Latin should be taught; second, a higher school or college in cities and notable towns; and, third, university instruction for those who showed aptness for learning.' This ideal was never completely realised, but its existence did much to maintain a high standard of popular education in Scotland. In 1646 the Scottish parliament passed an 'act for founding schools in every parish,' and made regulations for the rating to produce the necessary money, the schoolmaster's stipend being fixed at not less than 100 and not more than 200 merks. This led to a rapid increase in the number of schools; but though the act provided for the appointment of 'twelve honest men within the bounds' to see that its provisions were carried into effect, there were still parishes left without a school; notably in the Highlands. In 1662 this act was repealed, and a depressing time followed. But in 1696 the provisions of the act of 1646 were revived, with such changes as experience had shown to be necessary. In these two acts we find the legal foundation of the parochial school system of Scotland. The parish schools were always practically under the control of the Church. From the Reformation to the passing of the act of 1872 the appointment of the masters of the parish schools was entirely in the hands of the Church of Scotland. Even in the schools that sprang up in the burghs the Church claimed, and in many cases obtained, the appointment of the masters; though the burgh authorities in other cases resisted, and kept the patronage in their own hands. The parish schools varied considerably in merit, but speaking generally they represented a remarkably high standard of popular education. Dr John Kerr in his *Scottish Education* is able to boast 'that all the subjects, till lately, required for the Cambridge "Little-Go" examination were at the end of the 18th century, in some districts, not seldom taught in village parish schools.' In the north-eastern counties of Scotland—Aberdeen, Banff, and Moray—the parish schools in the 19th century reached an exceptionally high state of efficiency, owing to the encouragement given by the application of the Dick and Milne Bequests, the funds of which are still available for popular education. An important element in maintaining the high standard of attainments among the parochial schoolmasters was the close connection between the school and the pulpit, schoolmasters being very often fully qualified probationers waiting for an appointment to a church. Scotsmen are particularly anxious that Englishmen should note that in the act of 1872 that introduced compulsory education into Scotland there is no mention of the phrase *elementary education*. On the contrary, there is a provision that 'the standard of education which now exists in the public schools shall not be lowered.' Further, the school boards which were brought into existence by this act were called upon to apply a compulsory clause, not to choose, as in England, whether they would

apply it or not. From 1872 to the present time education in Scotland has followed much the same lines of development as in England. In the primary schools there was always much more of the higher work done than was attempted in the corresponding English schools, and in a great many cases there was a 'secondary department' added to the elementary school. But in June 1906 there was brought about a reorganisation of the secondary education of Scotland. All schools, whatever their history and to whatever category they formerly belonged, became 'intermediate' if they provided a three-year course of secondary education, and 'secondary' if they provided a course of at least five years. The 1918 Scotch Education Act is largely a measure of devolution. The central authority passes on a great deal of power to the new education authorities appointed *ad hoc* on a county basis to take the place of the nine hundred and more school boards that are abolished. The new authorities have the control of all grades of education short of the universities, and educationists are interested to see how the *ad hoc* scheme will work out compared with the rival scheme in England. Full-time education is now compulsory up to fifteen, and continuation work is compulsory from fifteen to eighteen. The secondary schools promote the supply of teachers by giving a three-year course for 'Junior Students,' who afterwards, as 'Senior Students,' take up the training provided by the Provincial Committees at the universities—Aberdeen, Edinburgh, Glasgow, St Andrews. Students in training for secondary work must, as a rule, take university honours in the subjects they propose to teach.

IRELAND.—The religious question has rendered the progress of national education in Ireland very difficult. At the beginning of the 19th century efforts were made to establish schools in which the pupils from the two communions could study all the secular subjects in common, and receive their religious instruction apart. This was the aim of the Kildare Place Society that was founded in 1811, and began to receive government grants in 1814. Its scheme included the reading of the Scriptures, but without note or comment. To this the conscientious Catholics could not submit, and the Catholic Church was able to render the society powerless to carry out the scheme. After several educational commissions had reported, the House of Commons in 1831 made a grant of £30,000 for national elementary education in Ireland. This money was not a fresh grant, but was merely the diversion of money that was withdrawn from the Kildare Place Society and the Society for Discountenancing Vice. For the administration of this public money a board of seven members was appointed, and thus was originated the Board of Commissioners of National Education in Ireland. The members were unpaid; though they soon found it necessary to have a resident commissioner with a fixed salary. The number of commissioners was gradually increased, till in 1860 it was fixed at not more than twenty, half of whom were to be Roman Catholics and half Protestants. By keeping in their own hands from the very beginning the right to inspect the schools they controlled, they avoided much of the friction that marked the development of the English educational administration. The principle of combined secular, and separate religious, teaching was maintained throughout; though at the earlier stages an excessive amount of time was devoted to the religious section—sometimes as much as two whole days a week. Local control was in the hands of a patron or patrons for each school. Committees could rank as patrons, but in the great majority of cases the patron was an individual, and in the Catholic schools almost invariably a priest. A particular kind of schools favoured by the board was bitterly opposed by the Roman Catholics. These were the model schools, which gave a higher education than the others, but on account of the opposition they aroused were never able to do all that had been expected of them. An excellent bit of work done by the board was the preparation of text-books; but certain economic and religious difficulties prevented this part of their work from becoming permanent. The Powis Commission of 1868 reported very elaborately in 1870, but it was not till 1883 that its recommendations were more or less carried into effect. In that year the system of voluntary denominational training-colleges was introduced into Ireland, and the course of training was increased from one year to two. In that year also it was agreed in the House of Commons, without a division, that the time had come to introduce into Ireland the principle of compulsory education. It was not till 1892 that free education was introduced for all between the ages of three and fifteen. An important element in the development of Irish education is the work of the Christian Brothers, a teaching body founded in 1802, recognised by a papal bull in 1820, having in 1825 eleven schools and forty teachers, and now, perhaps, the most influential teaching force in Ireland (see CHRISTIAN BROTHERS).

With regard to secondary education, we have the usual record of schools despoiled in the past; but the beginning of modern secondary educational administration may be said to be the establishment of the Board of Commissioners of Education in Ireland in 1813. The commissioners did their work as well as could be expected from unpaid officials, who were busy men and had little encouragement to exercise freedom of action as commissioners. Several committees and commissions reported with but small effect, till in 1885 the Educational Endowments Act was passed, which brought matters up to a point that corresponded to the English Endowed Schools Act of 1869, and still more to the Scotch Educational Endowments Act of 1882. The insuperable prejudice against co-operation in education between the Churches forced the government into the development of a system of examinations in secondary subjects that should encourage the teaching of these subjects irrespective of the school in which they were taught. The Intermediate Education (Ireland) Act was passed in 1878, and established an unpaid Board of Commissioners of Intermediate Education, whose business it was to provide an examination system on such a basis that prizes and certificates were given to deserving candidates, and a grant paid to the school in which they received their education. By the Government of Ireland Act, 1920, the capital funds of this board were divided between the governments of Southern and Northern Ireland.

Trinity College and the University of Dublin are practically identical, since there is no other college included in the university. This institution supplied the higher education for the Protestant population. Maynooth College dates from 1795, and finally became a part of the Catholic University opened in 1854. By 1882 this university had six constituent colleges. To provide for the higher education of all classes, without distinction of sect, the act of 1845 led to the foundation of three Queen's Colleges—at Belfast, at Cork, and at Galway. These were opened in 1849, and in the following year the Queen's University was formed to examine and grant degrees to the students attending these colleges. A change of name took place in 1879, when the Queen's University became the Royal University of Ireland. In 1910 a more

radical change took place, when the Royal University gave place to the National University of Ireland, which includes the University Colleges of Cork and Galway and the new University College of Dublin that was founded in 1909. The old Queen's College of Belfast ranks from 1909 as the Queen's University of Belfast.

CANADA.—There is no Minister of Education for the whole Dominion of Canada, the administration of educational affairs being left entirely in the hands of the governments of the nine separate provinces. Of these, British Columbia has a Minister of Education, who is also Provincial Secretary; Prince Edward Island has a Superintendent of Education; Manitoba has a Minister of Education, who is also Municipal Commissioner. In the rapidly developing Saskatchewan it is natural that the Minister of Education should also have to look after the treasury, railways, and telephones as well; while in the old-established Ontario there is a minister who gives his whole time to education. The general principle of Canadian administration is that education shall be compulsory and free. It is always a charge on both the central and the local funds. The compulsory clause is, however, somewhat generously interpreted, particularly in the parts that are just being settled. But, speaking generally, the advantages of education are so highly prized that there is no difficulty in maintaining a reasonable attendance at schools, even under very trying circumstances as to weather and distance. Every effort is made to bring education within the reach of all. Thus in Saskatchewan the territory is divided up into areas of twenty-five square miles, for every one of which an elective board of school trustees is appointed. The schools cannot be said to be secular, as in Australia, but in five provinces out of the nine they are unsectarian, and even in the remaining four the difference consists in the provision of separate schools for Roman Catholics. In Alberta, Ontario, and Saskatchewan these separate schools are found, and in Quebec there are two Boards of Education—a Protestant one and a Catholic. But though in the east of the province the Roman Catholics greatly outnumber the Protestants, there is an arrangement by which a minority may secure a separate school wherever it can show anything like a reasonable case. In this province there are two universities—McGill at Montreal, and the Roman Catholic University of Laval at Quebec. It is with cause that Ontario is proud of its educational system, whether it be justified or not in claiming it to be the best in the world. The University of Toronto ranks with McGill among the best on the continent of America. Indeed each province has now at least one university, and there are nearly twenty degree-granting bodies within the Dominion. The teaching of agriculture gets special attention: there is at Guelph a large and well-equipped college for students of this subject. Thanks to the munificence of Sir William Macdonald, there is also an excellent agricultural college and training-school for teachers at Ste Anne, near Montreal.

AUSTRALIA AND NEW ZEALAND.—The education given in all the states of this group is very much alike. So far as elementary education is concerned there are three terms that may be generally applied to it—free, compulsory, and secular. New Zealand differs from the Australian states, inasmuch as its educational administration is not so strictly centralised. The Minister of Education has as right-hand man the Inspector-general, who controls the central Board of Education, and keeps it in touch with the schools. On the other hand, though the inspectors take their orders from the central authority and have to see that the code is duly carried out, they report to the local authorities; though, of course, the reports finally find their way to headquarters. Elementary education is covered in six standards, the highest standard being equivalent to what is called the seventh standard in England. The elementary course is usually finished about fourteen, and thereafter provision is made for a secondary course that should cover four years, but that much more usually consists of only three, and in many cases of only two. So far as public education is concerned there is no gap between the elementary system and the secondary. From the nature of the Dominion there is a greater demand for a practical education than for a purely literary one; though, in proportion to the population, higher education is well provided for. There are over thirty endowed schools and colleges; and there are institutions of university rank at Auckland, Christchurch, Dunedin, and Wellington, which form the federal University of New Zealand, which has maintained a high standard of degree work, and has kept in close touch with the best university traditions of the old country.

The universities of the Australian Commonwealth are not of this kind, but follow the Scotch or the provincial English type. Each of the states has now a university; Sydney dates from 1850, Melbourne from 1855, Adelaide from 1874. Brisbane began work in 1910, and Perth got into working order in 1912. Even Tasmania has a little university of its own, with a rapidly increasing enrolment. The strictly secular character of the elementary instruction in Australia has had the effect of encouraging secondary private schools. The ideal towards which Australia is working is a national system of free primary, secondary, and university education; but at present the secondary system is largely in the hands of private persons and religious bodies. In New South Wales in 1916 there were 701 private schools. In Victoria secondary education is all but entirely carried on in private schools. In Queensland the 10 grammar-schools, with 6 new high schools, make a poor show as against the 154 private schools with their 19,857 pupils; and South Australia can show only 23 high schools to balance the 218 private schools. In Western Australia the private schools received a grant up to the year 1895, when it was stopped, with compensation to schools that had been already receiving it. The Commonwealth shows a very keen interest in education. In all the state governments there is a minister responsible for this part of public administration, and all the special difficulties of a sparsely populated area are effectively dealt with. Victoria and New South Wales are very proud of their educational systems, but they are keenly alive to the need of keeping abreast with modern developments. All the states take pains to keep themselves in touch with what is going on elsewhere, and their official reports give evidence of extraordinary alertness.

UNION OF SOUTH AFRICA.—The Union has a Minister of Education, who is also responsible for mines and industries; but it was provided in the South Africa Act, that 'Education other than higher education, for a period of five years, and thereafter, until parliament otherwise provides, shall be and remain under the jurisdiction of the respective Provincial Councils.' It has been provisionally agreed that higher education shall mean post-matriculation education. Accordingly the Provincial Councils have the control of elementary and secondary education, while the minister controls university and technical work, including the first-class certificate examination for teachers. Education for white children is practically compulsory throughout the Union, there being only a

small percentage of white children of school age not under instruction. Attendance is good throughout, but particularly at the characteristic private farm schools, where it reaches 95·5 per cent. The difficulty about the languages is likely to settle itself to the satisfaction of all parties except the extreme Dutch patriots. The advantages from a purely business point of view of a knowledge of English are such that parents of foresight are insisting upon their children getting this knowledge. The pressure for English instruction is coming from the Dutch themselves. The University of the Cape of Good Hope, which was incorporated in 1873, was a purely examining body, but in 1916 it was federated with several colleges as the University of South Africa. In the same year the Victoria College was turned into the University of Stellenbosch, and the South African College into the University of Cape Town.

British India.—The statistics of the subject are very incomplete, all that are available being found in the *Quinquennial Review of Education*, published by the government. The figures in what follows are taken from the *Review* for the quinquennium ending in 1917. The first five universities were Calcutta, Madras, Bombay, Allahabad, Punjab. To these were added in 1917 Mysore University and a Hindu University at Benares. Dacca and Patna are the next two, and Rangoon and Nagpur are to follow. There are altogether 184 affiliated colleges (156 in British territory, 25 in native states).

Secondary schools fall into four classes: English high schools, English middle schools, vernacular high schools, vernacular middle schools. The three following statements may be held to be applicable to all secondary schools: (1) Boys leave school at sixteen, or on having attained the stage of advancement that is usually reached at this age. (2) English is the medium of instruction in the two or three top classes in those schools that are classed as English. No English is taught in the vernacular schools. As a matter of fact, there is only one vernacular high school in India (Punjab). (3) The total expenditure on secondary education averages 27·6 rupees per pupil. The average direct expenditure per pupil is 5 rupees, of which the direct *public* expenditure amounts to 3·6 rupees.

The difference between high and middle schools is like that between *gymnasien* and *pro-gymnasien*. The middle school is merely a high school with two or three of the top classes cut off. The curricula of the secondary schools are largely determined by the matriculation at the universities. The teachers' qualifications and pay 'are below any standard that could be thought reasonable,' but have improved lately.

In India primary education is defined as the education of the masses through the vernacular. In some cases (Bombay) the elementary schools feed the secondary, but in general there is no connection between primary and secondary education. The number of boys at elementary schools in 1917 was 5,183,169, being 4·2 per cent. of the male population. For these there were 219,167 teachers (of whom 65,818 were trained), giving one teacher to about 24 pupils (in 1912 it was 27). Of the elementary schools, about a quarter are publicly managed. Of the privately managed schools, less than one-fifth are under missionary management. The average number of pupils in a school is 39; in 1912 it was 38. The salaries of primary teachers in board and municipal schools vary greatly—from 7·7 rupees per month to 18·6. These figures help us to realise how misleading it is to generalise about India as a whole. The government grants are extremely small, the annual amount per pupil varying according to district from 1·4 to 3·9 rupees. The payment of fees is general throughout India, but the system is softened by liberal exemptions in necessitous cases. The fees are low, averaging 14·5 annas per annum in ordinary schools and 7⅛ annas per annum in government schools. As to curriculum, the three R's are taught universally; geography is almost universal; history is taught in only some of the provinces. Physical exercises are compulsory in all the provinces except Burma. The deplorable system of payment by results was recommended for general adoption in India in 1882-83, but is now found only in Burma. The figures given above for elementary education apply only to boys. The number of girls attending primary schools in 1917 was 627,908, which shows an increase over the preceding quinquennium of 164,359, and thus indicates a very rapid development. Of these girls a little less than 60 per cent. attend schools for girls only, while rather more than 40 per cent. attend mixed schools. Co-education is customary in various degrees in the elementary schools up to the age of eight. It appears that the people do not resent co-education in the way that Europeans had expected. Certain educational advantages are sometimes recognised, and the familiar administrative advantage of cheapness is generally acknowledged. In one mode or another, female students are receiving instruction in the same branches of professional and general knowledge as men—except in Oriental studies, engineering, and agriculture. There are 12 arts colleges for women, with a total of 369 students, as compared with 122 arts colleges for men. Women are admitted to men's arts colleges, but they seldom seek admission. Professor Karve's university for women at Poona is likely to extend. It is a private and unaided institution.

Germany.—The history of elementary national education in Germany, as elsewhere, is a history of social and ecclesiastical struggle. After the enthusiasm roused by Pestalozzi and Fichte came reaction. The name of Ferdinand Stiehl is rendered notorious because of his 'Regulative' issued in 1854 to counteract 'over-education,' and reduce to their proper level the primary schools and the training-colleges that prepared their teachers. The teachers were not permitted to learn anything beyond what they were to teach in the elementary schools. In the schools themselves the method to be adopted was the mere communication of elementary knowledge, largely by means of learning by heart. The general lowering that resulted led to reaction in its turn, and in the Bismarckian era a more progressive policy was followed. The training-college curriculum was enriched, and the regulations for the elementary schools not only widened the curriculum and demanded better methods, but inaugurated a scheme for a higher kind of elementary school to be called the *mittel-schule*. This was to take a place between the elementary and the secondary school. It was to have not less than five, but usually six, classes, where the ordinary subjects of the elementary course would be carried to a more advanced point. But this type of school has not been a success, not because of its organisation or curriculum, but because of its social bearings. Like our own higher elementary schools, it has always suggested unfavourable comparisons with the real secondary schools. It has no privileges; cannot be called a 'higher' school; secures no exemptions, military or educational. While this is true in Prussia, it is worth noting that in some German states and in Austria the term *mittel-schule* means secondary school.

In Germany as a whole, elementary education is free and compulsory between the ages of six and fourteen. It is extremely thorough so far as it goes, but it is not co-ordinated with the secondary

system. The elementary schools (*volks-schulen*) form an independent system for pupils who are expected to finish their education at fourteen. Any higher education for such pupils is to be sought in the technical and other continuation schools that are carried on mainly in the evenings. The Scandinavian type of people's high school is finding favour in Germany, and a great deal is being done for popular adult education. The highest form of secondary education implies a nine-year course, preceded by a preparatory course of three years. The classes for the nine years have a uniform nomenclature in all kinds of schools. The German Sexta corresponds to the English Form I, Quinta to Form II, Quarta to Form III, Unter-Tertia to Form IVb, Ober-Tertia to Form IVa, Unter-Sekunda to Form Vb, Ober-Sekunda to Form Va, Unter-Prima to Form VIb, Ober-Prima to Form VIa. The nine-class institutions fall into three great groups, differentiated from each other by the curriculum. The *gymnasium* includes in its course both Latin and Greek. The *ober-realschule* gives no Latin or Greek, and makes French the basis of the teaching of languages. It restricts its teaching, in the main, to subjects belonging to our own times. The *realgymnasium* comes midway between the other two, and compromises by leaving out Greek and retaining Latin. It otherwise favours the modern spirit, and concentrates its teaching in the upper forms on the sciences and modern languages. There has been great jealousy among the three types of schools. Originally only pupils who had followed a complete course at a *gymnasium* were eligible for admission to the university. The *gymnasium* was regarded as a universal institution—an *einheits-schule* that prepared for all branches of university study. Its pupils were trained on both the classical and the modern sides, or, in the college phrase, *sub utraque*. This utraquistic preparation, as it is called, proved to be too great a demand, leading as it did to an unreasonable increase in the age at which students could begin their university course, and to over-pressure in the schools. As the result of a long struggle, in which the claims of *realien*, or exact sciences, were pitted against those of humanism, it was finally arranged in 1900 that a complete course at any one of the three types of schools should qualify for admission to the university. It is worth noting that in the controversy the newer schools claimed that the literary part of their course consisted of the 'newer humanities.' It has been suggested that there should be a fusion between the *ober-realschule* and the *realgymnasium*, and this is not unlikely to result from the development of the so-called *reformschulen*, in which no instruction is given in Latin till the fourth year (*unter-tertia*), French being started in the first year (*sexta*). Even in the *gymnasien* there are now cases in which the beginning of the classical languages is postponed—French to the fourth year (*unter-tertia*), and Greek to the sixth (*unter-sekunda*). In the German system the use of the prefix *pro* indicates that the school in question has only the first six classes of the nine-year course. Its highest class is the *unter-sekunda*. Thus a *pro-gymnasium* has no *ober-sekunda* or *prima*. This break between *unter-sekunda* and *ober-sekunda* is an important one, for it marks the limit at which the pupil may claim exemption from the longer period of military service. On promotion from *unter-sekunda* he is entitled to his *einjährig-freiwilligen-zeugnis*, which entitles him to limit his military service to one year. In proportion to its population Germany is particularly well supplied with universities of high rank. There are in fact twenty-one of them. Though supported by the state and under state control, they have preserved in a very remarkable way *lehrfreiheit* and *akademische freiheit*. The first leaves the professors perfectly free to teach according to their convictions, and the second secures to the students such complete freedom that many writers—notably Nietzsche—regard it as a positive danger. The student may take his course a year at a time in different universities. He usually follows distinguished professors, if he can afford it. That is, he may go one year to Leipzig because of one distinguished professor; the next to Halle because of another. In Germany the question is not so much, 'At which university have you studied?' as 'Under what professors have you studied?' The *lernfreiheit* leaves the student perfect freedom to attend whatever lectures he likes, an extension of even the American elective system. The final degree examination tests whether the student has made a wise use of the *lernfreiheit*. There is certainly nothing to complain of regarding the average German student in the matter of honest work.

Germany is particularly strong in the matter of technical schools of all kinds. The great institution at Charlottenburg is frequently held up for our imitation, and it has been more than once suggested that technical education in London should be organised on this model; though it is only fair to say that the education at Charlottenburg, though admirable, is not quite so advanced as seems to be thought in London. The following list of technical institutions from the English edition of Paulsen's *German Education* may be found useful: Technische Hochschulen (Technical High Schools), Berg-Akademien (Mining Academies), Forst-Akademien (Schools of Forestry), Landwirthschaftliche Hochschulen (Agricultural Colleges), Tieraerztliche Hochschulen (Veterinary Colleges), Handels-Hochschulen (Commercial Academies), Kriegs-Akademien (Military Academies), Artillerie-Schulen (Schools of Gunnery), Ingenieur-Schulen (Schools of Engineering).

FRANCE.—The present educational system of France is based upon the Napoleonic reconstruction that culminated in 1808 in the foundation of the Imperial University, whose grand master was an educational autocrat, responsible only to the emperor. The interruption of the Restoration period was not sufficient to break down the system, since the old universities had so completely disappeared that there was no material for the new government to build a fresh system upon. It has been said that French secondary education was the most aristocratic in the world, and it is rather remarkable that the Republic has been able so to modify the imperial organisation as to satisfy democratic ideals. Napoleon's purpose was not only to educate France, but by means of education to dominate men's minds, and the Republic does not seem averse to adopt the same attitude, at least on the negative side. Every precaution is taken that the centralised system of education shall at least not act against the government ideals. Even in schools that receive no aid from the state, government inspectors have the right of entry to examine text-books, exercise-books, and note-books, so as to make sure that nothing is being taught against good morals or against the state.

Though highly centralised, French education has local as well as central control. The Minister of Education is the centre of all authority. There is a general complaint that this minister has too much to do. Everything must be directly authorised by him, and the result is that he spends a good deal of time officially approving of matters that must of necessity be really determined by subordinates. He has three councils to help him. The *Comité du Contentieux* of seventeen, mostly lawyers, advise

him in cases of disputes. The *Conseil Supérieur* is made up of fifty-seven members (partly nominated, partly elected), who are all connected in some way or other with educational work; has advisory administrative and disciplinary powers; and is guided by a committee of fifteen of its members, who do the greater part of the work, since the *conseil* itself meets only twice a year. The third council that is at the minister's disposal is the *Comité consultatif*, which has three branches—primary, secondary, and superior. This plan of supplying an official with a council is characteristic of French educational administration. Thus the *prefet* of each *département* has a certain amount of educational control, and to help him is provided a *conseil départemental*. The real educational unit, however, is not the *département*. The French educational system is really the outcome of the former system under which the University of France controlled all education—primary, secondary, and superior. In 1896 the fifteen faculties within the French Republic were made into universities, and their general organisation and their relation to schools were determined by six administrative decrees during 1897. The country is divided up into seventeen geographical areas, which are known as *académies*. Each of these areas includes several *départements*, and is named after the town or city within its boundaries that is the seat of an institution of higher learning. Every *académie*, except Chambéry, has such an institution with at least a full faculty of letters. Over each *académie* is a rector, who is the supreme authority on education of all kinds within the area of his *académie*, and is responsible only to the Minister of Education. The council set apart for the help of the rector is known as the *Conseil d'Université*, dating from the Napoleonic time, but owing its present form to the changes of 1880. The rector is appointed by the president, and must hold the doctor's degree. His right-hand man is the academy inspector, who is in many matters his vice, but whose main independent functions are with the primary education in his *académie*. Primary education is free, and compulsory from six to fourteen, but by means of *écoles maternelles* and *classes enfantines* at the beginning, and *cours complémentaires*, *écoles primaires supérieures*, and *écoles manuelles d'apprentissage*, accounts for the ages between three and sixteen. But in France there is no organic connection between the primary and the secondary system. It is not impossible to pass from the primary to the secondary, but there are very few who do. The two systems are juxtaposed rather than co-ordinated.

The French secondary schools fall into two classes—the state schools and the free schools. The latter include those schools that were formerly conducted by the religious orders, but are now transferred to private individuals or to companies. To this class also belong certain independent schools, including the ordinary private schools, some of which are based upon English models. The state schools are either *lycées* or *collèges*. The former are to be found only in the large towns, and are entirely controlled and supported by the state. The *collèges* are partly supported by the local authorities of the district in which they are found, but are practically under as strict state control as the *lycées*; though efforts are being made to encourage the local authorities to take more interest in the *collèges*, and modify them to suit local requirements. *Collèges* are to *lycées* as nearly 5 to 2, but the *lycées* educate 50 per cent. more pupils than all the *collèges* put together. Teachers in both classes of schools have the same standing under the state, for since 1889 all teachers are servants of the state, and receive salaries from the national treasury. Both classes of state secondary schools take day-pupils, and many of them have hostels. In some 200 of the *collèges* the principal is permitted to farm the boarding arrangements under suitable restrictions, though the local authority is responsible in the last resort for any deficit that may occur.

The history of secondary education in France presents an almost exact parallel to the struggle between the *gymnasien* and the *realschulen* in Germany, and the result has been the same—diversity of type with equality of privileges. In France, however, the diversity of type has been secured in the same institutions, and has therefore greater elasticity than is to be found in the differentiated institutions in Germany. A complete secondary course in France includes ten classes. There is, first, the preparatory division, with its first-year class and its second-year class. Next comes the elementary division with the *classe de huitième* and *classe de septième*. Then follows the secondary course proper, divided into two cycles. The first cycle includes four years, and comprises the *classes de sixième*, *cinquième*, *quatrième*, and *troisième*. The first cycle has two parallel divisions. The A Division includes Latin from the *sixième* upwards, while Greek is voluntary from the *quatrième* upwards. In B Division there is neither Latin nor Greek, the time saved being devoted to French and the sciences. At the end of the first cycle, normally reached when the pupil has turned fifteen, there is available the *certificat d'études secondaires du premier degré*. For the course is so arranged that it makes a complete whole, though it is also suited for those who are about to take up the second cycle. The A Division does not lend itself quite so well to this idea of a course definitely complete at fifteen as does the B Division. In the second cycle the three classes are the *seconde*, the *première*, and the final year, which has two parallel sections—the *classe de philosophie* and the *classe de mathématiques*. As to curriculum, the second cycle is arranged into four sections: (1) Latin and Greek, the main studies; (2) Latin, and a more advanced study of the modern languages; (3) Latin, and a more complete study of the sciences; (4) no Latin, but greater attention to modern languages and the sciences. The natural goal of the second cycle is the *baccalauréat*. There is, however, a *non-baccalauréat* course of two years for those who have finished the first cycle, and want to get a more 'practical' training in modern languages and in the sciences, particularly in their applications. These courses are found only in certain schools, and are so modified as to meet local needs.

Other European Countries. — Except in Russia, where probably not more than 10 per cent. of the whole population have had education of any kind, it may be said that in all the countries of Europe education at the primary stage is free and compulsory. Even in Spain, Portugal, Greece, Bulgaria, Roumania, Servia, and Turkey itself elementary education is at least nominally compulsory. In Italy there are two grades of elementary education—one extending from six years of age to nine; the other from nine to twelve. Wherever both are available, education is compulsory up to twelve; in other cases the limit of compulsion is nine. In almost all the European countries the educational system is centralised, and the cost is divided between the central and the local authority. In some cases, as in Austria and Belgium, the whole cost of primary education comes ultimately to be paid by the communes. Two exceptional cases deserve notice. In the Netherlands, by the act of 1887, public instruction was diminished in favour of private instruction, even at the elementary stage. This means that the state favours education

by private bodies, and gives support to them. Where no private schools are available it provides them on its own account, but it appears to prefer to subsidise private enterprise. Switzerland is an exception to the general rule about centralisation, and yet has one of the best systems of education in Europe. Education is free and compulsory, though the compulsion is not so strictly enforced in the Catholic cantons as in the Protestant. Higher education is specially good, there being seven universities, all independent. The only share the Federal government takes in education is in maintaining a somewhat famous polytechnic at Zurich.

UNITED STATES OF AMERICA.—From the earliest times education has been highly valued in the United States. At the very beginning the democratic ideal enforced the need of universal education. The administration of education is vested in the local and state authorities, and is not centralised as in the case of the great nations of Europe. There is a bureau of education at Washington, but its functions are limited to the dissemination of information. It has no power of control. While each state has its independent educational system, it is remarkable how uniform the general plan is throughout the Republic. At the earlier grades it may be said that education in America is compulsory and free, but somehow the compulsory aspect does not need to be emphasised there so much as in Europe. It is the general belief that public opinion is so strong on the subject, that except in the case of immigrants, it is not necessary to enforce attendance at school. There is indeed a tendency to leave school rather young, but it is generally maintained that the American knows too well the handicap of the lack of education to run any risks. Dr Stanley Hall, however, gives some very disquieting attendance statistics in his *Educational Problems*. The typical elementary and secondary course may be said to occupy twelve years—eight years for elementary and four years for secondary education. The elementary work is done in what is proudly called the common school, where the sons of all classes of citizens sit side by side. The high school provides a four-year course. The eight years at the elementary stages are commonly called grades, the first six being really elementary; the seventh and eighth being intermediary, and frequently called the grammar-school grades. American educators tell us that in the grammar-school grades, as compared with the primary, 'the emphasis is shifted from the mastery of the means of knowledge as a purpose to the mastery of knowledge itself.' There is certainly a tendency to cut out the grammar-school period, and to divide up the twelve years into two equal parts—six elementary and six secondary. But a determining factor will be the decision of the problem of the function of the high school. It is felt that at present the school course is unduly dominated by the demands of the universities, whither only a small proportion of the pupils go. It is complained that the pressure of the universities on the high schools is communicated by the high schools to the common schools, so that the education of the whole country is dominated by a goal that only a very small fraction reach. In Dr Arthur C. Perry's *Problems of the Elementary School* (1910) we find a diagram in which the elementary school is figured as representing 94 per cent. of those under education, the high school 5 per cent., and the university 1 per cent. We have here the German problem of the *einheits-schule* presented under a new aspect. The Americans have the *einheits-schule*, and are not sure that they like it. So far as the unity it implies is a social unity, they are well content (though it is ominous that a university president should have to defend the common schools in an address entitled 'Call Nothing Common'); but when it comes to an educational unity, they begin to think that it might be better to have different kinds of schools according to the probable future of the pupils. The plan generally adopted in actual practice is to divide the twelve school years (6–18) into three periods: six years in the grades, three years at the junior high school, and three years at the senior high school. This supplies a vital articulation point at the age of 16. The junior high schools have established themselves in the confidence of the Americans as supplying a fitting terminus of a purely cultural training. Attention is now being mainly directed towards the organisation of the senior high schools as institutions for cultural training with a certain vocational bias.

Co-education is very general in America, and in spite of a fairly strong reaction it retains its hold. Objections come mainly from the east, and apply much more to the high schools than to the common schools. A more important problem of the same kind is the preponderance of women teachers. Up to the highest grades boys may be taught by women, and many Americans are wondering whether the result on the character of the boy is satisfactory. The kindergarten system has been thoroughly developed in America, and this, along with the predominance of women in the schools, is said to be producing an over-sensitive race.

America is more than usually well provided with universities. Many of these rank merely as good secondary schools would in Europe. If they would content themselves with the name of *college*, they would avoid unpleasant comparisons, and be recognised as the efficient institutions many of them are. In fact, French and German writers on education are inclined to suggest that there is room in the European system for the American college, somewhere between the *gymnasium* or *lycée* and the university. In any case, there are some thirteen or fourteen American universities quite on a level with our best European institutions, though differing considerably in type. With the exception of one or two universities in the east, they follow closely the type of the German, Scottish, and newer English universities. A marked feature of American education is the support it receives from philanthropic individuals. Institutions like the University of Chicago and that of Leland Stanford recall on a magnificent scale the generosity of pious founders who are almost extinct in England.

JAPAN.—We have in Japan one of the most striking examples of the deliberate adoption by a nation of a new system of education, embodying what it considers to be the best in foreign systems. The era of *Meiji*, or 'the Enlightened Government,' began in 1868, and under it the educational system was completely Occidentalised, the models being partly German, but mainly Anglo-Saxon. All children who have completed their sixth and have not yet completed their fourteenth year are said to be of school age, and must attend school, unless specially exempted, one of the recognised reasons for exemption being poverty. There is also a complete secondary and university system. At the earlier stages there were considerable numbers of foreign professors engaged by the government, but the policy is now being followed of having as much as possible done by Japanese. There is a complete system of ordinary and higher normal schools for the training of teachers. Physical education and hygiene are well attended to. Technical education receives special consideration, and it is here that most difficulty is found in securing proper teachers. All things considered, the higher education of girls is very satisfactory, and no doubt will develop rapidly. The text-books in the elementary schools

have given rise to a good deal of trouble through the dishonesty of publishers. Accordingly, the state has itself produced sets of text-books, and is taking all precautions that the standard thus set shall be maintained. The three foreign languages taught in the schools are English, German, and French. Since the Japanese regard English as the common language of the East, it greatly preponderates. In 1908 there were only two schools where German was taught exclusively, and seven in which the pupil might choose between English and another language. In all the other schools English was the only foreign language taught. It is also taught in the elementary schools, but the results are not yet very satisfactory on account of the poor qualifications of the teachers in this subject. However, improvement is taking place in this respect. Elementary education is free, but fees are charged in the higher elementary schools and for supplementary courses, though the fee may be remitted in the case of the poor. In the secondary schools, known as *middle schools* (whose purpose is 'to give a higher general education necessary for men'), tuition fees are levied, but are remitted in the case of those 'who are distinguished as specially worthy by their excellence in conduct and study.' Formerly those who had completed the higher elementary course were automatically admitted, if they desired, to the middle schools; but now the demand for admission is so great that a competitive examination has been instituted, and the age of leaving these schools, instead of being eighteen, as was intended, is now over nineteen. Middle schools are either public or private, there being about four public to one private. An excellent account of the subject is given by a former Minister of Education in Japan, Baron Kikuchi, in his *Japanese Education* (London, 1909).

BIBLIOGRAPHY.—(1) *Theory.*—Nearly all the German professors of philosophy during recent times have been expected to give a course on education; so we have the views of most of them on this subject—notably Kant, Hegel, Schleiermacher. Herbart went further, and in his *Allgemeine Pädagogik* (1806) and his *Umriss Pädagogischer Vorlesungen* (1835–41) elaborated a complete system. His educational writings have been Englished by the Felkins, and the whole Herbartian position is well put by F. H. Hayward, particularly in his *Critics of Herbartianism* (1903). In 1904 T. Raymont published his *Principles of Education*, and the consolidated educational theory of the present is now to be found in E. N. Henderson's *Principles of Education* (1910), F. E. Bolton's somewhat fuller, though less advanced, *Principles of Education* (1911), and J. Adams's *The Evolution of Educational Theory* (1912). One of the best presentations of an individual system is to be found in W. C. Bagley's *The Educative Process* (1905). T. P. Nunn's *Education, its Data and First Principles* (1920) deals admirably with recent developments. S. S. Laurie's *Institutes of Education* (1892) is the most systematic treatise in English. A. Bain's *Education as a Science* (1879) has had a great influence; and H. Spencer's *Education* (1861), though much criticised, is still a living force. G. Stanley Hall's *Adolescence* (1904) and *Educational Problems* (1911) are storehouses of matter that needs working up.

(2) *History of Education.*—K. von Raumer has a *Geschichte der Pädagogik* (Englished in 1863); so has K. Schmidt (1860–62). G. Compayré's *Histoire de Pédagogie* was Englished in 1886. Of English histories, T. Davidson's *History of Education* (1900) is good, but not so satisfactory as Paul Monroe's *Text-book of the History of Education* (1905). F. P. Graves has two excellent volumes, *A History of Education before the Middle Ages* and *A History of Education during the Middle Ages and the Transition to Modern Times* (1910). E. P. Cubberley's *History of Education* (1920) is a mine of information. For the classical period Paul Monroe has a *Source Book of the History of Education for the Greek and Roman Period* (1901). S. S. Laurie's *Pre-Christian Education* (2d ed. 1907), Mahaffy's *Old Greek Education* (1879), and Nettleship's famous article in Abbott's *Hellenica* are all valuable. For the Renaissance period W. H. Woodward's *Studies in Education during the Age of the Renaissance* (1906), *Vittorino da Feltre* (1897), and *Erasmus* (1904) practically exhaust the subject. Supplementing A. F. Leach's *English Schools at the Reformation* is *The English Grammar Schools to 1660* (1908), by Foster Watson, whose *Beginnings of the Teaching of Modern Subjects in England* (1909) is full of unexpected facts. Later periods are excellently treated in J. W. Adamson's *Pioneers of Modern Education* (1905), and his *Short History of Education* (1920). Ch. Letourneau's *L'Évolution de l'Éducation* (1878) is a more or less scientific presentation of the history of education. Two syllabuses on the history of education are available—E. P. Cubberley's (1902) and W. J. Taylor's (1909).

(3) *History of the Administration of Education.*—The following will be found useful: Graham Balfour's *Educational Systems of Great Britain and Ireland* (2d ed. 1903); J. E. G. de Montmorency's *The Progress of Education in England* (1904); J. Kerr's *Scottish Education* (1910); J. Strong's *History of Secondary Education in Scotland* (1909); Sir J. K. Shuttleworth's *Four Periods of Public Education* (1862); the very valuable series of *Special Reports* published by the Board of Education, edited up till 1903 by M. E. Sadler, whose volume on *Continuation Schools in England and Elsewhere* (1907) fills a gap in administrative history.

(4) *Books for Professional Teachers.*—The following volumes consist of series of articles by different writers, each dealing with the teaching of a subject in which he is a specialist: P. A. Barnett's *Teaching and Organisation* (1897); F. Spencer's *Aims and Practice of Teaching* (1897); J. Welton's *Principles and Methods of Teaching* (1906); J. W. Adamson's *Practice of Instruction* (1907); *The New Teaching* (1918), edited by J. Adams. E. Thring's *Theory and Practice of Teaching* (1885) is still of value. Works on Teaching are becoming rapidly specialised. Either an aspect of teaching is treated by itself, as in J. Adams's *Exposition and Illustration in Teaching* (1909); or a particular subject is selected for treatment, as in M. W. Keatinge's *Studies in the Teaching of History* (1910). Geography is treated in this way in separate works by Mackinder, Herbertson, Lyde, and Archer.

(5) *Encyclopædias.*—Hitherto the standard work has been W. Rein's *Encyclopädisches Handbuch der Pädagogik* (2d ed. 1902); but the new *Cyclopœdia*, edited by Paul Monroe, in 5 vols., promises to surpass anything that has yet appeared in any language. F. Buisson's *Dictionnaire de Pédagogie* (1878) is particularly strong in history. Sonnenschein's *Cyclopœdia of Education* (3d ed. 1906) is handy, unpretentious, and very cheap. Pitman's *Encyclopœdia and Dictionary of Education* (4 vols. 1921) is edited by Professor Foster Watson.

(6) *Bibliographies.*—There are two American Bibliographies of Education—Hall and Mansfield's (1886; 2d ed. 1893) and W. S. Monroe's (1903). A very useful 'Bibliographical Note' appears in Laurie Magnus's *National Education* (1901). Useful lists of works on education are to be found also in Nelson's *Standard Books* (first vol. published 1911), and Sonnenschein's *Best Books* (first part of new ed. published 1911).

See also the articles UNIVERSITIES, RENAISSANCE, WOMEN'S RIGHTS; those on Oxford, Cambridge, Edinburgh, Dublin, Harvard, and other universities at home and abroad; Newnham, Girton, Queen's College; on the greater colleges and schools (Eton, Harrow, &c.); those on the great educators (Colet, Comenius, Pestalozzi, Froebel, &c.); ARMY SCHOOLS, ART, CONSERVATOIRE, GYMNASTICS; KINDERGARTEN, SLOYD, &c.

Edward THE ELDER, eldest son of King Alfred, reigned *c.* 901–*c.* 925. He conquered the Danish parts of England as far as the Humber, permanently united all southern and central England, was acknowledged by the Welsh kings, and, according to tradition, was chosen by the Scots 'to father and lord.' See ENGLAND.

Edward THE MARTYR, son of Edgar (q.v.), ruled from 975 to 979 with the support of Dunstan (q.v.), being murdered at Corfe Castle by his stepmother's orders.

Edward, surnamed the CONFESSOR, the last Anglo-Saxon king of the old royal line, was born at Islip in Oxfordshire, the elder son of Ethelred the Unready, by his marriage in 1002 with Emma,

daughter of Richard the Fearless, duke of the Normans. On the death of Ethelred in 1016, Canute obtained possession of the throne, and next year married the widowed Queen Emma, by whom he had two children, Gunhild and Hardicanute. Until the death of Canute in 1035, Edward lived in Normandy, but was invited to his court by his half-brother Hardicanute in 1041, and next year succeeded him as king. This was brought about mainly by the great Earl Godwin, whose only daughter, Edith, Edward married in 1045, to treat her, however, throughout his life rather like a father than a husband. He was perpetually influenced by his favourites, who were usually worthless foreigners, and the history of his reign is merely the record of the struggle of the Norman or court party with the national or Anglo-Saxon party, which was led by Godwin and his son Harold. Wars with the Welsh, and an unsuccessful revolt of the Northumbrians, were the chief events in the later years of his reign. Edward died 5th January 1066. He was a poor and spiritless king, who, for his monk-like virtues, was canonised by Pope Alexander III. in 1161. With him the old English monarchy perished, save only for its spasm of dying energy in the few months' reign of the heroic Harold. See Freeman, and the early lives of Edward edited by H. R. Luard ('Record' series, 1858).

Edward I., king of England, was the elder of the two sons of Henry III., by his queen, Eleanor, daughter of Count Raymond Berenger of Provence, and was born at Westminster, June 17, 1239. His name was given him by his father out of reverence for the memory of Edward the Confessor, and in its English sound, as well as in the honest English temper, no less than the yellow hair and stalwart figure with which the young prince grew up, Englishmen might well have read the promise, that once more after two hundred years England would be ruled by a native English king. Edward was brought up at Windsor, was given by his father in 1252 the government of Gascony, and in 1254 married, in the monastery of Las Huelgas, Eleanor, sister of Alfonso X. of Castile, receiving immediately thereafter from his father Gascony, Ireland, and the Welsh march betwixt the Conway and the Dee, where, in fighting with the turbulent Welshmen, he learned his first lessons in warfare. At the Parliament of Oxford (1258) he took part with his father in his contest with his troublesome nobles, but thereafter appears to have at first sided with the great Earl Simon de Montfort, the leader of the barons or national party, without, however, impairing his own personal loyalty and affection for his father, with whom ere long he was reconciled. It was his rash eagerness in pursuing an advantage gained over the Londoners, who were devoted to the party of Simon, that lost the battle of Lewes (1264), one immediate consequence of which was the prince's imprisonment as a hostage for his father's pledges. Conditions for his liberation, discussed at Simon's famous parliament of 1265, were frustrated through Edward's escape by a stratagem from Hereford Castle; and at the final battle at Evesham (August 4), where Simon recognised, in the skilful disposition of his enemy's forces a fatal lesson learned from himself, the struggle practically ended with the great popular champion's death on the battlefield. Edward gained much influence by the wise prudence and moderation with which he stamped out the last embers of rebellion.

In 1270 he started at the instigation of Louis IX. of France to join the last of the crusades, but when he reached Tunis, found that king dead, and the expedition already desperate of success. He went on to Acre, and won great renown as a knight, but failed to save the Frankish kingdom in the East from its inevitable fate. In June 1272, while sitting alone on his bed, his own strength and energy saved him from being murdered by one of the infamous sect of the Assassins. Hastily guarding himself with his arms, and receiving a desperate wound, from which he afterwards suffered much, he tore the knife from his assailant's hand, and buried it in his heart. The ancient story that his queen Eleanor, who had followed him in his pilgrimage, saved his life at the risk of her own by sucking the poison from the wound, unfortunately lacks historical support, but fits well with the romantic temper of the times, as well as with the deep affection that survived throughout life betwixt husband and wife. Two months later he started for home, and at Capua, in the January of 1273, heard of his father's death two months before. Meantime he had been quietly proclaimed king, and as things went well in England, he visited the pope, did homage at Paris for his French provinces, and did not return to his kingdom till the August of 1274. At his coronation he received the homage of Alexander III. of Scotland for his lands in England, but Prince Llewelyn of Wales neglected the summons to attend, and only did his homage in 1276, under the combined terrors of excommunication and the royal army. Edward at once commenced that wise and large policy of domestic consolidation and financial as well as legal reform that has shed such lustre upon the reign of the English Justinian, and made it almost the most important epoch in the constitutional history of England.

His first warfare was with the turbulent and disaffected Welshmen, who had profited by the intestine turmoil of the preceding reign, and intrigued perpetually with the rebellious nobles of Henry III. for their own ends. The forced peace of 1277, and the national dissatisfaction at the stringent terms granted by Edward, which was not abated by the personal favours he heaped upon the princes Llewelyn and his brother David, were but the preludes to the final struggle which commenced three years later, and ended in the complete suppression of Welsh nationalism, with the defeat and death of Llewelyn, near Builth in Brecknockshire, and the cruel execution of David at Shrewsbury, as a traitor, in 1284. By the famous Statute of Wales in the same year, the ancient principality was finally annexed to the English crown, while English laws and English institutions were forced upon the conquered people. Edward devoted the next year to legislation, then went abroad to mediate, without success, in the quarrel between France and Aragon. He had soon to return to quell fresh disturbances in Wales, and even in England, where the great Statute of Winchester, which had been passed in 1285 to place the defence of the country on a really national basis, had not yet had time to effect its end. Finding that most of his judges had been corrupting justice, he punished them with an iron hand, next banished in 1290 all the Jews to the number of over 16,000 from the kingdom on the plea of extortionate usury. Earlier in the reign he had hanged 280 for money-clipping and forgery.

Just at this time the death of the young Scottish queen, the Maid of Norway, whom Edward had caused to be betrothed to his eldest surviving son, Edward of Carnarvon, opened up a fatal contest for the Scottish crown, which gave Edward his opportunity to assert anew the old but somewhat shadowy claim of the English crown to the over-lordship of Scotland. The southern half of that composite kingdom was inhabited by people of English blood and English institutions; its south-eastern part, the Lothians, had undoubtedly once formed part of the Anglian kingdom of Northumbria; while its south-western, Strathclyde or Scottish Cumbria, the population of which

was in great part Celtic, had in 945 been given by the English king Edmund I. to Malcolm as a fief. The northern portion of the kingdom was purely Celtic in blood, and had at no time been subject to English influences, but though the reigning family was itself of Celtic origin, its authority hardly extended effectively beyond the region inhabited by men of English blood. Undoubtedly the Scottish king in 921 chose Edward the Elder 'to father and to lord,' and the right then acknowledged was claimed successively by William the Conqueror, Rufus, and other English kings. Moreover, from the 12th century it had been customary for the Scottish kings or their sons to receive English earldoms, and do homage for them, but it continued to remain somewhat vague, whether such homage was understood to be extended beyond these earldoms, so as to include the Lowland provinces and the whole Scottish kingdom. William the Lion, taken prisoner at Alnwick in 1174, for his freedom acknowledged the supremacy of Henry II. in the treaty concluded at Falaise on December 7, but on his return found his subjects ill disposed to accede to his cowardly submission; and fifteen years later the claim founded on this special act of submission was formally renounced for a sum of 10,000 merks by Richard I., who was eager to raise money for his crusade. Such was the ill-defined position of this ancient controversy, when fate seemed to fling into Edward's hands the opportunity of defining it anew with all the clearness dear to his legal mind. It was easy for him to secure a recognition of his superiority from the selfish and eager candidates for the crown, and meantime he secured the Scottish castles, and after a deliberate examination of the rival claims, decided in favour of John Baliol, who, on his accession, paid homage distinctly for the whole kingdom of Scotland. He soon found his position as a vassal-king intolerable, betwixt the unruly turbulence of his subjects and the imperious demands of his over-lord, who allowed appeals to be led from Baliol's subjects to himself. Meantime the ambitious projects of the new king of France, Philip IV., involved Edward in anxieties for the safety of Guienne and his other possessions in France. Ere long the high-handed conduct of the French king made war necessary, and Edward, with characteristic energy, at once began his preparations, and summoned in 1295 an assembly of the estates of the realm, which was practically the beginning of our modern parliaments. The ever-increasing exasperation of the Scots at length broke out into open warfare in 1296. Edward at once marched northwards, captured Berwick, and carried his victorious arms as far north as Aberdeen, Banff, and Elgin, taking the great castles on the way, formally accepted Baliol's surrender of the crown at Montrose, and returned to Berwick (August 22), carrying with him the famous coronation-stone from Scone, after having subdued the whole kingdom in about five months. Here, six days later, he received the fealty of the clergy, barons, and gentry of Scotland, whose names fill the thirty-five skins of parchment known as the Ragman Roll.

At length he was at liberty to turn to France, but the great cost of his late expenditure had already driven him to make such heavy demands upon the revenues of the church, that the clergy now refused fresh subsidies, headed by Archbishop Winchelsea and supported by the bull 'Clericis Laicos' of Pope Boniface VIII. The king retaliated by placing the clergy of the kingdom in outlawry. At the Salisbury parliament in February 1297, the great barons also refused to take part in foreign war, while the merchants were exasperated because their wool had been seized. A compromise was soon effected with the clergy, and a temporary illegal grant for the immediate purposes of the war was procured from the nobles and commons who were with him. Edward sailed for Flanders, and at Ghent confirmed the Charter with such supplementary clauses as were demanded by his refractory nobles, thus finally establishing the right of the people themselves to determine taxation. This is only second in importance to Magna Charta itself as a landmark in the history of England. The suspicious fears of his people compelled Edward to repeat the confirmation at London in 1300, and again at Lincoln in 1301—an insult to his honesty which the king never forgave, and to which his subsequent banishment of Winchelsea was due. In 1303, and again the year after, Edward, in desperate straits for money, levied, by agreement with the foreign merchants, some new customs—the beginning of our import duties—without consent of the estates, and collected a *tallage* from the royal demesne, and again, in 1305, he obtained from Clement V. a formal absolution from the obligations of 1297. It is true that the first two measures were contrary to the spirit rather than the letter of his promise, and that he never sought to avail himself of the dangerous power granted him by the papal absolution, yet these three facts, says Bishop Stubbs, 'remain on record as illustrations of Edward's chief weakness, the legal captiousness, which was the one drawback on his greatness.'

It was the dangerous aspect of affairs in Scotland that forced the king to submit so easily to the demands of his barons. Already, in the spring of 1297, Wallace, without any countenance from the Scottish nobility, had commenced a guerilla warfare, and his handful of desperate men soon increased into an army, which completely defeated Earl Warenne and Cressingham at Cambuskenneth (Stirling Bridge) in September 1297, and ravaged England, with the most atrocious cruelties, from Newcastle to Carlisle. Edward's expedition to Flanders had been a failure, but he hastened to conclude a truce, so as to find time to chastise the Scots, cementing it by his betrothal to Philip's sister Margaret. The good Queen Eleanor had been already dead nine years. Meantime, Wallace's success had merely earned him the bitter jealousy of the Scottish nobles, and his power was finally broken in the disastrous defeat by Edward's army at Falkirk in July 1298. The king had two of his ribs broken by a kick from his horse on the morning of the battle, but rode throughout the day as if unhurt. The struggle lingered on some years under various leaders, as Edward found his energy paralysed the while by the intrigues of Philip, and the constitutional struggles with his barons. Pope Boniface, in 1301, put forth a claim to the overlordship of Scotland, which was repudiated by the whole body of the estates at Lincoln. It was not till the June of 1303 that the king was able to resume his conquest. Accompanied by a fleet carrying his supplies, he penetrated again into the far north, tarried a while in Dunfermline, and settled the kingdom after the reduction of Stirling, the last place of strength that held out. In 1305 Wallace was betrayed into his hands, sent to London, and cruelly executed as a traitor. The fate of this noble-hearted patriot is a fatal blot upon his conqueror's memory, but it should not be forgotten that Edward was profoundly convinced of the legality of his own claims over Scotland, and that Wallace to him was merely a pestilent rebel, who had earned his doom by treason to his lord and by the cruelties he had inflicted upon Englishmen. The same year the king prepared a new constitution for the conquered kingdom, divided it into sheriffdoms like the English counties, and made arrangements for the representation of the Scots in

the English parliament—a measure which, had it been successful, might have anticipated by four centuries the benefits of the union. It might now have been expected that Scotland was effectively subdued, but ere long Robert Bruce, who had hitherto played a dubious game, raised a revolt in the beginning of 1306, got rid of the regent Comyn, his most serious rival, by a foul murder in Dumfries church, was crowned king at Scone, and kept up an incessant but varying struggle during the winter of 1306 and the spring of 1307. The treachery of those who had sworn fealty to him, and whom he had trusted implicitly, roused Edward to the pitch of exasperation, and at the knighting of Prince Edward at Westminster, he swore a solemn vow to be revenged upon Bruce. He at once despatched a force to Scotland, and though now old and infirm, began preparations for his fourth expedition; but he was attacked with dysentery on the march, and his malady increased so much upon him that he died on the 7th of July 1307, at Burgh-on-Sands, near Carlisle, within sight of Scotland, leaving for his son Edward the dying command not to bury his body till he had utterly subdued the Scots, but to carry his bones with the army until the victory was complete. Eleven days later the young prince reached Carlisle, but returned a few weeks after to London, and buried his father's body in Westminster, where it still rests under a slab, with the simple but truly descriptive inscription: 'Eduardus primus, Scotorum malleus, hic est.'

See Seeley's *Life and Reign of Edward I.* (1871); vol. ii. (1876) of Bishop Stubbs's *Constitutional History of England,* his *Early Plantagenets* in 'Epochs of Modern History' (1876), and his prefaces to the *Reigns of Edward I. and II.* in the 'Rolls' series (1882–83); and T. F. Tout's monograph (1893).

Edward II., son of the preceding, was born at Carnarvon in Wales, 25th April 1284, and in 1301 was created Prince of Wales, being the first heir-apparent of the English throne who bore that title. In 1297 he was appointed regent in his father's absence, and as such signed the famous *Confirmatio Cartarum.* He accompanied his father on his various expeditions into Scotland, but was absent at his death in July 1307, and instead of carrying out his dying commands, returned to London to give himself to unworthy pleasures and the beloved companionship of his favourite the Gascon, Piers de Gaveston. A month later he created him Earl of Cornwall, and on his departure for France in the beginning of 1308 to marry Isabella, daughter of Philip IV., left him guardian of the kingdom. The indignant nobles demanded his banishment, and twice was the favourite forced to leave England, but as often was he recalled by the infatuated monarch, until at length they rose in arms, captured Gaveston, and executed him at Warwick in 1312. Two years later, Edward invaded Scotland at the head of an army of 100,000 men. At Bannockburn, on the 24th June 1314, he was defeated with immense slaughter by Bruce, whose heroism redeemed the dubious patriotism of his earlier years, secured his own crown, and the final independence of his kingdom. With the capture of Berwick in 1318, he had undone every trace of the conquest of Edward I. This great disaster in Scotland was followed by risings in Wales and Ireland, and two seasons of unexampled famine attended by still more fatal pestilence. From this time till 1322 the influence of Lancaster as the king's minister was supreme, but in that year, with the aid of his new favourites, Hugh le Despenser the elder, and his son, Hugh the younger, who had been already banished, but whom the king had recalled, Edward overthrew Lancaster, and put him to death. Immediately after, Edward invaded Scotland for the last time, but achieved no particular success, and in 1323 concluded a truce with that nation for thirteen years, and returned to England. A dispute now arose between him and Charles IV. of France, brother of his wife Isabella, in regard to the territories which he held in that country. Charles seized these, whereupon Edward sent over Isabella to remonstrate, and, if possible, to effect an amicable arrangement between them. Isabella already despised her husband, and hated the Despensers, and had contracted a guilty passion for Mortimer, one of the most unprincipled and powerful of the disaffected nobles. She now treacherously made common cause with many of the exiled nobles against her husband and the Despensers, and having obtained possession of the young Prince Edward, she embarked from Dort, in Holland, with a large body of malcontents, and landed on the coast of Suffolk on the 24th September 1326. Edward fled, but was taken prisoner in Glamorganshire. The Despensers, father and son, were executed, and the monarch himself compelled formally to resign the crown. His robust frame refusing to succumb to some months of the most inhuman treatment, he was murdered by a cruel death in Berkeley Castle, 21st September 1327.

Edward III., son of the preceding, was born at Windsor, 13th November 1312, and was crowned king 29th January 1327. During his minority the country was governed nominally by a council of regency, but really by Mortimer and his paramour Isabella. Early in 1328 the young king married Philippa of Hainault, and two years later seized Mortimer and put him to death, banishing his unworthy mother, Isabella, to her remaining twenty-seven years of privacy in Castle Rising. He next invaded Scotland to assist Edward Baliol, son of John Baliol, who, in the confusion that ensued on the death of the great Bruce, had made a descent on the country, and got himself crowned at Scone. In a bloody battle fought at Halidon Hill, near Berwick, 19th July 1333, the Scots were completely defeated, whereupon Baliol assumed the authority of a king, and did homage to Edward for his possessions, but a few months later had to flee from the kingdom. In the course of three years Edward thrice invaded Scotland, but though he frightfully wasted the country, and brought armies such as could not be met in the field, he could not break the invincible spirit of the people, who, after each invasion had rolled over them like a flood, rallied anew with a still more stubborn resolution to be free. But the scene of Edward's great exploits was France. Charles IV. having died without a son, Philip of Valois, the nearest heir by the male line, ascended the throne, under the title of Philip VI. Edward claimed the crown in right of his mother Isabella, sister of Charles; but as the law of France expressly excluded females from enjoying sovereign rights, it is needless to say that his claim was utterly groundless. The English king admitted that his mother, being a female, could not inherit the crown of France, but affirmed that he, as her son, might. But it is clear that he could not receive from his mother rights to which she herself had no claim. Yet never was a bad cause redeemed from baseness with more splendid triumphs. Edward declared war against Philip in 1337, raising money unsparingly by tallages, forced loans, and seizing wool for which it is true he promised to pay in the course of two years. Spite of the brilliant sea-victory at Sluys in 1340, the war was at first singularly unsuccessful, and Edward soon found himself at issue with his nobles, and especially the princes of the church, and was compelled to purchase the grants of money necessary for the war with concessions of privileges, which he occasionally endeavoured to evade by subterfuges that his

grandfather would have scorned. At length in 1346, accompanied by his eldest son, known as the Black Prince, he again invaded France, conquered a great part of Normandy, marched to the very gates of Paris, and on the 26th August 1346, inflicted a terrible defeat on the French at the famous field of Crécy. Here the Black Prince, though but sixteen years old, exhibited the most heroic courage. After some further successes, and the fall of Calais after a twelvemonth's siege, a truce for a few months was concluded between the two nations, afterwards from time to time extended. Just before the surrender of the famished citizens of Calais, occurred the heroic incident of Eustace de St Pierre and his five companion burgesses of Calais, who offered themselves as victims to the king's fury to save their fellow-citizens, and were saved only at the impassioned entreaties of Queen Philippa. Meanwhile the Scots had sustained in 1346 a severe defeat at Neville's Cross, near Durham, their king, David II., being taken prisoner, while in 1349 the terrible Black Death had carried off a third of the total population of England, and permanently changed the whole relations between labourer and master.

The war began anew in 1355, and next year, on the 19th September, the Black Prince obtained a brilliant victory at Poitiers, where King John of France was taken prisoner. The Scottish monarch was released under promise of a ransom of 100,000 merks in 1357, and King John in 1360, when a peace was concluded between the French and the English, by which the latter were to retain their conquests. King John, finding it impossible to raise his proposed ransom, honourably returned to captivity, and died in London in 1364. Shortly before this date, David, king of Scotland, whose residence in England had extinguished the little patriotism he ever had, entered into a secret agreement with Edward, in virtue of which his kingdom, if he died without male issue, was to be handed over to the English sovereign. Meanwhile, the Black Prince, who had married Joanna, daughter of the Earl of Kent, had received from his father Aquitaine and Gascony, and ruled there for some time very prosperously; but ultimately involving himself and his father in a war with France, which was disastrous in its issues, was obliged in 1374 to conclude a truce for three years. Edward waged war no more. In spite of his brilliant victories, in spite of the dazzling valour of his son, he was at the last unsuccessful. Under him, says Mr Freeman, 'England was successful in battles, but she was thoroughly beaten in war.' Neither in Scotland nor in France did he realise his desires. Affairs at home were no less unsatisfactory in the last years of his life, and public finance drifted hopelessly into ruin. He quarrelled with his parliaments, and saw public discontent sap the loyalty of his people, while he gave himself up to the influence of his rapacious mistress, Alice Perrers, and let the government slip into the hands of his third son, John of Gaunt. The Black Prince, who had headed a party opposed to his father's policy, died 8th June 1376, and the king himself expired almost alone on the 21st June 1377, after a reign of fifty-one years.

See Longman's *Life and Times of Edward III.* (1869), Warburton's *Edward III.* (1875), Mackinnon's *History of Edward III.* (1900).

Edward IV., son of Richard, Duke of York, and Cicely Nevill, daughter of the first Earl of Westmoreland, was born at Rouen in 1442, and brought up at Ludlow Castle, being known during his father's lifetime as Earl of March. The Yorkist claim to the crown will be discussed under Roses (Wars of the); here it is enough to say that Edward found himself, on his father's defeat and death at Wakefield (December 30, 1460), head of a strong and resolute party. With characteristic vigour he at once set out from Gloucester, won the battle of Mortimer's Cross (February 2, 1461), lost in the person of Warwick the second battle of St Albans fifteen days later; but only nine days thereafter, taking advantage of the reaction of the south against the excesses of Queen Margaret's victorious northern soldiers, entered London in triumph, and was hailed as king. A month afterwards he secured for himself the crown by the great battle of Towton, near York. The indefatigable queen, with the aid of French money, kept up the struggle in the north, but her defeats at Hedgeley Moor and Hexham (1464), and the capture of the unhappy King Henry (1465), in the meantime closed the door upon her hopes. The young Edward was handsome and frank in manners, and quickly became a most popular king. The commons granted him the wool-tax and tonnage and poundage for life. But Edward imperilled his popularity by his uncontrolled licentiousness, and by his ill-advised and at first secret marriage (1464) with Elizabeth Woodville, the handsome daughter of the Lancastrian Lord Rivers, and widow of Sir John Grey of Groby, displeased the great Earl of Warwick and many of his nobility, who had hoped to buttress the king's throne by a French or Burgundian alliance, and whose disaffection was further increased by the honours which were lavishly heaped upon the young queen's upstart relations. Warwick succeeded in detaching the king's brother, the Duke of Clarence, from his side, and made him his own by marrying him to his daughter Isabel. Meantime the tide of popular feeling showed the direction in which it was running by insurrections in the northern counties and in Lincoln. At length Warwick finding Clarence too weak a foundation on which to build a Yorkist revolt, crossed to France, and there made friends with his ancient enemy, Queen Margaret, and cemented the alliance by marrying his daughter Ann to her son, Prince Edward. In September 1470 Warwick landed in England, and Edward finding himself deserted on every side fled to Flanders; six months later he landed at Ravenspur, and pressed on to give battle to Warwick. His brother Clarence went over to his side, and in the final battle at Barnet, on Easter-day, April 14, 1471, the kingmaker fell on the field of his defeat. Edward next turned to meet Queen Margaret, and put an end to the war by the victory at Tewkesbury (May 4). He showed the savagery of his nature by the murder of the young Prince Edward, and the ruthless severity of his vengeance upon the other captives, some of whom had left sanctuary on promise of their lives being spared. The night of his arrival in London the old king, Henry VI., died in the Tower—of a broken heart as was given out. Edward henceforward sat securely on his throne, and used his power freely to extort money from his subjects by forced loans. In 1478 he stained his name by the private execution in the Tower of his brother Clarence—drowned according to an old tradition in a butt of Malmsey wine. Edward's partisanship of Burgundy against France had brought no glory to his army, the leaders of which were induced by French gold to abandon the war. Equally unsuccessful were his ambitious schemes for the marriages of his five daughters. Edward died suddenly, April 9, 1483, worn out before his time by his debaucheries.

See Gairdner's *Houses of Lancaster and York* (1874) his Introductions to the *Paston Letters* (1872-75); Strat ford's *Edward IV.* (1910); and Miss Scofield's (1923).

Edward V., son of the preceding, was born 4th November 1470. The story of his life is brief and tragic. At the death of his father, he was living

at Ludlow in Shropshire. When the news reached Ludlow, Earl Rivers, his maternal uncle, set out with him for London. Richard, Duke of Gloucester, however, contrived to obtain possession of his person at Northampton, and brought him to the capital himself, in May 1483. Towards the end of the same month Richard was appointed Protector of the kingdom. In June the young Duke of York, Edward V.'s brother, also fell into his hands. The two hapless boys were then removed to the Tower, and were never more heard of. In 1674 some bones were discovered below the stairs which led to the White Tower chapel, and were reinterred as the princes' remains in Westminster Abbey in Henry VII.'s chapel. There is no doubt that they were murdered by their uncle Gloucester, who himself began his short reign as Richard III., July 6, 1483.

Edward VI., born at Hampton Court on 12th Oct. 1537, was Henry VIII.'s son by his third queen, Jane Seymour, who died twelve days after his birth. Till he came to six years he was brought up 'among the women;' then his instruction commenced 'in learning of tongues, the Scriptures, philosophy, and all liberal sciences.' Cheke and Ascham were among his preceptors. On 21st Jan. 1547 he succeeded Henry, when Edward Seymour, Earl of Hertford, his uncle, got himself made Protector. A *novus homo*, who from a country gentleman had risen to be ruler of England through his sister's queenship, Seymour allied himself with the reformed party against the nobles of the old régime, and sought by some high achievement to justify his rapid exaltation. During the first year of his protectorate he invaded Scotland, to enforce the marriage-contract between Edward and Mary, Queen of Scots. In the battle of Pinkie (10th Sept. 1547) the Scots were utterly defeated, and Scotland lay at the mercy of Seymour, now self-created Duke of Somerset; but his presence was needed at home. He returned to find that his brother, Lord Seymour, the admiral, had been caballing against him. Somerset had him attainted; and on 20th March 1549 he was sent to the block, the boy-king consenting coolly to his death. That summer witnessed two rebellions — of Catholics in Devon, and of agrarian malcontents, under Ket the tanner, at Norwich. Both were suppressed; but two months afterwards a more formidable adversary arose in the person of Ket's vanquisher, John Dudley, Earl of Warwick, who worked the Protector's downfall by insinuations against him of 'ambition, vainglory, and self-enrichment' (such are the entries in Edward's Journal). Somerset was lodged in the Tower, pardoned, assailed anew, and this time beheaded (22d Jan. 1552), Dudley meanwhile being created Duke of Northumberland. The people regretted with good reason Somerset, for Dudley was both a worse and a weaker man. Indifferent in matters of religion (though he died a professed Catholic), he too let the Reformation take its course under Cranmer (q.v.) and Cranmer's more headstrong colleagues; his single aim was to secure the succession for his own family. With this view he married his fourth son, Lord Guildford Dudley, to Lady Jane Grey, daughter of that Duchess of Suffolk to whom by the will of her uncle, Henry VIII., the crown was to pass in default of issue by Edward, Mary, or Elizabeth. Northumberland now worked upon the dying boy to exclude his sisters and nominate Lady Jane as his successor. Edward consented; and a 'device,' thus settling the succession, was drawn up. The king lived only a few weeks after, dying at Greenwich on 6th July 1553, of poison it was rumoured, but more probably from the effect of quack nostrums on a consumptive frame. On 8th August he was buried in Westminster with Protestant rites, but mass of requiem was chanted in the Tower. A truer estimate of him—shrewd, cold, a very Tudor—may be formed from Prof. A. F. Pollard's summing up (*Political History of England*, vol. vi. 1910) than from Sir C. Markham's *Edward VI.* (1907).

Edward VII., eldest son of Queen Victoria, was born at Buckingham Palace, 9th November 1841, and christened Albert-Edward. After a careful education under four private tutors, he studied at the universities of Edinburgh, Oxford, and Cambridge. In 1860 he visited the United States and Canada; in 1862 travelled with Dean Stanley in the East; and on 10th March 1863 married the Princess Alexandra (born 1844; died 1925), eldest daughter of Christian IX. of Denmark. Besides three daughters, two sons were born of this marriage—the eldest, Prince Albert-Victor-Christian-Edward, Duke of Clarence (born 8th January 1864; died 14th January 1892), and George, Duke of York and Prince of Wales (born 3d June 1865; created Duke of York, May 1892; succeeded as George V. on the death of his father). Recovery from a six weeks' attack of typhoid was celebrated in St Paul's on 27th February 1872 with great enthusiasm—an enthusiasm emulated in the East on the occasion of a visit to India (1875–76). The King, the first British monarch of the Saxe-Coburg house, was a Field-marshal, and in 1874–1901 Grand-master of the Freemasons; and he constantly manifested a lively interest in exhibitions, charitable institutions, the housing of the poor, agriculture, and the well-being of the people. For the Queen his mother, he, then Prince of Wales, bore much of the burden of court ceremonials and public functions. He assisted in promoting the Royal College of Music; and the Imperial Institute was due to his suggestion. On 4th April 1900 he was shot at by a young anarchist, Sipido, in a train at Brussels; on 22d January 1901 he succeeded his mother as Edward VII. His coronation, arranged for the 26th June 1902, but postponed on account of a surgical operation, was celebrated with traditional splendour in Westminster Abbey on the 9th August 1902. He contributed greatly to the restoration of cordial relations with France, and at his death (6th May 1910) had conciliated at home and abroad universal respect for his political insight, tact, and kingly dignity. See Life by Sir Sidney Lee (vol. i. 1925).

Edward THE BLACK PRINCE, eldest son of Edward III. and Philippa, was born at Woodstock, 15th June 1330, and was created Earl of Chester (1333), Duke of Cornwall (1337), and Prince of Wales (1343). Knighted by his father at La Hogue in 1346, he the next month, mere boy though he was, fought bravely at Crécy, and is said to have won from his black armour his popular title—a title, however, first cited in the 16th century. In 1355–56 he undertook two marauding expeditions in France, the second signalised by the great victory of Poitiers, where King John and his son Philip were taken prisoners. In 1361 he married his cousin, Joan, the 'Fair Maid of Kent' (1328–85), who bore him two sons, Edward (1365–70) and the future Richard II.; in 1362 his father created him Prince of Aquitaine, and next year he departed to take possession of his principality. In 1367 he espoused the cause of Pedro the Cruel (q.v.), and at Navarrete won his third great victory, taking Du Guesclin prisoner; in 1370, worn out by sickness, he sacked Limoges with merciless severity. He died at Westminster, 8th July 1376. See Lives by G. P. R. James (1822), Le Poittevin de la Croix (1854), L. Creighton (1876), Dunn-Pattison (1910).

Edward, THOMAS (1814–86), the 'Banff naturalist,' son of a private in the Fife militia, was born at Gosport, and spent his early years at Aberdeen. After settling as a shoemaker in Banff in 1837, his

passion for natural history led him to collect many specimens and discover new species, which he classified, described, and exhibited. He was a Fellow of the Linnean Society. Smiles's *Life of a Scotch Naturalist* in 1876 awakened much sympathy, and a pension was given him of £50 a year.

Edwardes, Sir Herbert Benjamin, was born at Frodesley in Shropshire, 12th Nov. 1819. Entering the army of the East India Company in 1840, he was, on the outbreak of the first Sikh war (1845), appointed on the staff of Sir Hugh Gough, and fought at Mudki and Sobraon. As assistant to Sir Henry Lawrence, British resident at Lahore, he took an active share in punishing the Dewan Mulraj of Multan, who had murdered Mr Vans Agnew and Lieut. Anderson, defeating him twice, and capturing his city (1849). During the Indian Mutiny, Edwardes, as commissioner of the Peshawar frontier, did good service by conciliating Dost Mohammed of Afghanistan, and securing his neutrality. In 1865 ill-health obliged him to return to England, where he commenced to write a *Life of Sir H. Lawrence*, which was completed after his death (at London, on 23d Dec. 1868) by Herman Merivale. He also wrote *A Year on the Punjab Frontier in 1848–49*.

Edwards, Amelia Blandford, was born in London, 7th June 1831. Her first novel, *My Brother's Wife* (1855), was followed by a dozen others, among them *Debenham's Vow* (1869) and *Lord Brackenbury* (1880). She also published a volume of *Ballads* (1865), and, besides books of holiday travel in Belgium and the Dolomites, *A Thousand Miles up the Nile* (1877). Miss Edwards was the founder and honorary secretary of the Egyptian Exploration Fund, and wrote many papers on Egyptology. She died 15th April 1892. —Her cousin, Matilda Barbara Betham-Edwards (1836–1919), was born at Westerfield, Ipswich, and when quite a young girl attracted the notice of Charles Dickens, who published her poem, 'The Golden Bee,' in *All the Year Round;* it is included in her poems (1885). Her first novel, *The White House by the Sea*, appeared in 1857, *Dr Jacob* in 1864, and *Kitty* (described by Lord Houghton as 'the best novel he had ever read') in 1869. She also published *A Winter with the Swallows* (1867), *A Year in Western France* (1875), *Home Life in France* (1905), *Literary Rambles in France* (1907), *Mid-Victorian Memories* (1919), and edited Murray's *Southern, Eastern, and Central France*, and Young's *Travels* (1889).

Edwards, Milne. See Milne-Edwards.

Edwards, Jonathan, was born at East Windsor, Conn., 5th Oct. 1703, only son of Timothy Edwards, clergyman there for more than sixty years. The boy, precocious alike in learning and piety, graduated at Yale College in 1720; his doubts had given way to 'an inward sweet delight in God.' After acting as tutor at Yale from 1724 to 1726, he was ordained in 1727 colleague to his maternal grandfather, Solomon Stoddard, in his ministry at Northampton, Mass. Two years later the death of the latter left him alone, and here for nearly twenty-four years he laboured with remarkable earnestness, guiding his flock through the excitement of a revival begun by the preaching of George Whitefield in 1740. The happiness of his ministry was after seventeen years broken by a bitter dispute with his people about the circulation of immoral books, and about returning to the earlier Congregational rule of refusing to admit to communion persons not consciously converted. Edwards supported the more rigid views, and was obliged to resign his ministry in 1750. He next laboured as missionary to the Housatonnuck Indians in Massachusetts until 1758, when he was called to succeed his son-in-law, President Burr, of Princeton College, but died of smallpox only thirty-four days after his installation, 22d March 1758. Edwards is one of America's most original thinkers in metaphysics, and his treatise on the *Freedom of the Will* (1754) has never been superseded (see Will). He was a rigid Calvinist in theology, but his heart was warmed with a piety of rare saintliness and elevation. His other works include *Original Sin* (1758), *True Nature of Christian Virtue* (1788), and *Dissertation on the End for which God created the World* (1789). The most notable adherents of his school were Samuel Hopkins (q.v.); his son, Jonathan Edwards; Joseph Bellamy of Connecticut (1719–90); Nathaniel Emmons (1745–1840); Timothy Dwight (q.v.); and Leonard Woods, professor at Andover—almost all of whom wrote copiously. There have been many editions, more or less complete, of the works of Edwards, that by Dwight (with a biography, New York, 1829–30) being in 10 vols. This edition was republished at London in 2 vols. by Henry Rogers in 1834 and in 1860. See the Life by A. V. G. Allen (1889) and Squires's *Edwardean* (1903–4).—Jonathan Edwards, second son of the preceding, was born in Northampton, Mass., 26th May 1745, and was educated at the College of New Jersey; he became tutor at Princeton, and in 1769 pastor at White Haven, Conn. Here he laboured with all his father's energy till dismissed by his congregation in 1795 on the plea of their inability to support a minister. Next year he was called to the church at Colebrooke, Conn., and in 1799 to the president's chair of the new college at Schenectady, New York; but here he died 1st August 1801. He published an exposition of his father's theory of the will; and his own works, with Life, were published by his grandson in 2 vols. in 1842.

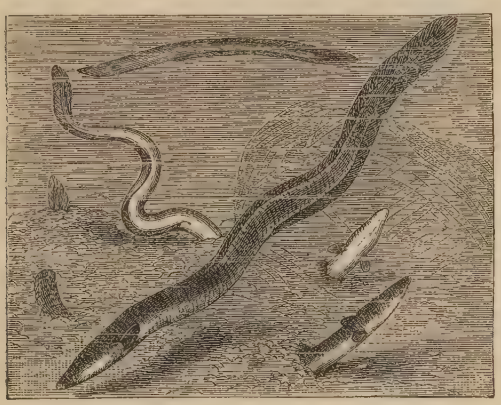
Edwin, king of Northumbria, was the son of Ælla, king of Deira, who died in 588. His father died when he was but three years old, whereupon Æthelric, king of Bernicia, seized his territories. The child was carried into North Wales, and there brought up. At length he found refuge with Rædwald, king of East Anglia, who took up arms on his behalf against Æthelfrith, the son of his oppressor, and defeated him in a great battle, in which the usurper fell (617). Edwin now obtained his father's kingdom of Deira, and ere long overran Bernicia, thus bringing under his rule a united Northumbria, which extended northward to Edinburgh, a city which he fortified, and which still retains his name. He next conquered Elmet (the West Riding of Yorkshire) from the Britons, and pushed his power westward to the sea, and even to Anglesea and Man. After Rædwald's death he also obtained the over-lordship in East Anglia, and overthrew the West Saxons, a victory which gave him the over-lordship of all England, save Kent. Edwin had already married Æthelburh, daughter of Æthelberht, the convert of Augustine. Under Paulinus' influence, and moved by his escape from assassination at the hands of the king of Wessex, and by his victory over Wessex, Edwin was converted to Christianity; and he and his nobles were baptised in the eleventh year of his reign. Thereafter, he became the most powerful prince in England. In 634 he fell in a disastrous battle at Hatfield Chase in Yorkshire. Edwin was canonised; his festival falls on 4th October. His story forms the subject of Alexander Smith's poem, *Edwin of Deira* (1861).

Eecloo, a town in the Belgian province of East Flanders, on the Liève, 12 miles NW. of Ghent by rail. It has manufactures of woollens, cottons, &c. Pop. 14,000.

Eel, a name somewhat widely applied in popular usage, but justifiably extended to all the members

of the family Anguillidæ, which is included in the order Physostomi of bony fishes. The family is a large one, with representatives in almost all fresh waters and seas of temperate and tropical zones. As is well known, the body is much elongated, cylindrical or ribbon-shaped; the usual scales are absent or rudimentary; and there are no pelvic fins. If unpaired fins are present, they unite in a long fringe. Teeth are usually well developed. Over two hundred species are known, all carnivorous, and preferring to keep near the bottom, sometimes at great depths.

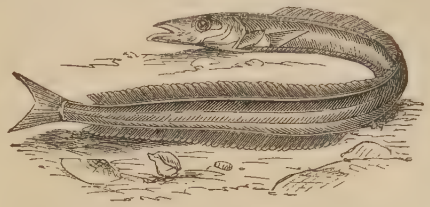
The genus Anguilla includes the eels *par excellence*, some twenty-five widely distributed species in all, the Common Eel (*A. vulgaris*) among the rest. The skin exhibits minute rudimentary scales, the upper jaw does not protrude, the tongue is free, the teeth small, the unpaired fins united in a continuous fringe. The common eel, though not without its mystery, is known to every one. The wide gape, the protruding lower jaw, the variable forms of head, the body cylindrical in front and then compressed, the long tail, the very varying colour, are familiar features. It occurs throughout most of Europe, frequenting, however, sluggish streams.



The Common Eel (*Anguilla vulgaris*).

Stealthy in its habits, the eel lies in the mud during the day, and wriggles about at night in search of all sorts of water-animals, including fishes. It is also certain that the eel may leave the water, especially when grass meadows are overflowed or wet with dew, and travel by night over the moist surface in search of food; its small external gill-aperture helps it to remain some time without water. In cold weather it hides itself in the mud. Eels never spawn in fresh water. The life-history, worked out by Schmidt, is remarkable. The mature eels pass from the rivers to mid-Atlantic, where they spawn, both sexes probably dying thereafter. The transparent larvæ (*Leptocephali*) live near the surface, and are for two years pelagic. After a remarkable metamorphosis they work their way to the shores, often travelling great distances. They migrate by day up the rivers, and are known as 'elvers.' Their marvellous procession is called the 'eel-fare.' The flesh of the eel is eaten, both fresh and preserved. They are caught by eel-spears, eel-pots, baskets, and in various other ways. (See FISHERIES.) In the blood of Anguilla, Muræna, and Conger, which is scantier than in most fishes, there is a powerful poison. The blood is exceedingly acrid to the taste, and though rapidly fatal when injected under the skin, is not markedly injurious in the stomach. The virulence of the poison is destroyed by heat.

The genus Muræna includes a large number of marine species, mostly well coloured, some of great length (6 feet), and with formidable biting powers. One widely distributed species (*M. helena*) was highly prized by the Romans, and is still fished. The genus Conger (q.v.) is separately discussed. Murænesox, Myrus, and Ophichthys are other important genera within the family Murænidæ.—The Electric Eel (*Gymnotus electricus*) belongs to a different though adjacent family (see ELECTRIC FISHES). The sand-eels (*Ammodytes*), which are



Sand-eel or Sand-launce (*Ammodytes lancea*).

often sought for bait, and are familiar to shore-wanderers, belong to quite a different set of bony fishes, and are also called *launce*. They are allied to the cods, and classified in the Anacanthini order. The marvellous adroitness with which they jerk themselves about in a pool, making use of the slightest cover of sand, is often admired.

A superstition has lingered through many centuries, finding typical expression in the works of Albertus Magnus, and repeated to-day in the experiments of country schoolboys, that horse-hairs left to soak in the brook grow into small eel-like animals. The fact at the root of this fancy is the frequent and sudden appearance of one of the Nematodes—the horse-hair worm.

The so-called 'eels' in paste, vinegar, fermenting and decaying substances, or stagnant water, are minute threadworms or Nematodes, often belonging to the genus Anguillula. Their bodies have the usual threadworm shape, and are almost transparent, though with thick cuticle. The rate of multiplication is very rapid; both eggs and adults have considerable power of reviving after Desiccation (q.v.). Adults have been known to reawaken after a maximum desiccation of fourteen years. See for these animals ASCARIS, THREADWORMS, &c.

Eel-pout, a name given in some parts of England to the Burbot (*Lota vulgaris*), and on some parts of the Scottish coast to the Viviparous Blenny (*Zoarces viviparus*).

Effen'di, a title of respect among the Turks, bestowed upon civil officials, and upon educated persons generally, in contradistinction to the military title of Aga. It is nearly equivalent to the French Monsieur, but is suffixed to the personal name.

Effervescence. Nearly all gases are more or less soluble in water, the amount of solubility depending on various conditions of pressure and temperature. As a rule, the lower the temperature and the greater the pressure, the greater is the solubility of a gas, so that when the temperature of such a solution is raised, or the pressure lowered, the gas escapes in small bubbles, giving rise to the phenomenon of effervescence. The most familiar instance of effervescence is when a bottle of soda-water is uncorked, the excess of carbonic acid gas over what can remain in solution escaping with effervescence. Again, when a seidlitz powder is mixed with water, effervescence occurs, owing to the inability of the water to retain the gas in solution. Many slight circumstances affect effervescence. Most people know that by stirring a glass of soda-

water, or by dropping into it a fragment of cork or a crumb of bread, greater effervescence occurs. Sometimes the liquid is rather viscid, and a persistent froth is produced, as when a siphon of lemonade is discharged into a tumbler. In such a case, the addition of a few drops of milk or of a little alcohol causes more rapid effervescence and settling of the froth. In the former of these cases, the bread crumb or the stirring acts by making it more easy for the gas to form bubbles and escape. In the latter case, the effect of milk may have a twofold cause, one similar to that of the crumb, the milk globules acting as nuclei; the other similar to the calming influence of oil on sea foam, the natural oil, butter, here coming into play. The alcohol merely acts by thinning the liquid.

Efflorescence, in Chemistry, is the term applied to the appearance of a white incrustation on the surface of certain bodies, as when a salt loses its water of crystallisation, and presents a white powdery appearance on the surface. Common washing-soda exposed to the air affords a good illustration of this phenomenon.

Eft (O.E. *efeta*, 'lizard'), synonymous with Newt (q.v.), a combination of the same root with the *n* of a prefixed *an* (*an-eft*, *an-ewt*).

Égalité. See ORLEANS (DUKE OF).

Egan, PIERCE (1772–1849), was the author of many works, including *Boxiana* and *Life in London*. The last, which Thackeray has immortalised in one of his *Roundabout Papers*, owed much to its coloured illustrations by the brothers Cruikshank.—His son, PIERCE EGAN the younger (1814–80), wrote innumerable novels for *Reynolds' Miscellany* chiefly and the *London Journal*.

Egba. See ABBEOKUTA.

Egbert, king of the West Saxons, was the son of Ealhmund, who bore rule in Kent, and was a descendant of the House of Cerdic. After the death of Cynegils (786), he was obliged by his more powerful rival, Beorhtric, to flee to the court of Charlemagne, whence he returned in 802 to fill the throne of Wessex. England was at this time divided into three great sovereignties: Northumbria, extending over what were occasionally the separate kingdoms of Deira and Bernicia; Mercia, which had now subjugated the petty powers of Kent, Essex, and East Anglia; and Wessex, which had absorbed Sussex. For his first twelve years Egbert reigned in peace; then followed a war with the West Welsh (Cornish), and a struggle with the Mercians, of which the turning-point was the great victory of Ellandune (probably near Winchester), and which ended in his being recognised as over-lord of their kingdom. In 829 the Northumbrians also, overawed by his army, accepted him as their suzerain, and thus Egbert became the first real king of England, although he did not formally assume that style, and continued to govern Mercia through its own king. Kent he bestowed upon his son Ethelwulf in 828, and did much to strengthen his own power by increasing the influence of the see of Canterbury. In his last years he had to struggle with a new and terrible enemy in the Scandinavian pirates, who began to harass the coasts. In 835 Egbert was defeated in a great battle in Dorsetshire, but in 837 he defeated, in a great battle at Hengestdune near the Tamar, a huge northern host allied with West Welsh insurgents. Egbert died in 839, having reigned thirty-seven years.

Egedé, HANS, the apostle of Greenland, was born in Norway in 1686, studied theology in Copenhagen, and was appointed pastor of Vagen in Norway in 1707. Having determined to convert the descendants of the Norse settlers in Greenland, he resigned his cure in 1717, and four years later embarked with his wife, two sons, and some companions, in all forty-six persons. Finding the Norse extinct, he turned to the Eskimos. He remained fifteen years in Greenland, during which time he laboured zealously among the people, and by his preaching and teaching secured a permanent footing there for the Christian mission, which owed its origin to him. Latterly some Moravian missionaries invaded his province, with whom Egede failed to agree. The death of his devoted wife, Gertrude Rask, in 1736 drove him from Greenland, but at Copenhagen he was busy promoting the cause of the Greenland mission, of which in 1740 he became superintendent or bishop. He died 5th November 1758. He has described the course and success of his labours in *Det gamle Grönland's nye Perlustration* (Copenhagen, 1729 and 1741).—His son, POVEL EGEDE, born in Norway in 1708, succeeded his father in Greenland, and, as bishop, completed in 1766 the translation of the New Testament into the language of Greenland begun by his father, and prepared also a catechism (1756) and a prayer-book (1783) in the same tongue. He died at Copenhagen in 1789.

Eger, a town and river of Czechoslovakia.—(1) The town (Czech *Cheb*) stands on the right bank of the Eger, 50 miles NW. of Pilsen, and near the German frontier. It was formerly a border fortress of some importance, but its fortifications were razed in 1809; it is now the chief railway centre in north-west Bohemia. The ruins of the imperial burg or citadel consist of a square black tower, a chapel (in the Romanesque and early Gothic style), and part of the great hall. The inhabitants of Eger (27,500 in 1921) carry on considerable trade and various industries, weaving, brewing, shoemaking, &c. In the town-house Wallenstein was murdered on 25th February 1634. Eger was taken by the Swedes in 1631 and 1647, and by the French in 1742.—(2) The river Eger rises 12 miles NW. of the town of Eger, in the Fichtelgebirge, at an altitude of 2362 feet, and flows in a general east-north-east direction, joining the Elbe opposite Leitmeritz, after a course of 190 miles. It is not navigable, owing to its falls and the boulders that obstruct its channel; but it abounds in fish. For another Eger, see ERLAU.

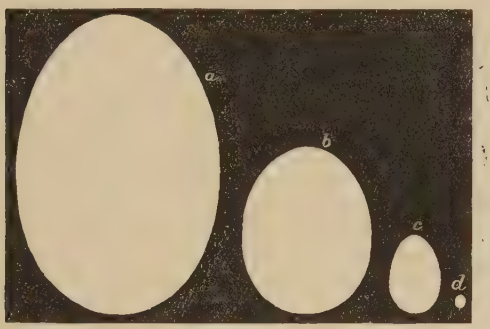
Egerdir, a small town of Asia Minor, gives name to a beautiful fresh-water lake, 30 miles in length, lying between the Sultan Dagh and the northern offshoots of the Taurus Mountains.

Egeria, the Nymph or Camena from whom, according to the legend, King Numa received the ritual of public worship which he established in Rome. The grove where Numa met his mistress to receive her instructions was dedicated by him to the Camenæ. Roman legends speak of two groves dedicated to Egeria—one near Aricia, the other before the Porta Capena at Rome, where the grotto of Egeria is still shown.

Egg, the female cell from which the embryo is developed—a process which, except in Parthenogenesis (q.v.), normal or experimentally stimulated, begins only after fertilisation by the male sperm. Using the word as equivalent to ovum, we may talk with equal accuracy of the egg of any animal, whether sponge, butterfly, fish, bird, or elephant. The essential part of the ovum is generally minute, and the entire element often so remains, alike in the lowest and the highest animals; the presence of extrinsic material, however, often makes the egg large and conspicuous. The most important and frequent extrinsic addition is the yolk, which serves as nutritive capital for the embryo or young animal. Next in importance are the various sheaths which surround the egg, especially

when the outermost of these forms a chitinous, horny, or limy shell. Gristly fishes, reptiles, and birds afford very good examples both of abundant yolk and firm shells. We commonly associate eggs with (oviparous) animals which bring forth their young in that form, but this is a question of degree, for oviparous and viviparous forms often occur among nearly related animals; the common ringed snake, which usually lays eggs, may be artificially induced to bring forth its young alive, and even among mammals, where the connection between mother and offspring is characteristically intimate and prolonged, the two lowest genera (see ORNITHORHYNCHUS and ECHIDNA) are oviparous. For technical details in regard to the egg, the reader is referred to the articles BIRD, CELL, EMBRYOLOGY, and REPRODUCTION; attention will be directed here only to four points—size, shell, colouring, and economic interest, all with special reference to the eggs of birds.

Size of Egg.—The accompanying diagram shows the striking contrast in relative size between the



eggs of four birds—the extinct moa, *a*, the ostrich, *b*, the hen, *c*, and a humming-bird, *d*. A moa's egg has been found measuring 9 inches in diameter, 12 in length, 27 in circumference. Ernst Krause mentions, in his most vivid of all general natural history books, that in the 17th century the inhabitants of Madagascar used to come to the Île de France to buy rum, which they received in great vessels formed from the egg-shells of the extinct Æpyornis. These shells, some of which are to be seen in European museums, measure 3 feet in circumference, and hold over 2 gallons—i.e. some six times as much as an ostrich egg, or 150 times as much as a fowl's. In contrast to the above, the weight of the humming-bird's eggs is computed in grains. (Of European birds, the largest are those of the swan, the smallest those of the golden-crested wren.) It is not in birds alone that we find striking contrasts in the size of eggs; those of a skate contrasted with those of a salmon illustrate a striking difference. The difference in the size of eggs means a difference in the amount of yolk and other extrinsic substances present, but what conditions this difference is a difficult question. The size of the egg can only be said to be generally proportionate to the size of the bird, thus the cuckoo is much larger than the lark, but the eggs of the two are about the same size; the guillemot and the raven are of about equal size, their eggs vary as ten to one; and many other examples of disproportion might be given. Hewitson has noted that the eggs of birds whose young are rapidly hatched and soon leave the nest are large. Professor Newton remarks that 'the number of eggs to be covered at one time seems also to have some relation to their size.' It is probable that the size of the egg, which is familiarly subject to considerable variation in poultry, has been more or less fixed in adaptation to different conditions in different types—e.g. the number to be covered in the nest.

The *shell* varies in composition in different classes. That of insects is chitinous (see CHITIN), of gristly fishes horny; a varying amount of lime is always present in reptile eggs, and predominates of course in birds. A bird's egg-shell consists almost wholly of carbonate of lime, but there is a little phosphate of lime and both salts of magnesia. Mr Irvine of Granton has made the interesting experiment of keeping fowls entirely without carbonate, allowing them only other salts of lime; the result was, however, that a normal carbonate of lime shell was still formed. The exact mode of formation of the limy shell is obscure; one can say little more than that the shell is secreted round the egg by the walls of the uterus or lower part of the female duct. In shape the egg is generally oval, but may be almost spherical, as in the kingfisher and owl; or pear-shaped, as in some of the auk family; or even doubly conical, as in the grebe. The pear-shaped egg of guillemots and razor-bills is well adapted to its precarious position on a ledge of cliff, for when it is jostled it rotates on its own axis without rolling. The same shape in the plovers allows close packing in the nest. In its surface texture the shell varies greatly, enamel-like in the kingfisher, oily in the ducks, pitted in some of the ostrich order, rough and encrusted in pelicans. Less conspicuous, but apparently to some extent characteristic of different families, is the minute structure of the shell.

Colour.—During the formation of the shell in the lower part of the oviduct of the bird pigment is also deposited. This occurs at various stages, producing the ground colour, the deeper, and the more superficial markings. The spots are normally circular, and most abundant on the anterior, larger, 'head' end, which first protrudes. As the egg is moved onwards, rubbing against the walls of the duct, the spots become in varying degrees blotched and diffused. The pigments themselves are numerous (Mr Sorby distinguishes seven), and seem mainly to be derivatives, directly or indirectly, of hæmoglobin, the red colouring matter of the blood. See PIGMENT.

The coloration varies in a single nest, and sometimes widely in a species. There is an extraordinary diversity of coloration in the eggs of guillemot, razor-bill, cuckoo, and the black-headed gull. Some evidence is forthcoming to show that a bird, such as a guillemot, which begins by laying an egg of a particular type of coloration, will continue to produce eggs of that type. This probably holds for the cuckoo, where the egg is sometimes very conspicuous in the foster-parents' clutch, and sometimes almost a facsimile except in texture. But it also appears that the quantity and quality of the pigments change with the constitution of the bird, the richest coloration being produced by birds at their prime. One of the most interesting facts in connection with the colouring of birds' eggs is their frequent similarity to their surroundings. Conspicuous eggs are usually in covered nests; and where the nests are rude and unconcealed, the eggs are very often like the colour of the ground. A valuable discussion of the colours of eggs will be found in Pycraft's *History of Birds* (1910).

Economic Import.—As the eggs of birds contain all the essentials for the nutrition of a young animal, they form, like milk, a highly nutritious diet for adult organisms. The contained albumen, fat, lecithin, and phosphates are all advantageous; and it need hardly be said that both man and animals are well aware of this fact (see POULTRY). The shells are occasionally turned to account—e.g. those of ostriches, for decorative purposes.—The enthusiasm for egg-collecting, shared by so many

naturalists, has probably not been equalled in any other department of natural science. Only a few quests, such as that for the eggs of the birds of paradise, have baffled the perseverance of collectors. The high prices paid for some treasures—e.g. the eggs of the great auk (£450 was paid for one in 1905) are only surpassed by those of some mollusc shells. This so-called sub-science of 'oölogy' has not, of course, been prosecuted without results of interest both in regard to the classification and general life of birds, but inquiry has largely passed from the collection and contemplation of egg-shells to the investigation of the embryo, and the deeper penetration has been richly rewarded. For some further particulars as to the egg-trade, imports of eggs into Britain, &c., see POULTRY.

Brewer, *North American Oölogy* (Washington, 1859); Cassell's *Book of Birds;* Hewitson, *Coloured Illustrations of the Eggs of British Birds* (3d. ed. Lond. 1856); Lucas, *Trans. Roy. Soc. Victoria*, xxiv. (1888); M'Aldowie, *Jour. Anat. Phys.* xx. (1886); Newton, article 'Birds,' *Encyclo. Brit.;* Sorby, *Proc. Zool. Soc.* (Lond. 1875); Carus Sterne (Ernst Krause), *Werden und Vergehen* (3d. ed. Berlin, 1886); Thienemann, *Fortpflanzungsgeschichte der gesammten Vögel* (Leip. 1845-56); Wolley, *Oötheca Wolleyana* (Lond. 1864). See articles AUK, EIDER-DUCK, OSTRICH, and BIRD.

Egg. See EIGG.

Egga, an important trading town in the northern provinces of Nigeria, on the Niger, with a pop. of 15,000. Pottery, iron, gold, and wooden wares, thick cloth, generally dyed blue, and leather are manufactured.

Egg-bird, or SOOTY TERN. See TERN.

Egg-plant (*Solanum melongena*), a species of Solanaceæ, a native of Northern Africa, whose plant grows to a height of two feet; in Britain it is a greenhouse annual. The egg-like fruit, known as Egg-apple, Aubergine, amongst Anglo-Indians Brinjal, and in the United States Jews' Apple, is a favourite article of food in the East Indies, and has thence been introduced to most warm countries. It varies in size from that of a hen's egg to that of a swan's egg, or larger, in colour from white or yellow to violet.

Egham, a village of Surrey, on the right bank of the Thames, 5 miles SSE. of Windsor, and 18 W. of London. Near it are Runnimede (q.v.), Cooper's Hill (q.v.), and the Royal Holloway College for Women (1886). Virginia Water (q.v.) is also here. Pop. of urban district, 14,000.

Egidius. See GILES, ST.

Egina. See ÆGINA.

Eginhard, or EINHARD (*c.* 770–820), born at Maingau in East Franconia, was sent to the court of Charlemagne, where he became a pupil of Alcuin and a favourite of the emperor. Louis, successor of Charlemagne, continued his father's favour. For years Eginhard was lay abbot of various monasteries, but ultimately retired to Mühlheim. Here he died, and was buried beside his wife, Emma. His *Vita Caroli Magni* (*c.* 820) is the great biographical work of the middle ages. It has been edited by Jaffé (1876), Holder (1882), and Garrod and Mowat (1915). There is an English translation by Glaister (1877). Eginhard's *Annales Francorum* embraces the period 741–829; his *Epistolæ* number sixty-two. See French edition of his works by Teulet, with translation and Life (1848). On the (purely legendary) story of his having made a romantic marriage with a daughter of Charlemagne, Fouqué founded his play of *Eginhard and Emma*, and Longfellow one of his *Tales of a Wayside Inn.*

Eglantine, the old and poetic name of the Sweet Briar or other smaller-flowered rose. Milton seems to confound several quite distinct plants (honeysuckle, &c.) under this name; which has of late been bestowed on the Australian hardy evergreen *Rubus eglanteria.*

Eglinton and Winton, ARCHIBALD WILLIAM MONTGOMERIE, EARL OF, K.T. (1812–61), twice Lord-lieutenant of Ireland, was a well-known patron of the turf and field-sports, and is chiefly remembered for his splendid reproduction of a tournament at Eglinton Castle in 1839. Amongst the knights was Louis Napoleon. See Sir W. Fraser's *Memorials of the Montgomeries* (1859).

Egmont, LAMORAL, COUNT OF, PRINCE OF GAVRE, was born at the castle of La Hamaide, in Hainault, 18th November 1522. He accompanied Charles V. to Algiers in 1541 and in all his later campaigns, married the sister of the Elector Palatine in 1545, was invested with the Golden Fleece, and in 1554 went to England to negotiate the marriage between Philip and Mary. He distinguished himself at St Quentin (1557) and Gravelines (1558), for which he was made governor of Flanders and Artois. He now sided with the party in the Netherlands that were dissatisfied with Philip's Catholic policy, and from a courtier became a hero of the people. His imperious character, however, and his subsequent conduct, make it doubtful whether he was actuated by high motives or by self-interest and disappointed ambition. When Margaret, Duchess of Parma, was made regent, Egmont sided with the Prince of Orange; but when insurrections took place, he broke with the Prince of Orange and the 'Beggars' League.' He seemed to have restored order, when, in April 1567, the Duke of Alva was sent as lieutenant-general to the Netherlands. The Prince of Orange and other chiefs of the insurrection left the country; Egmont remained, and seemed to have gained his confidence, but suddenly he and Count Horn were seized and carried to Ghent. They were condemned to death, and on June 5, 1568, beheaded at Brussels. A famous monument to him was erected at Brussels in 1865; a more enduring memorial is Goethe's tragedy with Beethoven's music. See HOLLAND; Juste's *Le Comte d'Egmont* (1862); and Motley's *Dutch Republic.*

Egoism (Fr. *égoisme;* Lat. *ego*, 'I'), an ethical term used in the sense of selfishness; it is specially opposed to Altruism (q.v., and see ETHICS). The word is sometimes used to denote a metaphysical system of subjective idealism, in which the Ego is the sole reality (see FICHTE).—*Egotism*, also derived from Lat. *ego*, is used rather in the sense of self-conceit, a tendency to refer constantly to one's self and quote one's own authority.

Egremont, a market-town of Cumberland, on the river Eden, 6 miles SE. of Whitehaven, whither it sends iron ore. On an eminence to the west stand the ruins of Egremont Castle, the legend of whose horn forms the subject of a poem by Wordsworth. Pop. 6600.

Egret. See HERON.

Eguren, JOSÉ MARÍA, Peruvian poet, born at Lima, has in his *Simbólicas* (1911) and other volumes of delicate symbolist verse reminded English readers of Walter de la Mare. He is also a painter and musician.

Egypt, a country in north-east Africa, extending from the Mediterranean to the first cataract of the Nile at Assuan, from 24° 6′ to 31° 36′ N. lat. The name is derived from the Greek *Aigyptos*, perhaps a translation of Hakaptah, 'the house of the *ka* of Ptah'—a name of Memphis—or formed from the Sanskrit root *gup*, 'to guard,' as *agupta*, 'guarded about,' or a variation of the name Koptos, the modern Quft in Upper Egypt, the city at which the dynastic Egyptians entered the Nile Valley.

In hieroglyphs and Coptic it is called *Kemi*, 'the black [land],' from the colour of the soil; and by the Hebrews, *Mazor*, 'guarded' or 'fortified' (in the singular—i.e. Lower Egypt), or *Mizraim* (in the dual—i.e. Upper and Lower Egypt, but also used as a singular), modified by the Assyrians into *Musr*, and by the Persians into *Mudraya*. The name is still preserved in the Arabic *Misr* (vulgarly *Masr*), a word applied alike to the country and its capital, Cairo. Egypt is literally what Herodotus termed it, 'the gift of the Nile,' *doron tou potamou*, for it extends only so far as the annual inundation of the river spreads its layer of alluvial sediment, brought down from the washing of the Abyssinian mountains, turning the barren sands into cultivable soil, and then retreating to its normal limits, leaving the rich deposit to the influences of sun and air and human labour. Economically and ethnologically, Egypt is confined to the bed of the flooded Nile; the bordering deserts and the southern provinces of Nubia, Khartoum, and the rest towards the equator form no part of the Egypt of nature or of history, though from time to time they have been politically joined to it. Thus limited, Egypt occupies little more than 11,000 sq. m., or about a third the area of Ireland.

The White Nile rises in the Victoria Nyanza in Central Africa, the Blue Nile in the highlands of Abyssinia, the two streams meeting at Khartoum, and being joined 200 miles farther north by the only great tributary of the river, the Atbara. The whole course of the Nile, from the Ripon Falls, where the waters of the Victoria Nyanza find their outlet, to the sea at the Rosetta mouth, is 3473 miles. The river enters Egypt at Assuan, breaking through the transverse granite barrier which there runs east and west. The valley constituting the land of Egypt was formed by a fissure caused by upheavals on the east; the drainage of water falling into it widened it as a broad cañon through the plateau of limestone; the river thus formed has later cut its own bed in the deposits of gravel and alluvium with which it has itself overlaid the valley. The bed has varied its position in course of time, some of the old beds being still visible. In these ancient beds, worked flint implements are found among the rolled gravels. From Assuan to Edfu the cliffs which bound the Nile Valley are of sandstone; north of Edfu they are of limestone. The strata dip from south to north; the formations of the south are the earliest. South of Edfu the nummulitic limestone disappears completely, and is replaced by the so-called 'Nubian' sandstone. The eastern desert is entirely different in character from the western, being much higher, owing to the upheavals already mentioned. To the west the low ground only rises into cliffs at the south, and the plateau itself, the Libyan Desert, is level and rolling. On the east the cliffs begin at Cairo and the desert extends to the Red Sea, where the hills, formed of crystalline rocks, rise in peaks to a height of 6500 feet. The plateau of the eastern desert slopes down westward; it is formed of cretaceous and tertiary sandstones and limestones, and ends abruptly in cliffs which form the barrier on one side of the Nile Valley, and vary in height from 500 to 1400 feet. The eastern desert is subject to sudden and violent rainstorms; these when sufficiently near the valley cause rushing torrents to pour down the wadies, carrying all before them. Such rainstorms are more common than is usually supposed; they occur about once in two years. The chief physical peculiarity of Egypt is the fact that the whole agricultural water-supply depends on the Nile and its annual inundation, and not upon rain. The regular increase of the Nile every year is a phenomenon which has excited the wonder of all writers on Egypt from the earliest times. This rise is due to the rainfall in Abyssinia, which causes the Blue Nile and the Atbara to come down in flood. In the dry season the Blue Nile is a small stream and the Atbara is reduced to a chain of pools; the White Nile, being fed from the great Victoria Nyanza, still retains sufficient volume to fill the river-bed. The current of the White Nile, when the river is at its lowest, is sluggish, and the slow current, combined with the hot sun, favours the growth of organisms in the water; these produce the phenomenon known as the 'green water,' which has a putrid taste and smell. The heavy rainfall of Abyssinia causes the Blue Nile to rise at the end of June; it brings down in suspension a heavy load of red soil washed from the mountains on which it rises. This is the 'red water,' which, flowing more rapidly than the green water, carries it quickly down to the sea. The Atbara also bears its part in the inundation, but not to so great an extent as the Blue Nile. The actual rise of the Nile is about 23 feet; the amount of water discharged by the river at Assuan is from 17,700 cubic feet per second at its lowest, to 323,000 cubic feet per second at the height of the flood. The waters of the inundation, spreading over the country on each side of the river, deposit their load of silt, the fertilising properties of which are due to the presence of phosphoric acid, potash, and nitrogen. The perennial irrigation now practised causes less soil to be deposited, the surplus being swept out to sea, where it is dispersed, forming wide shoals to the east.

The general appearance of the valley is thus described: 'In the centre the brown-toned river, turning reddish when swollen by the rains of the inundation; higher up on either side, but chiefly on the western, the bright green fields of waving corn, or beans, or lupin; then a border still higher of dusky barren rock; and then the slopes of the deserts—the long red and yellow and gray ridges of sand and limestone rock, generally low and tame in outline, and lying at some distance back from the river, but sometimes closing to the very bank in bold headlands, scored by torrent-beds where water rarely flows, and then shearing away to the distance of several miles, and leaving a wide, level plain of cultivable land' (Lane-Poole, *Egypt*). The Nile from Assuan to Cairo pursues a northerly course, varied by one considerable bend near Thebes. At 30° 15′ N. lat., a few miles north of Cairo, it divides into two main streams, terminating in the Rosetta and Damietta mouths. The other five mouths which existed in antiquity have silted up; and the triangular or Δ-shaped district, enclosed by the streams and supposed by the ancients to have been recovered from the sea, forms the Delta. The southern part of the country from Assuan to Cairo is known as Upper Egypt; a part from Cairo to Darut esh Sherif is sometimes separated as Wustâni or Middle Egypt, the ancient Heptanomis; and the northern part or Delta is Lower Egypt.

Though subject to cold winds in the winter, the climate is mild, especially south of the Delta and in the desert; from Cairo to Alexandria the air contains more moisture and is less salubrious; while the Mediterranean coast is subject to rain, and rendered less healthy by the belt of salt-marshes. The average temperature at Cairo ranges from 53° to 83° Fahrenheit, though it sometimes reaches 95° in the summer, or even 115° during the khamsin. At Assuan the average temperature is from 60° in the winter to 93° in the summer. The prevailing winds in Egypt are northerly from May to October, north-westerly for the remainder of the year, with the khamsin at irregular intervals in March, April, and May. The khamsin are hot

southerly winds blowing chiefly during the months of March and April. The simoom is a violent sand wind, commoner in the desert than in the valley, but rare anywhere. Earthquakes are occasionally felt. The Nile subsides within its banks by the end of November, and the irrigated land, over which the water has been carefully equalised by drains and embankments, is sown; soon it is covered with green crops, which are reaped in March. In spite of the dry air of the valley and desert, Egypt is by no means remarkably healthy; in addition to occasional visitations of plague and cholera, ophthalmia, diarrhœa, dysentery, and boils prevail, owing to the absence of rain favouring dirt habits and the high temperature favouring infection, and European and even Nigritic races are acclimatised with difficulty. With prudent modifications of our modes of life, however, British people, even young children, thrive well in most parts; and for certain classes of invalids—for instance, consumptives—the desert air is wonderfully recuperative.

Geology.—Egypt is separated from Nubia by a low, hilly region, about 50 miles broad from north to south, composed of granitic rocks. The same crystalline rocks extend up the shore of the Red Sea to near the opening of the Gulf of Suez, stretching inland for fully 30 miles. The scenery in this part of the Nile Valley is wild and rude, and the course of the river is frequently interrupted by cliffs and broken masses of granite, which form cataracts or rapids. The granitic region terminates at Assuan, the ancient Syene, whence the red granite for the ancient monuments of Egypt was procured. For about 85 miles, from Assuan to Esné, the walls of the valley are composed of sandstone of Cretaceous age; below Esné the sandstone is covered by a limestone belonging to the Upper Chalk series. This continues on both sides of the valley for about 130 miles, when it is covered by a Tertiary nummulite limestone, which forms the further prolongation northward of both ranges of hills. In the southern parts of the limestone region the magnificent cliffs and wild valleys form most striking scenery; frequent tablelands occur, on one of which are built the pyramids of Gîzeh (q.v.), the material employed being the predominant limestone; while steep sand-dunes are met with in parts of the desert. Most of the area outside the valley is hard rock covered with scanty marl and gravels; in the flat lands bordering the Nile the rock is coated to a depth of about 30 feet (at the river's bank, thinning away towards the desert) with the alluvium brought down by its waters, which has formed the Delta at its mouth. This alluvium consists of an argillaceous earth or loam, with finely ground mica derived from the decomposed granite, and more or less mixed with sand, and a quartzose sand probably derived from the adjacent deserts by violent winds. This sedimentary deposit is so uniform that it seldom shows stratification, yet within short distances great variety is observed in what are apparently synchronous deposits. The increase of the deposit is estimated at about 4½ inches in a century.

The rocks of Egypt afforded the stones used in its edifices and sculptures: granite and syenite (from Assuan), basalt (from Abu Zabel), breccia (from the limestone caves), diorite, verde antique, and porphyry (from the mountains of the Arabian desert), sandstone and limestone (from the hills bordering the Nile), and alabaster (from Tell-el-Amarna). Emeralds, gold, silver, and copper were formerly found near the Red Sea; salt, natron, and sulphur are still among the mineral products. For the great Nile reservoir, see ASSUAN, NILE.

Natural History.—The signal peculiarity of the vegetation of the Nile Valley is the absence of woods and forests. Even clumps of trees (except palms) are rare, though some have been recently planted. The Pharaohs obtained their timber chiefly from the Lebanon; perhaps in early times some was indigenous, as great wooden beams were used in the royal tombs of the Ist dynasty; modern Egypt is supplied from the forests of Asia Minor and Russia. The date and dôm palms, the sycamore, acacia, tamarisk, and lebbek are the commonest trees; the myrtle, elm, and cypress are rare; the mulberry belongs to Lower Egypt. Among fruit-trees, the vine, fig, pomegranate, orange, and lemon abound in special localities; apricots, peaches, and plums are of poor flavour; Indian figs (prickly pears) and bananas have been naturalised; and water-melons are at once the meat and drink of the people in the hot days. Of flowers, the celebrated lotus, or water-lily, supplied many ideas to Egyptian architects. Though common in ancient times, it is now seen only in neglected canals of the Delta, owing to the systematic drainage of marshes and swamps; for the same reason, the papyrus reed has also disappeared from Egypt.

The lack of jungle or cover of any sort accounts for the poverty of the Egyptian fauna. The hyæna, jackal, fox, hare, rabbit, jerboa, ichneumon, weasel, shrew, hedgehog, genet, polecat, spalax, and field rats and mice are common enough; the gazelle is the chief quarry; the wild-ass, wild-pig, and wild-cat are almost extinct; and the crocodile, like the hippopotamus, scared by European rifles and steamboats, has beaten a retreat to the tropics. The ordinary beasts of burden are the ass and the camel, the latter being always one-humped; the draught buffalo and the horse are importations unknown to the ancient Egyptians prior to the XVIIIth dynasty. The short-horned cattle, famous from the time of the Pharaohs, are seldom killed by the natives, and mutton is the staple butcher-meat in Egypt; goats also are common. The dog is considered unclean by Mohammedans, and is used merely as a scavenger and watch-dog. The cat is looked upon with considerable favour owing to its supposed enmity to snakes, which it is said to kill in large numbers. Bats are common in many of the ancient buildings and caverns. Of domestic birds, water-fowl were anciently the most numerous, and still abound; the small gallinaceous poultry we now see are probably not of older date than the Persian invasion. Pigeons have always been abundant. There are three or four varieties of vulture; eagles, falcons, hawks, kites, owls, hoopoes, swallows, wagtails, larks, sparrows, plover, and quail are common, and many of them figure in the hieroglyphics. An Ibis (q.v.), conjecturally identified with the sacred ibis of which many fables are told, is far from rare. The ostrich is now bred in farms in the Delta. Of reptiles, lizards, frogs, and toads abound, also chameleons. Snakes are numerous, both poisonous and non-poisonous; among the former are the horned snake Cerastes (q.v.) and the deadly cobra, the uræus or royal serpent of the ancient Egyptians. The trionyx, or soft tortoise, is plentiful in the Nile; the ordinary tortoise is found in the Delta only, but was known in prehistoric times. The Nile is full of fish, generally of rather poor flavour; the best are the binny (see BARBEL), the bulty, the latus (one of the perch family), and the bayad or silurus. In the lakes of the Delta the dolphin is not uncommon. The Sacred Beetle (*Scarabæus sacer*) is one of the most remarkable insects. The scorpion's sting is sometimes fatal, and spiders (*solpuga*, erroneously called tarantulas by Europeans), to say nothing of minor insect pests, and locusts remind us that the Plagues of Egypt are not merely ancient history.

Egypt is essentially an agricultural country, and in some parts, by the aid of regulated artificial irrigation, the rich alluvial deposit will bear three crops in the year. Wheat is the chief cereal; but barley, maize, durra, beans, lentils, clover, &c. are also largely grown, with very little trouble beyond the management of the water. When fields require more fertilising material than the silt deposited by the Nile, the peasants dig the ancient sites, as the remains of the mud-brick buildings form an excellent fertiliser owing to the salts contained in them. The extensive culture of papyrus, which anciently supplied material for paper, has in modern times been superseded by that of the sugar-cane, cotton, indigo, and tobacco.

Divisions.—In ancient as in modern times Egypt was always divided into the Upper and the Lower, or the Southern and the Northern, country. A third great division, the *Heptanomis*, was introduced at the time of the geographer Ptolemy; it is now known as Middle Egypt or *Wustâni*. From the earliest period Egypt was further subdivided into a number of *nomes*, or departments, varying in different ages. The prehistoric division of the Delta was into eight nomes; these gradually increased, probably for political and administrative reasons, to thirty in the XIXth dynasty. In Upper Egypt the prehistoric nomes were four, increasing to thirty-six in the XIXth dynasty, and to fifty in Ptolemaic times. For religious purposes, however, the number seems to follow the divisions of the XIIth dynasty, twenty-nomes for the Delta and twenty-two for Upper Egypt; forty-two in all. This number is emphasised by the forty-two assessors who sat with Osiris in the judgment of the soul, and who probably originally represented the principal god of each nome. Every nome, or department, had a separate local government of a nomarch or lieutenant-governor, besides governors of the cities and of the temples, scribes, judges, and other functionaries. Its limits were measured and defined by landmarks. In the 5th century A.D. Egypt was divided into Augusta Prima and Secunda on the east, and Ægyptiaca on the west, Arcadia (the Heptanomis), Thebais Proxima as far as Panopolis, and Thebais Supra to Philæ. Under the Mohammedans, the triple division into Misr el-Bahri (Lower Egypt), el-Wustâni (Middle), and es-Sa'îd (Upper) has prevailed, but the number of subdivisions has varied; at present there are fourteen provinces, or *mudiriyehs*. Each province is governed by a *Mudir*, assisted by a council or *diwan*. The council is composed of the *Wakeel*, or deputy-governor; the *Kadi*, or judge; a chief clerk, tax-gatherer and accountant, a superintendent of police, and the chief physician of the province. Every province is subdivided into districts, each under a *Nazir;* under whom again are the *Sheikhs* of the villages. Certain towns—e.g. Alexandria, Cairo, Port Said—have their own government, and are not under the *Mudir* of the province. For the division of the territory beyond the limits of Egypt proper, see SUDAN (annexed 1876, abandoned 1885, reoccupied 1897–99).

Population.—The aboriginal people of Egypt appear to have been a dolichocephalic race, large-featured and tall, with intermixtures of Semitic and negroid elements. The Semitic stock appears to have been introduced early, as the language shows a marked affinity with other Semitic tongues. The overwhelming majority of the inhabitants are Moslems; the Copts (q.v.), though increasing, make up only 6·31 per cent. of the entire population. Of foreigners, the greater number are Bedouins and negroes; and there are, besides Armenians, Jews, Syrians, and Turks, Europeans of all nationalities (for details, see the section on Statistics of Modern Egypt). The Moslems belong to the sect of Sunnis, with whom the grandsons of Mohammed—Hassan and Husên—rank as saints and martyrs. The Copts are Monophysites—i.e. believers in the one Nature of Christ; their ritual approximates to that of the Greek Church. The statements of Greek writers that castes existed in ancient Egypt appear to be founded on the fact that usually a son followed his father's profession; but, with one exception, every class might intermarry with any other class, and many men could follow two professions at once, as in the case of priests and soldiers. The only exception to the rule of free intermarriage was the class of hogherds, who were set apart as unclean, and were not only not allowed to marry outside their own 'caste,' but were not even admitted into the temples. Of caste as it is known in India there is no trace in either ancient or modern Egypt.

Religion.—The Egyptian religion began in primitive and savage cults, and ended as a philosophical pantheon. Each nome, or division, had its own deity, who was considered supreme in his own district. The earliest deities seem to have been goddesses, to each of whom were united later two male gods, looked upon as her husband and son respectively. These groups of deities, known as 'triads,' are found in all the principal centres of worship in Egypt, with the exception of Heliopolis. Thus Ptah, Sekhmet, and Imhotep formed the triad at Memphis; Amon-Ra, Mut, and Khons at Thebes; Hor-Behudti (Horus), Hathor, and Har-pa-khrat (Harpocrates) at Apollinopolis Magna. Successive conquests and the advance of ideas caused the introduction of new gods, the older and more primitive deities being then grouped with the new one under the name of the *pesezt*, or 'company of nine.' This was especially noticeable at Heliopolis, where the triad was not worshipped, but where the three-times-three or ennead seems to have been first introduced. This Heliopolitan theory was transplanted to other centres of worship, but was never thoroughly established elsewhere.

Fig. 1.—Sekhmet.

In the XVIIIth dynasty an attempt was made, chiefly, it would appear, by the Heliopolitan priests, or by their influence, to introduce some uniformity into the confusion of the Egyptian pantheon. The great gods of the principal cities were identified with Ra, the sun-god, and thus we find compounds like Amon-Ra, Sebek-Ra, and Min-Ra. At the same time some of the goddesses were fused with Hathor and Isis; but as the worship of the female deity was older and more deeply rooted in the minds of the people, the fusion between the goddesses is not so complete as between the gods, and many of the goddesses retain a distinct and separate existence to the last.

The division into (1) Local Gods, (2) Solar Gods, (3) the Osiris cycle, makes the Egyptian pantheon intelligible. Under the Local Gods are comprised all the animal or animal-headed gods as well as the triads; the Solar Gods are the Heliopolitan ennead and all the gods whose worship is influenced by the Heliopolitan creed; in the Osirian cycle are the deities who surround Osiris. Each local god was considered in his own district as supreme over all other deities, and as the creator of gods and men; hence we have such varying legends as Khnum, the ram-headed god of Elephantine, forming men out of clay on the potter's wheel; Ptah

of Memphis creating the world out of matter or chaos; and from the tears of the god Khepera men and women came into being. When a principality rose into power through the local chieftain becoming king, the local deity became one of the great gods of Egypt, supreme for the time being, and ever after retaining a certain hold on the religion of the whole country, as Ptah of Memphis, who was the god of the kings who reigned at Memphis, and who composed the IVth, Vth, and VIth dynasties; Sebek, the crocodile, worshipped in the XIIth dynasty, the kings of which came from the crocodile-haunted province of the Fayûm; Amon, later called Amon-Ra, whose power rose with that of the Theban monarchs of the XVIIIth dynasty; Bast, the cat-goddess of Bubastis, whom the kings of the XXIInd dynasty specially worshipped.

The gods of the Solar cycle were identified by the Egyptian theologians with the cosmic deities familiar to all ancient religions. Ra was preceded as the sun-god at Heliopolis by Atmu (or Tum), but in historical times he has become the supreme deity, and the position of the older god is only indicated in some of the religious texts. The

Fig. 2. Amon-ra.

Fig. 3. Anubis.

Fig. 4. Thoth.

rising sun was called Khepera or Horakhti (the Horizon-Horus), and was represented in the form of Harpocrates or Horus the Child; at the zenith he was named Ra; and Atmu was the setting sun. The Sun sailed in the Manzet boat on the celestial Nile above the earth; and as he sank in the west the souls of the dead, who accompanied him in his night journey, gathered at Abydos and passed through the Gap of Abydos into the Mesektet boat, in which the passage of the under-world was made. Here the corpse of the dead Sun, represented as a ram-headed figure, was towed by various deities and by the souls of the dead through the Duat, or other world, floating on the infernal stream as it had floated on the celestial river. This land of thick darkness, to which light came only during the passage of the Sun through its midst, was divided into countries, each division entered by a fortified gate. At each gate sat armed warders, while serpents belching flames protected the actual openings. At every hour of the night the boat with its sacred load, guarded and protected from all danger by the band of deities and souls, passed through one of the gates. At midnight the Sun was revivified by the beetle—the scarab, the emblem of the resurrection—and alive and rejoicing he pursued his triumphant way, fighting and overcoming his eternal enemy, the snake Apep, and rising in glory over the earth as the child Horus in the morning.

The Osirian deities are those who cluster round the chief goddess and god of Egypt, Isis and Osiris. The legend of the enmity of Set against his brother Osiris; the murder of Osiris by Set; the flight of Isis to Buto; the search by Isis for the body of Osiris; her discovery of it at Byblus; Set's finding of it, and tearing of it into fragments to be scattered broadcast over Egypt; the second search of Isis, this time for the pieces of the body; her reuniting of them, and thus causing the revivification of Osiris; and the battles between Horus and Set, are fully related in Plutarch's *De Iside et Osiride.* Osiris, whose cult was spread throughout Egypt, was worshipped under four aspects—(1) as god of the moon, (2) as god of vegetation, (3) as god of the dead, (4) as incarnate in the king. In the ritual of this god, many survivals of primitive and savage customs were retained throughout the historical period. Isis, the myriad-named, had a cult quite distinct from that of Osiris, and figures of this goddess nursing the infant Horus are a prototype of the Madonna and Child. A few foreign deities were incorporated into the Egyptian pantheon when Syrian influence was at its height—Baal, Astarte, Anaitis, and Reseph being the best known. The so-called 'heresy' of Akhenaten at the end of the XVIIIth dynasty, worshipping only the rays of the sun and prohibiting all other devotion, is generally considered to have been due to Syrian influence. Many local deities were worshipped under the form of animals, in which they were supposed to be incarnate. The special animal so honoured was installed in the adytum of the temple, and gave oracular responses. The best known of these was the Apis bull of Memphis, whose worship had a national extension due to his being 'the incarnate soul of Osiris.'

The cult of the dead reached a very high point in Egypt owing to the belief in the *ka*, or double; offerings were made to it of food and of all objects necessary for its comfort, and as pictures were supposed to have *kas* which could be of use to the *ka* of the owner, representations of scenes of daily life were sculptured or painted on the walls of the tomb chapels. Herodotus is the only author who maintains that the Egyptians believed in the transmigration of souls; but in the Book of the Dead such transmigration or transformation is looked upon as a voluntary act, to be performed or not at the will of each individual. Besides the *ka*, there was also the *ba*, or soul, which went with the sun through the under-world.

Religious Monuments.—The religious edifices of the Egyptians consist of tombs and temples. These are indeed the chief survivals of their marvellous architecture, for their private houses (built almost entirely of sun-dried brick) are now mostly swallowed up in the rising alluvium, and but few forts remain. The Pyramids (q.v.) themselves are royal tombs, huge structures reared to mark and to guard the sarcophagi of kings, with small temples dedicated to the cult of the dead monarch in front. The royal tombs of the Ist and IInd dynasties at Abydos, constructed of mud-brick and wood with but little stone, are the earliest Egyptian monuments. Then follow the pyramids, made at first of hewn stone and later of rubble and mud-brick, with smaller tombs, often finely sculptured, around them. The next are the rock tombs of the XIth and XIIth dynasties, in which the subterranean character of the pyramid-vaults is maintained in the deep well or burial-pit; the entrance-chapel, in which the memorial services were performed, is sometimes decorated, as at Beni Hasan, with a portico and proto-Doric columns, while the walls are adorned with paintings of scenes of daily life. At this period the chapel belonging to a royal tomb was placed on the edge of the cultivated

desert, in the axis of the tomb which was in the cliff behind. Finally, at Thebes the kings of the XVIIIth and succeeding dynasties built their magnificent funerary temples in the open space on the western desert, where their beauty could be seen by all, while the royal tombs were in the valley behind the cliffs, carefully hidden from human eyes. The finest of these rock-hewn sepulchres are those of Amenhetep II. and Sety I., which retain the rich and varied colouring still bright and fresh, showing the power and skill of the ancient artists. Egyptian temples can be divided into three classes—(1) the royal funerary temple, (2) the processional temple, (3) the shrine temple. The royal funerary temples were for the cult of the dead king; they contain a statue of the king standing in an open court, and an altar for the offerings. The type of this kind of temple is the Ramesseum at Thebes. The processional temple is open front and back, and in the centre, under a roof, is a stone block on which the boat of the god was placed; the block was of a convenient height for the priests to raise the boat on their shoulders. The temple was open at both ends to allow the procession to pass in and out. The best example of this kind of temple is that of Thothmes III. at Medinet Habu. The shrine temple is found from the XVIIIth dynasty onwards, some temples which were originally processional being altered by later kings to suit the changed condition of the cult. The shrine is always enclosed and dark, sometimes built of masonry, sometimes made of a single block of stone. The figure of the god remained in the shrine, and was seen only by the priest of the highest rank and on rare occasions by the king. The shrine temple was looked upon as the dwelling-place of the god, in which the god was conceived to live as a king or nobleman lived in his palace—rising in the morning, his toilet performed by his servitors (the *hemu neter*, or 'servants of the god'), the incense being the morning and evening meals of the deity, and a bevy of priests and priestesses attending to his wants as the man-servants and maid-servants of a royal household attended on their human master. The typical shrine temples are Edfu (q.v.) and Dendereh (q.v.). Karnak, the largest and perhaps the most celebrated temple in Egypt, is a mass of ruins. The obelisks which stood in front of the now completely destroyed temple of Heliopolis were removed by Cleopatra to Alexandria, whence one was brought to this country, and now stands on the Thames Embankment; while another has gone to New York—only one still remaining on the original site.

The ethical standard of the ancient Egyptians was a very high one. The so-called Negative Confession, recited by the dead man when his heart was being weighed in the balance before the great god Osiris, shows what deeds were considered sinful. Besides the sins of the Jewish decalogue, the oppression of the poor, the widow and the orphan, interference with the water-rights of others, falsifying weights, making mischief and stirring up strife, were included in the catalogue of crimes.

Ancient Civilisation.—According to the Egyptians themselves, the country was ruled first by the gods, then by ten semi-mythical kings, and lastly by the historical kings, of whom Menes was the first. This tradition is borne out by the discoveries at Naqada and elsewhere of a prehistoric civilisation, which lasted many centuries, though its exact duration cannot be fixed. The development of the great civilisation of Egypt can, however, be traced from its first beginnings in the early predynastic period, when the use of metal was hardly known and the potter's wheel had not yet been invented. In the Ist dynasty the working of stone for building purposes was already in use, the potter's wheel and the lathe had been introduced, as well as the notation of time, the Egyptian system of numeration, weights and measures, books on anatomy and medicine, the geographical division of the country, and

Fig. 5.—Sacred Bark.

the division of the year into 365 days, divided into three periods of four thirty-day months, with five intercalary days at the end of the year. By the IVth dynasty the buildings show a complete mastery of engineering and geometry; moreover, the arts could not have reached such a high development without some acquaintance with technical details of hardening metals and of glazing. The art of literary composition also existed at this early period, for two kings of the Ist dynasty are credited with being authors; long religious texts are found on the pyramids of the VIth dynasty, and a code of manners and morals drawn up in the Vth dynasty is still extant, though the actual papyrus is of the XIIth dynasty (see PAPYRUS; for Egyptian writing, see HIEROGLYPHICS). Architecture had attained great refinement at an early period; not only were temples, tomb-chambers, and other edifices squared and directed to face the cardinal points, but cantilever roofs in stone were adopted as early as the IVth, and the brick vault or round-headed arch was in existence in the IIIrd, dynasty. The transport of enormous blocks of stone testifies to an early development of engineering skill. Stone columns were in use in the IVth dynasty; in the Vth the palm column, the papyrus column, and the so-called proto-Doric column are first seen. The last is best known in the XIIth-dynasty tombs at Beni Hasan. The symmetrical arrangement of the temples, consisting of rectangular courtyards and hypæthral halls of many columns built before the original shrines, with their gateways slightly converging to the apex, and their bold and severe lines, prove the high development of architecture. The ashlar masonry of the pyramids is unsurpassed in the history of the world. Stone-sculpture reached its height in the IVth dynasty. The many conventions that bound the Egyptian artist show that stone-sculpture had its rise in clay-modelling. The support up the back of the figure, the foot advanced, the slab of

stone left between the legs, prove that the original material in which the artist worked was soft and yielding, requiring support lest the superincumbent weight should crush the lower part of the figure. When a firm and rigid material was introduced, conventions were so firmly fixed that no later artist could break free from them. The ivory statuettes of the Ist dynasty show a realism and a truth to nature that were never attained at later periods. The sculptures found at Meydûm, Gîzeh, and Saqqara—the celebrated figures of Rahotep and Nefert, the diorite statue of Khafra, and the wooden statues of Ka-aper (the 'Sheikh el Beled,' fig. 6) and his wife—are the finest examples. The lions and sphinxes of a later period (fig. 7), moreover, are often executed with amazing spirit. Sculptures in low relief—the depth often not more than ¼ of an inch—decorate the walls of tombs and temples (fig. 8); and a peculiar kind of bas-relief, known as *relief en creux*, also prevailed. In this the figures are sunk in slightly convex relief, but the intermediate ground is not cut away. Copper statues cast from moulds appear in the Vth dynasty; in the XIIth dynasty statuettes were cast, by the *cire-perdue* method, on a sand-core. Casting bronze statues on a core was an art introduced from Egypt into Greece by Rhœcus. Painting was commoner in later times as a cheap substitute for sculpture; it had a rigid architectural character, and followed the same canon as sculpture. The colours were laid on flat, the background being gray, white, or yellow. Outline drawings show a freedom of line and a mastery of form that is not surpassed in modern art. The architectural details of Egyptian temples and the hieroglyphs appear to have been always coloured, and this added additional charm to the sculptures. The religious papyri were often embellished with elaborately coloured vignettes, somewhat resembling the illuminations of medieval manuscripts. The Egyptians were also much devoted to music, the harp and flute appearing in use as early as the IVth, and heptachord and pentachord lyres as early as the XIIth, dynasty; besides drums, tambourines, flutes, cymbals, trumpets, and guitars in the XVIIIth, the most primitive form was the jingling sistrum, the instrument used in all religious worship (fig. 9). Many of the instruments were of great size, and must have produced considerable effect. Songs were chanted to the accompaniment of various instruments, and women beat time to their chants by clapping their hands to emphasise the rhythm. The well-known threshers' song, which occurs in the tomb of Ty of the Vth dynasty, has been paraphrased as:

Fig. 6.—Ka-aper, the 'Sheikh el Beled.' (Statuette in wood.)

Fig. 7.—Ram-headed Sphinx.

Hie along, oxen,
Thresh the corn faster,
The straw for yourselves,
And the corn for your master.

The refrain to this song was, 'Thresh for yourselves, O oxen.' The peasant songs were, in all probability, like the peasant songs of modern Egypt—a line of solo, with a refrain in chorus. In more ambitious poetry the same method is preserved in the strophe and antistrophe, of which the earliest and finest example is the Hymn to Senusert III. of the XIIth dynasty. In the mechanical arts many inventions had been made. The blowpipe, used on a large scale for metallurgy, appears in the Vth dynasty (fig. 10); bellows and siphons in the XVIIIth. Copper adzes, chisels, and harpoons were employed in the prehistoric periods; the use of the lever was fully understood in the IVth dynasty; the balance appears very early, but the steelyard does not occur till Roman times. Flint was the common material for tools in the prehistoric period, though the use of metal was already well known. At first copper was the chief metal; this was superseded by bronze in the XVIIIth dynasty, and iron, though known at all periods, is not common till the XXVIth. The earliest dated Glass (q.v.) made in Egypt is of the reign of Thothmes III.; but glass, evidently imported, is known as early as the Ist dynasty. Hand-made pottery was used in the earliest prehistoric period, and a glazed ware and wheel-made pottery begin in the Ist dynasty. The Egyptians used, at an early period, shields and cuirasses of quilted leather; their weapons were stone-headed maces, clubs, bows, and daggers in prehistoric times, while spears and swords appear later. For sieges they employed the testudo, ladders, and mines. The army was composed of infantry till the XVIIIth dynasty, when war-chariots were introduced; for prior to that period the ass was the chief means of transport, and, carriages not having been invented, persons and goods were carried on the panniers of asses, or on a kind of saddle slung between two animals. War-boats no doubt existed at an early period; models and paintings of boats occur in prehistoric times, and mention is made of shipbuilding under the IIIrd dynasty, and of an armed expedition by boat to Nubia in the Vth dynasty; a regular navy occurs in the IIIrd, when Snefrû built a fleet of sixty ships. The Nile, however, being the chief highway of Egypt, was constantly navigated by rowing and sailing vessels. An extensive commerce was carried on with neighbouring nations, and their tribute enriched the country with slaves, cattle, gems, valuable metals, and objects of curiosity. Rare animals were collected for ostentation. Under the earlier dynasties, the chief occupation of the nation appears to have been rearing cattle and cultivating grain, while the amusements consisted of banquets, games, hunting, and fishing; and the establishment of each noble—like that of a feudal baron of the Middle Ages—contained in itself all the organisation and artificers necessary for its maintenance. Transactions were carried on largely by barter; though rings of gold, probably of a standard weight and value, were also used. The unit of value, however, was always reckoned in copper. The Persians first introduced coined money (see NUMISMATICS). The wealth of families was often spent on the tombs and furniture of the dead, and the preparations for embalming were on so vast a scale that filial piety did not disdain to mortgage not only the sepulchres, but the very mummies of its ancestors (see EMBALMING).

Amusements were various, from singlestick and juggling, the dance of the *ghawazi* (fig. 11), and bull-fights, to draughts, dice, and *mora*. In fact,

Fig. 8.—Wall-painting from the Tomb of Ptah-hotep, at Saqqara: of the Pyramid age.

ancient Egypt had, like any modern country, a material civilisation, which exerted all the requirements of industry, and forgot none of idleness.

The civil government was administered nominally by the Pharaoh, whose substitute was the vizier. Each province had its own governor, who was responsible for its good administration; the mechanism of government was carried on by officials of various kinds and grades. Sacred scribes attended to the ecclesiastical interests, and inferior scribes to the local interests. The public works, the collection of grain and other dues, the cattle, workmen, wells, irrigation, had each their separate organisation of superintendents and scribes. The temples were ordered by high-priests and an inferior hierarchy, with overseers and governors of revenues, domains, and donatives; and each temple, like a monastic institution, had its carefully subdivided organisation. The military force was ruled with severe discipline, under the direction of nomarchs, colonels, captains, and lieutenants. In early times there was a local militia, aided by foreign mercenary troops; this gradually developed into a standing army, and in the reign of Rameses II. we find the army divided into territorial divisions. The criminal and civil law was administered by judges, who held travelling assizes, and to whose tribunals the necessary officers were attached. Appeals could be made to the Pharaoh, to the vizier, and, in Roman times, to the prefect. The execution of deeds required so many witnesses that fraud evidently often occurred. The superior position of women in the social scale, notwithstanding the permission to marry within degrees of consanguinity usually forbidden, shows that the Egyptians reached a higher point of delicacy and refinement than either their eastern or their western successors. This high position was due to the fact that all landed property, including the throne itself, descended in the female line, from mother to daughter. Colossal in its art, profound in its philosophy and religion, and in possession of the knowledge of the arts and sciences, Egypt exhibits the astonishing phenomenon of an elevated civilisation at a period when the other nations of the world were almost unborn.

Fig. 9.—Sistrum.

Chronology and History.—In the time of Ptolemy Philadelphus, in the 3d century B.C., Manetho of Sebennytus, high-priest of Heliopolis, who had the best records of his country at his command, drew up, at the request of the king, a history in which we have the complete statement of the old Egyptian division of the space of time, from Menes

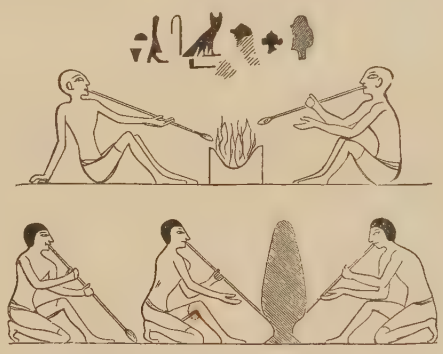


Fig. 10.—Egyptian Smith.

to Alexander the Great, into thirty dynasties. The original work of Manetho has perished; but chrono-

Fig. 11.—Musicians and Dancers.

logical epitomes have been preserved by Julius Africanus (300 A.D.), Eusebius, and Georgius Syn-

cellus (800 A.D.), and a comparison of these statements, corrupted as they are, with the records of the monuments has clearly established the truth and authenticity of Manetho's authorities. The Hebrew Scriptures, Herodotus, Diodorus, Josephus, Eratosthenes, and others also contain chronological information. The division of the kings into dynasties is followed by all modern Egyptologists—the actual date of a dynasty being arrived at, where possible, by astronomical or seasonal data. The Egyptians themselves had a double calendar—(1) the official calendar, which consisted of 365 days in the year, losing a day every four years, and therefore shifting gradually through all the seasons; and (2) the solar calendar of 365¼ days in the year. The two calendars coincided once in every 1460 years, this period being called by the Greeks a Sothic cycle, from Sopd, Sothis, or Sirius, the Dog-star; for the Egyptians calculated their new year from the rising of the Dog-star at dawn.

As the chronology is still a matter of dispute, the table of dynasties which follows gives the dates from the Ist to the XVIIIth dynasty as calculated from Manetho's History, and the same dates as calculated by Meyer. After the XVIIIth dynasty, the two methods being practically in agreement, only one date is given for each dynasty.

Dynasty.	Manetho.	Meyer.
I.	5546 B.C.	3400 B.C.
II.	5293 "	—
III.	4991 "	2980 "
IV.	4777 "	2900 "
V.	4493 "	2750 "
VI.	4275 "	2625 "
VII.	4077 "	2475 "
VIII.	4007 "	—
IX.	3907 "	2445 "
X.	3807 "	—
XI.	3622 "	2160 "
XII.	3579 "	2000 "
XIII.	3366 "	1788 "
XIV.	2913 "	—
XV.	2540 "	—
XVI.	2256 "	—
XVII.	1738 "	—
XVIII.	1587 "	1580 "
XIX.	1375 "	—
XX.	1202 "	—
XXI.	1102 "	—
XXII.	952 "	—
XXIII.	749 "	—
XXIV.	715 "	—
XXV.	712 "	—
XXVI.	664 "	—
XXVII.	525 "	—
XXVIII.	405 "	—
XXIX.	400 "	—
XXX.	378 "	—
Alexander the Great	332 "	—
Ptolemaic Dynasty	323 "	—
Roman Conquest	30 "	—
Arab Conquest	642 A.D.	—

Egypt was fabled to have been first governed by a dynasty of gods, who, according to Manetho and other authors, were: Hephæstus (Ptah), Helios (Ra), Agathodæmon, Kronos (Geb), Osiris, Typhon (Set), and Horus. These gods reigned 13,900 years, and were succeeded by the demi-gods, manes, and mythical kings, who reigned 11,000 years in all. This fable points to a tradition of an ancient and settled government of long duration, in which the power was wielded by kings of North and South Egypt before the date of Menes, the first historic king; a tradition which has been confirmed by the discovery of prehistoric burials, showing a long period of rising and waning civilisations before the advent of the dynastic Egyptians. The epoch of Menes is the starting-point of Egyptian history, and is placed at 5500 B.C. by Manetho, at 3400 B.C. by Meyer. Menes has been identified with King Narmer, of whom several contemporary monuments still exist. He is said to have founded Memphis by diverting the course of the Nile, to have made laws and instituted the worship of the gods, and, finally, to have been killed by a hippopotamus. His immediate successor, Atothis, is traditionally credited with the authorship of a treatise on anatomy. The tombs of the kings of the Ist dynasty are at Abydos, and were excavated first by Amélineau and then by Petrie. The objects found there include pottery, vases of hard stone, copper implements, carved wood and ivory, some very fine weaving, and jewelled bracelets, which are among the finest examples in the world of the goldsmith's art. The first recorded expedition to Sinai to obtain copper occurred in the reign of Semerkhet (Mersekha) of the Ist dynasty. In the IInd dynasty the primitive worship of sacred animals was reintroduced, and the right of inheritance through the female line officially sanctioned. Zeser, the king of the IIIrd dynasty, was the builder of the Step-pyramid of Saqqara, the first of the Egyptian pyramids; and the last king of this dynasty, Snefru, built the pyramid of Meydûm. Round his pyramid were buried the nobles and officials of his court; and in these tombs were found inscriptions and sculptures, among them the famous seated figures of Rahetep and his wife Nefert. The first three dynasties lasted 769 years, the IVth dynasty beginning about 4700 B.C. Khufu, the Cheops of Herodotus, constructed the Great Pyramid at Gîzeh, and has been handed down to posterity as an impious and cruel tyrant by the priests whom he offended; for he closed the temples and forbade sacrifices, thereby relieving the people from a heavy burden and striking a severe blow at the power of the priesthood. Khafra (Chephren), his successor, built the second of the Gîzeh pyramids and continued the policy of Khufu. Menkaura (Mycerinus), who built the third pyramid, reversed that policy, reopened the temples, and restored the priesthood to power. The high civilisation of this period marks an epoch in Egyptian history, and the numerous tombs of this and the subsequent dynasty exhibit a highly advanced state of art. The statues of Khafra (found near the Sphinx), carved in black diorite, are notable evidence of artistic feeling and mechanical skill; the cultivation of farms, the chase, the arts, enjoyed a great part of the attention of the Egyptians; the simpler mechanical inventions were in common use, but the horse and chariot had not yet been introduced. The Vth dynasty was also Memphite, and consisted of nine kings, reigning about 220 years. The VIth dynasty, also from Memphis, lasted about 200 years. Tombs and inscriptions of this period are found throughout Egypt—from Assuan to Tanis, and even in the Wady Hammamât, the valley leading from Koptos to the Red Sea. The pyramids of these kings are at Saqqara, and are remarkable for the inscriptions on the walls of the tomb chambers. These inscriptions are now known by the name of the 'Pyramid-texts,' and are the earliest religious writings that have yet been discovered in Egypt. They throw great light on the early beliefs of the country, and elucidate some of the chapters in the Book of the Dead (q.v.), or Ritual, of later times. They are also of great importance linguistically, being the only long texts in the archaic form of the language which remain to us. Pepy II., the fifth king of the VIth dynasty, is recorded to have reigned ninety-five years, coming to the throne at the age of five and dying at the age of one hundred. During his reign armed expeditions were sent into Nubia under a captain named Una, in whose biographical inscriptions many historical details are preserved. The dynasty ended, according to Manetho, with a queen (Nitocris), said to have been buried in the Third Pyramid of Gîzeh. Nitocris is the subject of various legends, and is believed by the Arabs to be a witch who still haunts the pyramid. The period from the

MEDITERRANEAN SEA
Damietta
Rosetta
ALEXANDRIA
Port Said
Suez
Jerusalem
Hebron
Gaza
Dead Sea
LOWER EGYPT
CAIRO
Giza
Pyramids
MEMPHIS
EL FAIYUM
Medinet el Faiyum
Lake Moeris
Wady el-Maghâra
Wady Farogh
Wady Natrûn
Shibîn el Kûm
Tell el Kebir
Ismailia
Bitter Lakes
Suez Canal
Gulf of Suez
Gulf of Aqaba
SINAI PENINSULA
Desert of Et Tîh
Wady el Arabah
Qal'at el-Aqaba
Mount Sinai
Wady Musâ
Petra
Kerak
Rabba
Hesbân
Birs Seba
Rafah
Qal'at el Arish
Qatiya
Salihiya
Tanis
Bilbeis
Ashmûn
Mehalla el Kebîr
Mansûra
Damietta
Rosetta
Abu Qir
Aboukir
Alexandria
Maryût
Abûsir
Behnesâ
Beni Suef
Feshn
Minia
Samalût
Tehna
Beni Hassân
El Minya
Mellâwi
Tell el-Amarna
Qusiya
Monfalût
Asyût
Abu Tig
El Bedari
Tahta
Ekhmim
Suhâg
Menshiya
Girga
Qena
Dishna
Naqâda
Qûs
Qift
Luxor
THEBES
Karnak
Medinet Hâbu
Erment
Esna
El Kâb
Edfu
Redesiya
Silsila
Aswân
1st Cataract
Aswân Dam
PHILAE
Shellal
Kurkur Oasis
Dungul Oasis
Abu Hor
Dakka
Temple of Maharraqa
Seyala
Dirr
El Subua
Korosko
Ermenna
Abu Simbel
Farâg
Halfa
2nd Cataract
Tanjikia
Halfa
Qaraqen
Amka
Bir Halfaha
Masmas
Toshka
Ibrim
Gebel Kurkur
Gebel Silsila
Gebel Tenasseh
Gebel Ataqa
Gebel Galâla
Gebel Zeit
Gebel Dukhân
Gebel Belih
Gebel Fatire
Gebel Hadid
Gebel Umm Esh
Gebel Shedid
Gebel Resâs
Gebel Nebâga
Gebel Masrar
Gebel Feraye
Gebel Nikrab
Gebel Meneiga
Gebel Seiga
Gebel Eigat
Bir Neshi
Bir el Heimar
El Murra
Bir Tondi
Bir Natarzuga
B. Ungut
B. Negib
Wady Tih
Wady Feiran
Wady Sudr
Wady Qena
Wady Hammamat
Wady Jemâl
Wady Defuf
Wady Alaqi
Wady Ghazir
Wady Araba
Wady el Buek
Wady Saqayet el Kebir
Wady Halâs
Wady Ergeb
Wady Hammatâr
Wady Nehâge
Wady Ghadir
Wady Muelih
Wady Dhabâ
Wady Mersâ Zebâra
Wady Mersâ Nekkeri
Wady Shedît
Wady Shedîd
Wady Abu Tûr
Wady Feiran
Wady Natrûn
Wady Tumeilat
Wady Araba
Wady Farâg
Wady Yusuf
Wady Rayan
Wady Moeila
Wady Mughagha
Wady Girga
Wady Mazâr
Wady Qena
Wady Dukhân
Wady Belih
Wady Fatire
Wady Hadid
Wady Umm Sidr
Wady Qena
Wady Esh
Wady Tumeilat
Wady Araba
Wady Farâg
Wady Yusuf
Wady Rayan
Wady Moeila
Wady Mughagha
Wady Girga
Wady Mazâr
Wady Qena
Wady Dukhân
Wady Belih
Wady Fatire
Wady Hadid
Wady Umm Sidr
Wady Qena
Wady Esh
Libyan Desert
Arabian Desert
Eastern Desert
Western Desert
Desert of Et Tîh
Desert of Et Tîh
Desert of Et Tîh

beginning of the IVth to the end of the VIth dynasty is known as the 'Old Kingdom.'

From the VIth dynasty to the XIth Egyptian history is almost a blank, and the remains scanty and fragmentary (Petrie, *Sedment*). In the XIth dynasty, however, the country became more settled under a line of kings called Antef and Mentuhotep, whose coffins and burial-places have been discovered at Thebes. A decree deposing one monarch and appointing another is dated to the reign of Antef V., and was found at Koptos. The successive reigns and monarchs of the XIIth dynasty (B.C. 3579) are fixed by numerous monuments. Amenemhat I., the founder of the line, opened the quarries of Tura, and embellished On or Heliopolis. The monuments of his successor, Senusert I., exist in many parts of Egypt, notably in the Fayûm, Beni Hasan, Heliopolis, and Koptos. His campaigns gave Egypt peace on her borders, thereby allowing the country to develop its resources. Senusert III.'s campaigns carried the frontier of Egypt as far south as Semneh; he was worshipped as a god in Nubia until the middle of the XVIIIth dynasty or later. Amenemhat III. was the first to control the inundation of the Nile, by forming Lake Mœris as a vast reservoir for the surplus water; he also built the Labyrinth, which roused the wonder and admiration of later ages, and constructed the pyramid beside it. The period from the XIth dynasty to the XIIIth is known as the Middle Kingdom. It is from this period that we obtain some of the finest specimens of Egyptian literature; the stories of the Westcar Papyrus are not only folk-tales, but autobiography (the Story of Sa-nehat) and attempts at literary composition (the Eloquent Peasant). The great Hymn to Senusert III., found at Kahun, is composed in strophe and antistrophe.

Another blank period occurs between the XIIth and the middle of the XVIIth dynasty. At the beginning of this time a great movement took place of the peoples in the north and east of Syria; they seem to have moved southward, conquering as they went, and finally appeared in the Nile Valley, where they were known to the later Egyptians as the Hyksos, or Shepherd Kings. These invaders took possession of Lower Egypt and Memphis, and established a great stronghold at Avaris, the modern Tell-el-Yehudiyeh, at the entrance to the Wady Tumilât (see Petrie, *Hyksos and Israelite Cities*). Joseph was perhaps the vizier of one of the later Hyksos kings. Seqenen-Ra, the last king of the XVIIth dynasty, lost his life in a battle against the Hyksos in Upper Egypt; but the work of expulsion was carried on by Aahmes I., his successor, the first king of the XVIIIth dynasty (about 1600 B.C.), who took Avaris by assault, and drove them into Syria, where their power was completely broken in the campaigns of Amenhotep I., the immediate successor of Aahmes I. Thothmes I. continued the career of conquest begun by his predecessors, making expeditions into the heart of Nubia in the south, and as far as the Euphrates in the north. He also began the magnificent buildings for which the XVIIIth dynasty is so justly famous. Thothmes II. is best known as the husband of the greatest of all Egyptian queens, Hatshepsut. She was associated by her father in the government with himself, and after his death and the death of her husband she ruled alone, as her son-in-law and successor, Thothmes III., was not old enough to take up the reins of government. Under Thothmes III. and his immediate successors Egypt reached the highest point of material prosperity to which she ever attained. The conquests of Thothmes III. made Egypt mistress of the greater part of the known world, with an extended sphere of influence in the Ægean. The whole of Syria was subject to Egypt, the vassal-kings paying a yearly tribute to the Pharaoh as their overlord. Nubia, as far as the third cataract, also owned the dominion of Egypt; and trade with these foreign countries increased the wealth and prosperity of the country. The temples of the gods were endowed with large revenues from the tribute of the conquered nations, and the temple of Amon at Karnak increased in size and elaboration. A calendar preserved at Elephantine records the heliacal rising of the Dog-star on the 28th of Epiphi; the actual date has been calculated by Mahler by means of the recorded dates of two new moons occurring in this reign, and is thus proved to be the year 1470 B.C., a date within ten years of that obtained by adding together the lengths of reigns as given by Manetho. The reign of Amenhotep III. is the culminating point in the glory of the XVIIIth dynasty. His monuments are found throughout Egypt; the best known are the temple of Luxor and the two Colossi of Thebes, one of which is the celebrated Vocal Memnon of the Greeks. In this reign can be discerned the beginning of a heresy, apparently fostered by Queen Tyi, which became the dominant factor in the following reign. Amenhotep IV. succeeded his father, Amenhotep III. A fanatic and an enthusiast, he sacrificed everything in his zeal for the new religion. He changed his name to Akhenaten (Glory of the Sun-disk); he mutilated monuments on which the name of Amon occurred; he removed the capital from Thebes to Akhet-aten (the modern Tell-el-Amarna); and in his attempts to destroy the ancient and national faith, he neglected his foreign dominions, reducing his own country to anarchy, and losing the provinces of Syria, that great possession left to him as an inheritance from his fighting ancestors. The cult of the Aten, for which Akhenaten strove with fanatical zeal and energy, lasted but a few years after the death of its royal votary. Tutankhamen, his immediate successor, returned to the old faith, and was buried among the Amon-worshipping kings at Thebes. His tomb was found by Mr Carter and Lord Carnarvon in 1922, and is the only untouched royal burial yet discovered.

The link which connects the monarchs of the XVIIIth with those of the XIXth dynasty has been lost, but we know that the first king of the XIXth dynasty was called Rameses, a name that was borne by eleven of his descendants in the XIXth and XXth dynasties. He was succeeded by his son Sety I., who made a gallant and partially successful attempt to recover the lost country of Syria; but though he held southern Syria as far as Galilee, the northern provinces never again submitted to Egypt, and his campaigns were mere raids which produced no lasting effect. He undertook the pious duty of restoring the monuments mutilated or destroyed in the troubles at the end of the previous dynasty, and the temple which he built at Abydos is one of the finest examples of the technical skill of Egyptian artists. His tomb, in the Valley of the Tombs of the Kings at Thebes, was discovered by Belzoni. The rock-hewn passages and chambers are covered with scenes and inscriptions of the nightly journey of the Sun through the under-world. On the death of Sety I., his son Rameses II. ascended the throne; the date calculated from the horoscope of the latter is 1300 B.C. His reign lasted sixty-six years. He fought several campaigns in Syria at the beginning of his reign, and penetrated as far north as Naharaina, but he never held the country, and finally was obliged to retire after making a treaty with the Hittite king. This treaty was engraved on a tablet of silver, a copy of which was sculptured on the walls of Karnak; the Hittite copy, written in cuneiform

on a clay tablet, has been unearthed at Boghaz Keui. It is an extradition treaty, and the articles show that the Hittites (q.v.) were strong enough to treat with the king of Egypt upon equal terms. The battle of Kadesh is the most famous of the exploits of Rameses II.; it was celebrated in an epic by the poet Pentaur, and the poem with scenes of the battle was sculptured on the walls of many temples. Rameses II. was a great builder, and remains of his work are found on every important site in Egypt. His most splendid monument is the rock-hewn temple of Abu Simbel, at the entrance to which are the largest colossi in the world. The storehouses in the city of Pithom (Tell-el-Maskhuta) are dated to this reign. The long and increasingly feeble reign of Rameses II. proved disastrous to Egypt. Her power rapidly declined; and so far from holding foreign dominions, foreigners invaded the Delta, settling there and ousting the inhabitants. Art also declined rapidly, and became coarse in technique and completely wanting in vitality. Merenptah, the thirteenth son of Rameses II., succeeded to the throne; but though advanced in years, he began his reign with vigour, driving out the foreign settlers and restoring order in the Delta. In the Triumph Stela of Merenptah is the only mention of the people of Israel that has yet been found in Egypt. The later kings of the XIXth dynasty were of no importance. The XXth dynasty opens with Rameses III., whose naval victories and wars with the Syrian and African races are recorded on the walls of his temple at Medinet Habu. The list of his benefactions to the temples of Egypt is recorded in the Great Harris Papyrus, and the legal account of the trial of the ringleaders of a harem conspiracy, by which Rameses III. appears to have lost his life, is one of the most interesting documents that remain to us. The rest of the dynasty consists of the sons and grandsons of Rameses III., who gradually fell under the power of the priesthood of Amon. On the death of the last Ramesside, the high priest of Amon, Herhor, became king, and founded the XXIst dynasty. A rival government was established at Tanis in the Delta. The daughter of the last Pharaoh of this dynasty was married to King Solomon. The XXIInd dynasty is more important chronologically than historically, for Sheshanq I., the first king, is the Shishak of the Bible, who invaded Syria and raided Jerusalem in the reign of Rehoboam. The sculptures of Osorkon II., found by Dr Naville while working for the Egypt Exploration Fund at Bubastis, are important for the study of certain aspects of Egyptian religion. In the XXIIIrd dynasty, Piankhy, king of Ethiopia, invaded and conquered Egypt, establishing his own family on the throne. The XXIVth dynasty consists of one king only, Bak-en-renf, the Bocchoris of Manetho, who is said to have been taken prisoner and burned alive by the Ethiopian Sabaco of the XXVth dynasty. From this period Egyptian history is connected with the histories of Judæa and Greece. Tirhakah, who came to the assistance of Hezekiah against Sennacherib, ruled over Egypt and Ethiopia. He was driven out of Egypt when that country was invaded and conquered by the Assyrians under Ashur-bani-pal. The Assyrians divided the country into provinces, each under its own governor, but at the beginning of the XXVIth dynasty (650 B.C.) Psammetichus, by the help of Greek mercenaries, united the country under one strong central government. During this dynasty the Greeks first settled in Egypt; Naukratis was granted to them as a trading port, while the mercenaries were settled in different parts of the country; the camps of the mercenaries eventually became trading centres until the Egyptians grew jealous, and Amasis II. suppressed them, at the same time granting special privileges to Naukratis, which was permitted to remain. A canal across the Isthmus of Suez was planned and begun by Necho, in whose reign Phœnician sailors first sailed round the Cape of Good Hope. Necho invaded Syria and defeated Josiah, king of Judah, but was himself defeated and driven back by Nebuchadnezzar at Carchemish. Apries (the Pharaoh Hophra of Jeremiah), after reigning a few years, became involved in civil war, and was defeated by his rival, Amasis II.; after being kept a prisoner for three years, he was put to death. The character of Amasis left a lasting mark upon the minds of his subjects, and Herodotus records many anecdotes regarding him. In this dynasty there was a renaissance of art, and archaic forms of language and customs were revived. The style of sculpture is archaistic, the statues of the Old Kingdom serving as models. At the death of Amasis, Cambyses invaded Egypt, and from the XXVIIth to the XXIXth dynasty Egypt was in the hands of the Persians, though a few native kings struggled feebly to maintain the independence of the country. The XXXth dynasty was successful in this endeavour, and drove out the Persians for a short time. The chief kings of this dynasty were Nectanebo I. and Nectanebo II. The last-named was traditionally credited with being a great magician. The Persians again invaded and took possession of Egypt, but so great was their misrule that Alexander was hailed by the Egyptians as their saviour when he defeated the Persians and drove them out of the country.

Egypt now passed under the influence of Greece; for on the death of Alexander the Great one of his generals, Ptolemy, made himself king of Egypt and founded the Ptolemaic dynasty. The earlier Ptolemies were enlightened patrons of learning. The foundation of the Museum and Library of Alexandria, and the liberality displayed by the kings, attracted all that was best in literature, science, and learning to Egypt. The Septuagint translation of the Hebrew Scriptures, the history of Manetho, and the problems of Euclid are among the achievements of the brilliant Alexandrian period. The later Ptolemies appear to have been sunk in vice, and the dynasty came to an end with the Roman conquest and the death of Cleopatra.

Egypt became the private property of the Roman emperors, and until 1922 was never again an independent country. So jealous were the emperors of their possession that no senator was allowed to set foot in Egypt. The most important events under Roman rule were: the introduction of the Julian year by Augustus (B.C. 24), the introduction of Christianity in the 1st century A.D., the visit of Vespasian (A.D. 70) and of Hadrian (A.D. 122), the visit of Caracalla (A.D. 211), the development of Gnosticism, the conquest of Egypt by Zenobia (A.D. 270), the persecution of the Christians by Diocletian (A.D. 304), the rise of Manicheism, the great Arian controversy in the reign of Constantine, the rise of asceticism and monasticism, and the final destruction of paganism.

At the division of the Roman empire (A.D. 395) Egypt passed to the Eastern empire, and at its fall had become one of the great patriarchates of Christendom. But owing to the feud between the Jacobites and the Melkites (or Royalists, see COPTS), persecutions against the National Church (Jacobite) were constantly recurring. The Melkite governor, known as the Mukaukis, ruled the country in the name of Heraclius at the time of the Arab invasion; and, by the records that remain, it is evident that he betrayed Egypt into the hands of the Mohammedan general, 'Amr ibn el-Asr, who took possession of the country and made it a province of the Khalif Omar.

History since the Mohammedan Conquest.—The Moslem Arabs invaded Egypt at the close of 639, took Pelusium after a month's siege in 640, defeated the Romans at Bilbeys, and crushed their army at Heliopolis. The Egyptians (Copts), eager to be freed by any means from the tyranny of the Orthodox (Greek) Church, opened negotiations with 'Amr, the Arab general, and obtained generous terms. The country as a whole submitted. The Roman fortress of Babylon fell in 641, and Alexandria surrendered in the autumn (but was temporarily reoccupied for the Eastern empire in 645). From then to this day Egypt has been a Mohammedan country. From 641 to 969 it was a province of the Omayyad and 'Abbâsid khalifate, ruled by governors of Arab and latterly of Turkish race. One of these last, Ahmad ibn Tûlûn, made himself practically independent, annexed Syria, and founded the dynasty of the Tûlûnids (868–905), renowned for its luxury and noble buildings. Another governor followed his example, and established the dynasty of the Ikhshîdids (935–969). This in turn gave place to the heretical (Shi'a) line of the Fâtimid Khalifs (q.v.), who advanced from their capital at Kayrawân, conquered Egypt, and founded modern Cairo (969) and the Azhar mosque. One of this line, the mad khalif El-Hâkim, was adopted as founder by the sect of the Druses (q.v.), who still pay him divine honours and expect his return. The long reign of El-Mustansir (1036–94) was marked by civil war, persecution of Christians, and a fearful famine which lasted seven years and depopulated whole quarters of Cairo. The Fâtimids were deposed by the Kurd general, Salâh-ed-dîn (1169–93), son of Ayyûb, commonly called Saladin (q.v.), who fortified Cairo and built the Citadel. He waged war against the Crusaders, took Jerusalem, and annexed the greater part of Syria. In 1218 the Crusaders, under John of Brienne, made an attack upon Egypt and took Damietta; but the Ayyûbid sultan El-Kâmil, nephew of Saladin, defeated them at Mansûra in 1221, and they left the country. The attempt of St Louis, thirty years later, ended in the surrender of the French king and all his army to the Mamelukes (Mamlûks). It was the last of Saladin's line, Es-Sâlih Ayyûb, who introduced this famous bodyguard of Turkish Mamelukes, or white slaves, who, on his death, usurped the supreme power (1250). For more than two centuries and a half Egypt was governed by kings of servile origin, called the Bahri or Turkish and the Burji or Circassian Mamelukes. These kings, who succeeded each other chiefly by virtue of force of arms, were distinguished for their valour, their administrative powers, their luxury, and their encouragement of the arts. They fought for the holy places of Palestine, and gallantly drove back the Mongol hordes; they exchanged embassies with France and Venice, with Persia and Abyssinia; and presented one of the most startling anomalies of history, the 'spectacle of a band of disorderly soldiers, to all appearance barbarians, prone to shed blood, tyrannous to their subjects, yet delighting in the delicate refinements which art could afford them in their home-life, lavish in the endowment of pious foundations, magnificent in their mosques and palaces, and the noblest promoters of art, of literature, and of public works that Egypt had known since the days of Alexander the Great' (Lane-Poole, *Art of the Saracens*). Cairo (q.v.) is still full of their monuments, and Arabic literature owes them much. In 1517, however, this brilliant series of rulers came to an end on the conquest of Egypt by the Ottoman sultan Selîm I.

Nearly three centuries of weak and corrupt government by Turkish pashas, varied by faction and rebellion of the Mameluke chiefs, happily relieved by artistic and literary activity, bring us to the French invasion of Bonaparte in 1798. His conquest of Alexandria and victory near the Pyramids led to the temporary subjection of the country, from which the French were, however, expelled by the British after the battle of Alexandria in 1801, when the country was restored to the Porte. The accession of the Albanian soldier Mohammed 'Ali to the pashalik in 1805 imparted a galvanic prosperity to Egypt, by the merciless destruction of the turbulent Mamelukes (whom a disastrous British expedition in 1807 vainly sought to restore), the formation of a regular army, the increase of security, the improvement of the irrigation, and the introduction of the elements of European civilisation. From 1811 to 1818 Mohammed 'Ali waged war upon the Wahhâbis of Arabia, and subdued part of that country by the generalship of his son Ibrahim; in 1820 he annexed part of the Sudan and founded Khartûm, and from 1824 to 1828 his troops, under Ibrahim, occupied various points in the Morea and Crete to aid the Turks in their war with the insurgent Greeks. The Egyptian fleet was annihilated at Navarino, but Ibrahim remained in the Morea till forced to evacuate by the French army, under Maison, in 1828. In 1832 Ibrahim began the conquest of Syria, and totally routed the Ottoman army at Koniya; after which the Porte ceded the province to Mohammed 'Ali on condition of tribute. War breaking out again, the victory of Nezib in 1839 would perhaps have elevated him to the throne of Constantinople; but the quadruple alliance in 1840, the fall of Acre to Admirals Stopford and Napier, and the consequent evacuation of Syria compelled him to limit his ambition to the pashalik of Egypt, which was made hereditary in 1841. In 1848 Mohammed 'Ali became imbecile (he died in 1849), and his son Ibrahim sat on his throne for two months, when he died, and was succeeded by 'Abbâs Pasha, Mohammed 'Ali's grandson, who was murdered by slaves in 1854, and succeeded by Sa'îd Pasha, youngest son of Mohammed 'Ali. M. de Lesseps now obtained the co-operation, hitherto withheld, of the Egyptian government in his scheme of the Suez Canal (q.v.), which was opened in 1869. Sa'îd was succeeded in 1863 by his nephew, Isma'îl, son of Ibrahim, who, by a firman purchased from the Sultan by nearly doubling the Egyptian tribute, took in 1867 the hereditary title of Khedive; the succession to the throne of Egypt was made direct from father to son, instead of descending, according to Turkish law, to the eldest male of the family; and in 1872 the Sultan granted to the Khedive the rights (withdrawn in 1879) of concluding treaties and of maintaining an army, and virtually gave him sovereign powers. Thus secure on a hereditary throne, Isma'îl began a series of vast internal reforms, built roads, bridges, lighthouses, laid down railways and telegraphs, reconstructed the postal service, improved the harbours at Suez, Port Said, and Alexandria, supported education, and introduced mixed courts of law. Extending his dominions southward, he annexed Dar-Fûr in 1874, and in that and the following year further conquests were made. In order to provide funds for his vast undertakings, in 1875 he sold to Great Britain 177,000 shares in the Suez Canal for £4,000,000. The condition of the Egyptian finances, however, loaded by heavy loans, was almost hopelessly involved; various distinguished financiers were sent from England to endeavour to arrange a solvent system, and after many inquiries and several failures, a dual English and French Control was established, and the finances were placed entirely under European management. A promise of constitutional government ended in 1879 in the summary dismissal of Nubar Pasha's ministry, and this brought about the peremptory interference of

the European governments. The Khedive, who declined to abdicate, was, at the instance of the Western Powers, deposed by his suzerain the Sultan in June 1879, and Prince Tewfik, Isma'îl's eldest son, was proclaimed Khedive.

The British Occupation.—A Law of Liquidation for regulating the conditions of the public debt was passed at the instance of five European Powers in 1880. In the next year came the military revolt under 'Arâbi Pasha, fomented by general discontent, jealousy (not only of European influence, but of Turkish and Circassian favouritism in the army promotions), and perhaps the germs of nationalist aspirations towards autonomy. 'Arâbi demanded from the Khedive an immediate change of ministry and the increase of the army to 18,000 men. He became practically a military dictator, and in 1882 British and French war-ships were despatched to Alexandria to overawe the rebels, but their appearance was followed in June by rioting and massacres of Europeans in the streets. Meanwhile 'Arâbi was strengthening the fortifications. The British admiral demanded that the work should be discontinued. 'Arâbi persisted; the French fleet sailed away, and the British ships bombarded the fortifications (11th July). The Egyptian troops were suddenly withdrawn from Alexandria, whereupon the city was plundered and partly burned by Egyptian rioters; while the British admiral, Sir B. Seymour (Lord Alcester), was apparently unable to land a force to restore order until the third day, when he occupied the city until the arrival of troops under Sir A. Alison, who kept 'Arâbi in check behind his lines at Kafr Dawar. Meanwhile Sir Garnet Wolseley hurried out with more troops from England, and other regiments (some native) were despatched from India; the point of debarkation was Ismailia, on the Suez Canal; and in twenty-five days the British forces under Wolseley had traversed the desert, utterly defeated the main body of 'Arâbi's army at Tell-el-Kebîr (13th September), and occupied Cairo. 'Arâbi was tried, pleaded guilty, and was banished to Ceylon. (He was allowed to return to Egypt in 1901, and lived there in harmless obscurity till his death in September 1911.) The authority of the Khedive being thus restored, most of the British troops were withdrawn, and measures taken for the reorganisation of the country. Lord Dufferin went to Cairo after the war, and drew up a constitution which remains illusory; and Sir E. Baring (afterwards Earl of Cromer) continued the task of organisation. But the attempt to persuade the Khedive's government to rule according to British ideas, and to get British officials and their Egyptian colleagues to work smoothly together, led to repeated crises and changes of plan. A conference of the great Powers in 1884, and a subsequent negotiation with Turkey in 1886, did not relieve Britain of her exclusive responsibility; and the resuscitation of Egypt under British rule was hindered by the severe visitation of cholera which occurred in the summer of 1883, when 150,000 persons perished, and still more by the rebellion in the Sudan.

The Rebellion in the Sudan.—'Arâbi's revolt and its consequences loosened the hold of Egypt on the Sudan (q.v.), which by Baker's annexations in 1874 and following years had gradually extended to the shores of the Victoria Nyanza. A widespread rebellion broke out in Dar-Fûr and Kordofan under Mohammed Ahmed, calling himself the *Mahdi*, or 'guided by God' (see ISMAILIS, MOHAMMEDANISM, and KARMATHIANS). He was born at Dongola about 1843, educated near Khartûm, and then spent fifteen years in fasting and retirement in the island of Aba, whence he at length sent emissaries to preach the doom of Turkish rule in the Sudan and the advent of the true Mahdi. An attempt of Raûf, the governor-general, to suppress this propaganda was resisted with bloodshed in August 1881, and thenceforward the movement spread rapidly. In January 1883 Sennâr revolted, and the Mahdi occupied El-'Obeyd. An untrustworthy army sent by the Egyptian government under an English officer, Hicks Pasha, was annihilated near El-'Obeyd in November 1883. The Mahdi's influence was extended to the Red Sea shores by his lieutenant, Osman Digna. An Egyptian force under Consul Moncrieff was routed with severe loss in the same month near Suâkin, and Baker Pasha was disastrously defeated at Tokar early in 1884; but these reverses were wiped out by the hard-won successes of a British expedition under Sir G. Graham at Teb and Tamanieb. Meanwhile, in January 1884, General Gordon (q.v.), who had previously done good work in the Sudan from 1874 to 1879, had gone, at the request of Mr Gladstone's government, as English representative to Khartoum, to secure the withdrawal of the Egyptian garrisons from the Sudan; for Egypt had, on the advice of England, reluctantly agreed to give up all her possessions in the Sudan save the Red Sea littoral. Gordon, though supported by only one other English officer, gallantly maintained his position in Khartûm against the Mahdi's followers, and even ventured successfully on the aggressive. He had found, however, that he had attempted an impossible task; he could not leave the garrisons to fall into the hands of the Mahdi, and he required reinforcements of British troops before he could drive the latter from the neighbourhood of Khartûm. Timidity and indecision marked the whole of the policy of the English government, both towards the Sudan and the Red Sea littoral. At last, too late, in October 1884, an English expedition under Lord Wolseley was despatched, and selected the difficult and tedious route up the Nile, instead of making a rapid dash from Suâkin to Berber. A flying column sent across the desert from Korti in advance of the main army encountered determined opposition, but after defeating the Mahdi's forces, generally known as the dervishes, at Abu-Tlia (Klea), 17th January 1885, reached the Nile at Metemma, with the loss of its commander Sir Herbert Stewart and General Burnaby. At Metemma the harassed column found some of Gordon's steamers awaiting them, on which, after some inevitable delay, a small advanced party under Sir C. W. Wilson embarked. They came in sight of Khartûm only to learn that it had already fallen, and that the heroic Gordon had been killed on 26th January. There was nothing to be done, and they made their way back to Metemma under a heavy fire; the energy of Lord Charles Beresford and his sailors alone saved them from destruction. The main object of the expedition having failed, the army was hastily withdrawn, and the Sudan was left to its fate. For eleven years it was abandoned to an appalling reign of terror, which left it desolate, devastated, depopulated, and paralysed with dread. The Mahdi, a cruel voluptuary as well as an impostor, died in June 1885, and was succeeded by his lieutenant, or *khalîfa*, 'Abdallah, an even worse brute than his master, of whose savage sway ample accounts were brought by escaped prisoners, such as the Austrian officer Slatin Pasha. Reconquest was of course inevitable, for the Sudan commands the water and hence the wealth of Egypt. The folly of the abandonment of 1883 and the shame of 1885 had to be wiped out. It took time, however, to organise an Egyptian army that could be trusted, and for four years all that could be done was to hold the frontier at Wadi Halfa and keep the dervishes out of Egypt proper. General Grenfell's victory with Egyptian

troops over the dervishes at Toski on 3d August 1889 showed that the persistent work of Sir Evelyn Wood, Grenfell himself, and Kitchener had at length produced an efficient native force; and this was confirmed by the defeat of Osman Digna at Afafît in 1891, which freed the Red Sea littoral. In 1892 Sir Herbert (afterwards Earl) Kitchener became Sirdar of the Egyptian army, and after four years of steady preparation he made the move to the south. The victory over the dervishes at Firka on 7th June was followed by the capture of Dongola in September 1896. A railway—Kitchener's potent aid—was thrown across the desert to Abu Hamed, the dervishes retreated from Berber, and in 1898 they were driven out of their entrenchments on the Atbara river, 7th April, by a combined Egyptian and British army; and on 2d September, with 22,000 men, Kitchener, ably supported by Hector Macdonald, Hunter, and others, won his crowning victory at Omdurman over 40,000 of the enemy. Khartûm was taken. The khalîfa escaped, but was run to earth, 24th November 1899, by Sir Reginald Wingate, and died fighting to the last, surrounded by his no less desperate emîrs. Immediately after Omdurman, Kitchener went up the Nile to Fashoda, where he found that a small expedition under Major Marchand had hoisted the French flag. The difficulty was diplomatically arranged, and Marchand departed in December. What is technically described as an Anglo-Egyptian 'Condominium' was established in the Sudan, 19th January 1899, under Kitchener as the first governor-general; and on his appointment to the South African command Wingate succeeded. The total loss of men in the reconquest of the Sudan in seventeen engagements (1885–99) was but 536 killed and 1810 wounded, and the cost of the campaigns of 1896–98 was £2,350,000, of which the railways accounted for about half. The restoration of a devastated, depopulated province of a million square miles to prosperity has necessarily been a work of time, labour, and economy. Much has been accomplished. Khartûm, which has been rebuilt, is now connected by rail with Cairo, and Berber with Port Sudan on the Red Sea, a valuable outlet for trade. The Gordon College in the capital is introducing a carefully planned system of education. Slave-dealing has been practically exterminated, and with the gradual recovery of population, and with it of agriculture, the financial condition has greatly improved. With enlarged irrigation the Sudan will soon pay its own way.

Egypt under Lord Cromer.—Meanwhile Egypt, relieved from the apprehension of the Mahdi, was gradually recovering from the state of anarchy and debt in which Isma'îl had plunged her. This restoration to order and solvency is mainly the work of one man, the Earl of Cromer, 'the man who has made modern Egypt.' 'In less than twenty-four years Egypt, under the guiding hand of Lord Cromer, has risen from bankruptcy and abject misery to her present state of opulence and credit. Never in all her long and varied annals have the masses of her people enjoyed as they now enjoy the blessings of a just and orderly and enlightened rule. That rule is the creation of Lord Cromer' (*Times*, 13th May 1907). A financier by birth, he perceived that the key to the whole difficulty lay in the financial muddle. It was for many years a fight with bankruptcy, and this is the explanation of the abandonment of the Sudan in 1883. Money was wanted for irrigation, the prime necessity of Egypt, as well as for every kind of reform. A modification of the law of liquidation, sanctioned by the London Convention of 1885, gave Lord Cromer a freer hand, and irrigation works were begun. The repair of the barrage of the Nile by Sir C. Scott-Moncrieff in 1890, and the great dams at Assuan and Asyût, began in 1898, and carried to a successful issue by Messrs Aird, have together added at least £3,500,000 a year to the value of the country's productiveness, and every peasant now gets his share of water for his field as well as the richest landowner. Taxes, no longer collected under the whip, were in great measure remitted, and the total taxation per head fell; yet the revenue rose. The finances were brilliantly managed. Most significant of all, the educational budget has increased fivefold. Such was the triumph of Lord Cromer's unremitting toil for nearly a quarter of a century. He found Egypt ruined, outraged, and miserable; he left it in 1907 prosperous, wealthy, and one of the lightest-taxed countries of the civilised world. His work was accomplished in the face of strenuous opposition, from the Powers, the Sultan, and a venomous native press; and international restrictions hampered him at every turn. The Anglo-French Agreement of 1904, which at last removed all causes of friction between English and French interests in Egypt, together with most of the financial restrictions which had obstructed progress, was not the least of his conspicuous successes. He was succeeded by Sir Eldon Gorst, on whose death in 1911 Lord Kitchener was appointed British agent and Minister Plenipotentiary. Sir John Maxwell was appointed during the war, and was succeeded by Lord Allenby.

Railways.—There are now over 2000 miles of railway in Egypt (excluding the Sudan), besides 800 miles of invaluable light railway for agricultural produce. There are 1500 miles of railway in the Sudan. That from Wady Halfa to Khartûm, made for military purposes during the reconquest, was opened for general traffic in 1889; and the connection between Berber and the Red Sea at Port Sudan (near Suakin) was opened in 1905.

Statistics.—The area of Egypt, including the Libyan oases, but excluding the Sudan, is about 400,000 sq. m., of which, however, the greater part is desert or water, and only 12,000 sq. m. can be regarded as settled and cultivated. Of the population (1917) of 12,750,918, foreigners numbered only 200,000 (of whom about 56,000 were Greeks, 40,000 Italians, 30,000 Turks, 21,000 French, 24,000 British). The males exceeded the females by 50,000. Of the native population, over 4,000,000 are engaged in agriculture; half are classed as 'unproductive or unknown occupation' (this includes the women, who are certainly not unproductive), and of the remaining fourth, about 489,000 are engaged in manufactures, 280,000 in trade, 230,000 in professions of various kinds, 136,000 live on their incomes, and there are nearly 100,000 nomads. Of the population over ten years of age 62·65 per cent. are engaged in agriculture. In religion, 11,600,000 (in round figures) are Mohammedans, 856,000 Copts, 77,000 Greek Orthodox, 107,000 Roman Catholics, 47,000 Protestants, 59,000 Jews. The population of the chief towns is as follows: Cairo, 791,000; Alexandria, 445,700; Port Said, 91,000; Tanta, 74,000; Asyût, 51,000; between 30,000 and 50,000, Mansura, Fayûm, Zagazig, Demenhûr, Minya, Suez, Damietta, Benî-Suweyf; smaller towns are Sherbîn, Ekhmîm, Menûf, Mellawî, Kinê. The population (in 1917, 1057 per sq. mile) has well-nigh doubled since 1883, and the trade has grown to £96,000,000, of which rather less than half consists of exports, notably the splendid yield of cotton.

Government.—The administration till the entry of Turkey into the great European war (December 1914) was conducted by native ministers under the Khedive 'Abbâs II. (who succeeded on the death of his father, Tewfîk, 7th January 1892), but with English departmental advisers. A British protec-

orate was then proclaimed, the Khedive deposed, a prince of the same dynasty set up as sultan, and a British High Commissioner for Egypt was appointed. Though obstruction was not unknown, neither the General Assembly nor the Legislative Council had attained to any degree of influence when they were amalgamated in 1913. The Legislative Assembly thus formed was partly elected, partly nominated. Agitations, encouraged by the Turkish revolution, culminated in the murder of the Copt Boutros Pasha, the prime-minister. The situation had become acute in 1919 when a commission under Lord Milner was sent to work out a plan for a constitution. The High Commissioner proclaimed that the policy of Great Britain was to preserve autonomy under British protection, and to develop self-government. In 1922 Great Britain declared the independence of Egypt, and in 1923 the new constitution was signed. Egypt now claims suzerainty over the Sudan. The provinces are administered by fourteen local councils under the mudîr, with limited power (granted 1910) to make by-laws; and five towns are under governors.

Compare SUDAN, NUBIA, KORDOFAN, FAYÛM, DARFÛR, GORDON, HARAR, &c. For descriptions of some of the most important monuments, see ABU-SIMBEL, ABYDOS, ALEXANDRIA, DENDERA, EDFU, ESNÉ, MEMPHIS, OBELISK, PHILÆ, PYRAMID, THEBES. For further information, consult the *History of Egypt* (6 vols.; 3 by Petrie, the others by Mahaffy, Milne, and Lane-Poole, 1895–1923); Breasted, *Ancient Records* and *Ancient Times;* Capart, *Primitive Art in Egypt* (trans. by Griffith, 1905); Erman, *Life in Ancient Egypt* (trans. by Tirard, 1894) and *Egyptian Grammar* (trans. 1894); Lanzone, *Dizionario Mitolog. Egiz.* (1881); Lepsius, *Denkmäler* (1849–74); Mariette, *Les Mastabas* (1884); Maspero, *Dawn of Civilisation, Struggle of the Nations, Passing of the Empires* (1894–1900), and *Egyptian Archæology* (1887); Murray, *Ancient Egyptian Legends* (1913), *Elementary Egyptian Grammar* (1914); Petrie, *Arts and Crafts* (1909), *Researches in Sinai* (1906), and *Egyptian Tales* (1895); Prisse d'Avennes, *Histoire de l'Art Egyptien* (1863); Rossellini, *Monumenti dell' Egitto* (1844); Weigall, *Antiquities of Upper Egypt;* Wilkinson, *Manners and Customs of the Ancient Egyptians* (ed. Birch, 1878); Annual Memoirs of the Egypt Exploration Fund, of the Egyptian Research Account, and of the British School of Archæology in Egypt; Butler, *The Coptic Churches* (1884) and *The Arab Conquest* (1902); Butcher, *Story of the Church in Egypt* (1897); S. Lane-Poole, *History of Egypt in the Middle Ages* (1901) and *Art of the Saracens* (1886–87); Lord Cromer, *Modern Egypt* (1908); Lord Milner, *England in Egypt* (1892); Sir Auckland Colvin, *The Making of Modern Egypt* (1906); Lane, *The Modern Egyptians* (1836; new ed. 1871); *Journals of General Gordon* (1885); Sir C. Wilson, *From Korti to Khartûm* (1885); C. Royle, *Egyptian Campaigns* (1886); Fraser Rae, *Egypt To-day* (1892); Murray's and Baedeker's guide-books; Budge, *The Egyptian Sudan* (1907).

Ehrenberg, CHRISTIAN GOTTFRIED (1795–1876), naturalist, born at Delitzsch in Prussian Saxony, travelled in Egypt, Syria, and Arabia, and with Humboldt in the Ural and Altai Mountains, and by a score of works on microscopic organisms founded a science.

Ehrenbreitstein, a town and fortress of Rheinland, is picturesquely situated on the right bank of the Rhine, directly opposite Coblenz, with which it is connected by a bridge of boats and an iron railway-viaduct; pop. 3000. The fortress occupied the summit of a precipitous rock, 387 feet above the river, and inaccessible on three sides; on the N. and NW. very strongly fortified. The French captured it in 1799; in 1815 it was assigned to Prussia by the Congress of Vienna, and in 1816–26 was thoroughly refortified. The fortifications were razed in accordance with the Treaty of Versailles.

Ehrlich, PAUL, a great bacteriologist and chemotherapist, was born of Jewish family at Strehlen, in Prussian Silesia, 14th March 1854, and educated at Breslau gymnasium and the universities of Breslau, Freiburg, Strassburg, and Leipzig, graduating in medicine. He worked in various institutes in Berlin, a professor from 1881. Later he was director of the institutes of experimental therapy and chemotherapy at Frankfurt-on-the-Main. He died in his laboratory at Homburg, 20th August 1915. Interest in the affinities of chemical reagents for living matter underlies his work from his early studies of aniline dyes to his world-famous discovery of salvarsan in 1910. New stains invented by him came into general use for microscopical and other scientific purposes. He found that certain dyes had a specific affinity for the tubercle bacillus. Applying these methods to the study of blood corpuscles, he became a pioneer in hæmatology. One of the founders of serum-therapy, he conducted important researches on immunity and on diphtheria antitoxin and its standardisation. Cancer occupied his attention for a time. He then attacked the disease-bringing parasitic protozoa. His 'trypan red' dye is a valuable means of killing certain trypanotomes in animals, though no cure for trypanosomiasis in man. Methodical tests of a series of compounds of arsenic and mercury led to the discovery of a specific for Syphilis (q.v.), 'salvarsan'—an excellent example of experimental industry directed by imaginative reason. See the *Festschrift* for his sixtieth birthday (1915).

Eibenstock, a lace-making town of Saxony, 41 miles SSW. of Chemnitz; pop. 9000.

Eichendorff, JOSEPH, FREIHERR VON (1788–1857), last of the romantics, a Silesian, fought with distinction in the War of Liberation, wrote poems, short novels, and a history of German poetry from a Catholic standpoint.

Eichhorn, JOHANN GOTTFRIED (1752–1827), professor of Oriental languages at Jena and Göttingen, in his introductions to the Old and New Testaments applied the ordinary methods of literary criticism to Scripture. He is chiefly remembered for his hypothesis of the origin of the Gospels (q.v.).

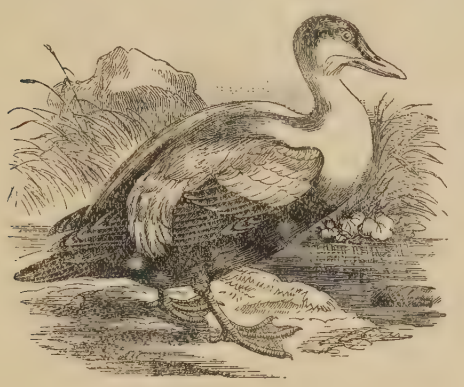
Eichstätt, in Bavaria, 67 miles NNW. of Munich, became a bishopric in 745, and was long capital of a small principality; pop. 8000.

Eichwald, CHARLES EDWARD (1795–1876), born at Mitau, filled chairs at Kazan, Vilno, and St Petersburg; travelled in Central Asia, the Caucasus, Persia, Switzerland, and Scandinavia: and wrote on his scientific journeys, the mineral wealth, zoology, and palæontology of Russia.

Eider, a river forming the boundary between Sleswick and Holstein, rises SW. of Kiel, and flows westward to the North Sea at Tönning, after a course of 117 miles. It is navigable as far as Rendsburg, whence the Eider Canal (1777–84) maintained water-communication between the North Sea and the Baltic (Kiel Harbour) until superseded by the Kiel Canal (see BALTIC SEA).

Eider-duck (*Somateria*), a genus of birds in the duck family (Anatidæ), included under geese (Anseres). The Common Eider-duck (*S. mollissima*) lives on the Arctic and northerly shores of the Atlantic in both hemispheres, and breeds as far south as the Farne Islands (where they are called St Cuthbert's ducks) and the Bay of Fundy in America. About 2 feet in length, it is heavy for its size. Of the females and young males the colour is rusty brown, with dark streaks and spots. The adult males, however, have a more complex plumage, especially in the breeding season. The crown of the head, the under surface, and tail are black; the cheeks are sea-green; while white prevails over the neck and upper surface. After breeding, black prevails. The fine elastic gray down, so much used, especially on the Continent,

for bed-coverlets, is chiefly developed on the breast of the bird. The best quality is not taken from the bird directly, but gathered from the nest; each nest furnishing annually about a quarter of a pound. The nest among the rocks is formed of fine seaweeds, often matted along with mosses and twigs. The female does the brooding; when the brood is hatched, the mother pillages her breast for down to serve as covering. The down is often carried off



Common Eider-duck, Adult Male.

two several times by the eider-down gatherers, and then the male may pluck off his slightly inferior feathers if the mother has no more to spare. The flesh is eaten by Greenlanders and others. The eggs are more esteemed. It seems probable that with a little care the duck might be domesticated on some of the Scottish islands. The King-Eider (*S. spectabilis*), whose down is also collected, is about the same size, but of different colour; it lives in the far north of Asia and America, and a few breed in Iceland and the Faröe Islands. There are three other species.

Eifel, THE, a barren and bleak plateau of Rheinland, between the rivers Rhine, Moselle, and Roer, showing extensive traces of volcanic activity. Its surface, which ranges at an average altitude of 1500 to 2000 feet, is for the most part broadly undulating, and diversified by crater-like depressions and volcanic peaks and ridges, whilst towards its edges it is seamed by deep, wooded, rocky ravines. Its highest and, at the same time, most inhospitable parts are in the west and north-west, whence it falls away gradually to the Rhine on the east, and to the Moselle on the south. The central portion of the plateau is crossed by a range of basaltic summits, the loftiest in the Eifel system, including the Hohe Acht (2494 feet), Nürburg (2255), and Kellberg (2211). The ridges of the north-west are connected by the Hohe Venn with the Ardennes. Geologically, the basement of the plateau belongs to the Lower Graywacke of the Devonian formation, with irruptions of Eifel limestone, parts of which are rich in fossils. Above this are deposited, with tolerable regularity in a horizontal position, strata of Triassic age, containing considerable quantities of metallic ores, especially zinc and lead. The Eifel was for a long period the scene of volcanic activity; zones and islands of basalt are frequent, as also eruptive masses of basaltic lavas, with tufa and pumice. With the exception of the vine and fruit trees on the east and south edges of the plateau, and a little agriculture (up to 1700 feet), the Eifel is uncultivated, its rocky soil being too poor, and its climate too raw and bleak for anything to grow but heather.

Eiffel, GUSTAVE, engineer, born at Dijon, 15th December 1832, was in 1858, only three years after completing his studies at the École Centrale, intrusted with the construction of the large iron bridge over the Garonne at Bordeaux, and was one of the first to introduce caissons worked with compressed air. The bridge over the Douro at Oporto, the great viaduct of Garabit, in Cantal (described by him in an elaborate monograph, 1889), and that over the Tardes, near Montluçon, and the gigantic locks designed and partly prepared for the Panamá Canal were among his most notable achievements and designs; while in the huge framework erected for Bartholdi's statue of Liberty may be seen the germ of the idea which afterwards assumed the form of the colossal iron structure (1887–1889) on the Champ-de-Mars in Paris with which his name is identified. The Eiffel Tower contains three stories, reached by a series of elevators or lifts, and the platform at the summit is 300 metres (985 feet) above the ground. About 7,000,000 kilogrammes (a little less than 7000 tons) of iron were employed in its construction; the cost was about £260,000, of which £60,000 was voted by the state, and the remainder supplied by M. Eiffel, who expected to recoup himself out of the admission fees during the twenty years for which he held a concession. The tower has been used since 1910 as a wireless station. In 1893 he was condemned to two years' imprisonment and a fine of 20,000 francs for breach of trust in connection with the Panamá Canal works. In his old age he took up research in meteorology and in air-resistance in relation to aviation. He published an annual *Atlas Météorologique, Recherches expérimentales sur la résistance de l'air* (1907), and *L'Hélice aérienne* (1920). He died in December 1923.

Eigg, or EGG, a Hebridean Island, 7½ miles W. of the mainland of Inverness-shire, and 5 SW. of Skye. With an utmost length and breadth of 6½ and 4 miles, it is 12 sq. m. in area, and culminates in the remarkable Scuir of Eigg (1346 feet), near which are columnar cliffs like those of Staffa. Here in 617 St Donnan and fifty more monks from Iona were killed by the queen, though her people objected that 'that would not be a religious act;' and here, towards the close of the 16th century, 200 Macdonalds, men, women, and children, were smoked to death in a narrow-mouthed cave by Macleod.

Eight, PIECE OF. See PIASTRE.

Eikon Basilike, a work whose full title is *Εἰκὼν Βασιλικὴ: The Portraicture of His Sacred Majestie in his Solitudes and Sufferings.* It was published immediately after the execution of Charles I. (1649), and within a twelvemonth ran through fifty editions in various languages. Written in the first person, it professes to be Charles's own composition, and if it be a forgery, it is certainly one of the cleverest of the kind. It is no blind apology, for, to take but a single example, it does not vindicate the death of Strafford: 'I,' says its author, 'am so far from excusing or denying that compliance on my part (for plenary consent it was not) to his destruction, whom in my judgment I thought not, by any clear law, guilty of death, that I never have any touch of conscience with greater regret.' Though Milton and others did at the time insinuate doubts whether the work was not by some secret coadjutor, doctor or prelate, yet generally it was accepted as the king's, until, in a fifteen months' correspondence (1660–62) with Clarendon and the Earl of Bristol, Dr John Gauden (q.v.) laid claim to the sole authorship: 'This book and figure [the frontispiece] was wholly and only my invention, making, and design, in order to vindicate the King's wisdom, honour, and piety.' Gauden professed to have begun the work in or about the year 1647, and to have submitted a MS. copy of it to the king 'in the Isle of Wight, by the favour of the late Marquis of Hertford, which was delivered to the king by the now Bishop

of Winchester.' On the other hand, some assert that Charles had written the first six of its twenty-eight chapters before the battle of Naseby (1645). The question, one of much complexity, is not yet settled either way; to discuss it thoroughly is here impossible. Enough, that historians generally, from Lingard to Green, have pronounced against Charles; whilst some of those who have sifted his claims are in his favour, as Dr C. Wordsworth, in *Who wrote Eikon Basilike?* (1824–28), and E. J. L. Scott, in his edition of the work (1880). But see W. B. Odgers in the *Modern Review* (1880), Doble in the *Academy* (1883), and E. Almack's *Bibliography of the King's Book* (1896).

Eildons, a triple-crested height in Roxburghshire, due south of Melrose, whose middle and highest peak (1385 feet) commands a glorious view. 'I can stand,' said Scott, 'on the Eildon Hill, and point out forty-three places famous in war and verse.' Of an older magician, and of an older poet, the Eildons also have memories—Michael Scott and Thomas the Rhymer. Newstead, at their foot, has the great Roman camp of *Trimontium*.

Eilenburg, a town of Prussian Saxony, on an island in the river Mulde, 15 miles by rail NE. of Leipzig, has manufactures of cloth, calico, tobacco, chemicals, beer, hardware, furniture, and agricultural implements; pop. 18,000.

Eilethyia (hieroglyph. *Nekheb;* city of Lucina, now called El-Kâb), a city of ancient Egypt, situated on the right bank of the Nile, a little below Edfu. The present ruins consist of the remains of small temples dedicated by Rameses III. to Ra; a Ptolemaic temple dedicated to the eponymous goddess Lucina by Physcon or Euergetes II., with additions by Ptolemy Alexander I. and the elder Cleopatra; and an ancient temple dedicated by Amenophis III. to the local deities. The names of other monarchs are also found in the ruins; but the most interesting and important remains are the rock-tombs, some as early as the 13th dynasty, excavated in the hills. That of Aahmes, the 'captain of the sailors,' records his services in the wars of the early monarchs of the 18th dynasty against the Hyksos or Shepherds, and other Asiatic and Nigritic races. Another, that of Pahir, is decorated with rich and elaborate paintings representing the pursuits of agriculture, fowling, fishing, &c. The city was an outpost against the southern tribes, and its fort, a large inclosure of crude brick, was of importance as early as the Shepherd war. The goddess Suben (Eilethyia or Lucina) was a special protectress of Upper Egypt.

Eimeo (called by the French *Moorea*), one of the French Society Islands, in the Pacific Ocean, about 10 miles WNW. of Tahiti, the principal member of the group. Area, 51 sq. m.; pop. about 2000. It consists of deep valleys and abrupt hills—the former well cultivated, and the latter heavily timbered. Here Christianity was first introduced in Polynesia; and here the South Sea College of the London Missionary Society was established. Most of the natives are Protestants.

Einbeck, or EIMBECK, a town of Hanover, is situated on the Ilme, 23 miles N. of Göttingen by rail. Although a place of considerable importance in the 15th century, and a Hanse city, it has decayed greatly in recent times. It manufactures sugar, tobacco, carpets, &c. Einbeck was noted in the 15th century for its beer (*Eimbecker Beer*, whence 'Bock'). The town suffered severely in the Thirty Years' War; and in 1761 the French demolished its walls. Pop. 10,000.

Einhard. See EGINHARD.

Einsiedeln, a town of Switzerland, in the canton of Schwyz, 27 miles SE. of Zurich by rail. Pop. 8500. In Einsiedeln great numbers of prayer-books, sacred images, wax candles, rosaries, medallions, &c. are made. The town is, however, chiefly celebrated for its Benedictine abbey, to which some 200,000 pilgrims resort annually to worship at the shrine of a black image of the Virgin, the 14th September being the principal day in the year. The abbey itself was founded in the 10th century, and after being repeatedly destroyed by fire, was rebuilt as a quadrangle in the Italian style in 1704–19. It contains a valuable library, with several incunabula and MSS., these last dating from the 8th to the 12th century; also a museum of natural science and natural history. Rudolph of Hapsburg elevated the abbot of Einsiedeln to the dignity of a prince of the empire in 1274. Near the town the Austrians under Jellachich were defeated by the French under Masséna on 14th August 1799.

Einstein, ALBERT, mathematical physicist and astronomer, elaborator of the theory of Relativity (q.v.), which is working a revolution in conceptions of space, time, and gravity, and is perhaps the profoundest influence in the thought of the time, was born at Ulm, in Württemberg, 14th May 1879, son of a Jewish manufacturer. He spent part of his childhood at Munich, and went to school at Aarau, in Switzerland. He studied mathematics and physics at Zürich University, taught in the technical high school in that city. Afterwards he was employed in the patent office at Bern. Meanwhile he had published papers on various physical subjects, such as the Brownian movements. His earlier and narrower theory of relativity was enounced in 1905. In 1909 he became extraordinary professor at Zürich, in 1911 professor of physics in the German university of Prague, and in 1912 returned to Zürich technical high school. In 1913 he was elected a member of the Berlin Academy of Sciences, and a sinecure professorship enabled him to devote all his time to research and the direction of the Kaiser-Wilhelm Institut für Physik. His generalised theory of relativity was put forth in 1915. Later a chair was provided for him at Leyden, to be held along with his Berlin chair, three weeks to be spent every year at Leyden. A democrat and pacificist, Einstein signed the protest against the manifesto of those men of science who approved of the Great War, joined in an appeal in favour of the German revolution, and worked for the League of Nations. As a Jew and a Zionist he was subjected to annoyance by Berlin anti-Semites, and offered his co-operation in the work of the proposed university of Jerusalem. See, for his theories, his own *Relativity: the Special and the General Theory* (trans. R. W. Lawson, 1920), and the article RELATIVITY in this Encyclopædia.

Eisenach, a town of Weimar (Thuringia), is beautifully situated on the Hörsel, at the north-western verge of the Thuringian Forest, 69 miles by rail SE. of Cassel, and 49 W. of Weimar. Once the capital of a principality, Eisenach is still a thriving and industrious town, with wide, clean, and well-paved streets. It has a ducal palace (1742), now used as a court-house; a spacious market-place, and manufactures of art pottery, leather, &c. Sebastian Bach, of whom a statue was erected in 1884, was a native; and Fritz Reuter died at Eisenach in 1874. Pop. (1875) 16,163; (1919) 41,375.

On an eminence rising 600 feet above the town, engirt by forests, stands the castle of Wartburg, founded in 1067, and till 1440 the residence of the Landgrave of Thuringia. It is famous as the spot where the Minnesingers (q.v.) assembled to hold a poetic contest ('the war of the Wartburg') about 1207; as the home of St Elizabeth (1511–27); and

as the ten months' asylum to which Luther was carried by the Elector of Saxony (May 1521). The chapel in which Luther preached, as well as the chamber which he occupied, and in which he discomfited the Evil One by throwing the inkstand at his head, is still pointed out. The whole pile has been magnificently restored since 1851. See WALTHER VON DER VOGELWEIDE, WOLFRAM VON ESCHENBACH; also TANNHÄUSER.

Eisenberg, a town of Germany, in the state of Thuringia, on an eminence between the Saale and the Elster, 36 miles SE. of Leipzig; pop. 10,000.

Eisenerz, a mining-town of Austria, in the north of Styria, 20 miles NW. of Bruck. It stands in a narrow mountain-valley at the north foot of the Erzberg (5000 feet), a mountain so rich in iron ore that the miners, instead of cutting mines into it and following the metal in veins, quarry the rock from the outside; the ore is then broken small, and conveyed to the smelting-house without further preparation. The ore is very rich in metal. Aragonite (*Eisenblüte*, or *flos ferri*), resembling branching coral in form, and of the most beautiful and purest white, is found in grottos in the interior of the mountain. Pop. 6000.

Eisenstadt, a walled town of Austria, 26 miles SE. of Vienna. The Esterhazy palace (1683–1805), in the centre of the town, contains a valuable library.

Eisleben, Luther's birthplace, a town of Prussian Saxony, 24 miles WNW. of Halle. Once the capital of the counts of Mansfeld, it is the centre of a rich mining district. Pop. (1875) 14,378; (1919) 22,713. The house in which Luther was born was partially consumed by fire in 1689, but was restored, as also have been the house in which he died, the church (Peter-Paulskirche) where he was christened, and another (Andreaskirche) in which he preached. In 1883, on the occasion of his quatercentenary, a bronze statue was unveiled of the Reformer, and a new gymnasium inaugurated, successor to the one which he founded two days before his death. See Grössler's *Geschichte Eislebens* (Halle, 1875).

Eisner, or KOSMANOWSKY, KURT, leader of the Bavarian revolution of 1918–19, was born, a Jew, in Berlin, 14th May 1867. A member of the staff of *Vorwärts* and other socialist papers in Berlin, Nürnberg, and Munich, he was several times imprisoned for his writings, as in 1918, when he opposed the war. On his release he held a great meeting in Munich, overthrew the monarchy, and became president of the Bavarian republic. He opposed centralisation in the Reich. Leaning towards the council system, he accepted a National Assembly, and on his way to open its first sitting was assassinated in Munich, 21st February 1919. An idealist of great 'personal magnetism,' he wrote a number of meritorious books. His *Gesammelten Schriften* (not quite complete) were published in 1920.

Eisteddfod, the name given to a congress of Welsh bards and musicians, having for its object the preservation and cultivation of the national poetry and music, and in a secondary degree of the national customs and traditions. In very early times contests took place at Caerwys in Flintshire, and at other towns, when degrees were conferred upon the successful competitors, the honours thus won procuring the bard's ready admittance into the castles of the Welsh princes and nobles. Eisteddfods are known to have been held in the reigns of Edward III. (1327–30), Henry VI. (c. 1451), Henry VIII. (c. 1525), and Elizabeth (1568). Then for a couple of centuries the contests seem to have been discontinued, but were revived in 1798, after which date they were frequent for a time. See *The Welsh People* (1900), by Rhys and Brynmor Jones.

Ejectment (*Ejectio firmæ*) was, in English law, a form of possessory action, wherein the title to land might be tried, and the possession recovered. Under the old common law, a person dispossessed of his freehold was often obliged to have recourse to the cumbrous forms of a real action. A lessee for years, on the other hand, if dispossessed, could only claim damages for ejectment; but at an early period the courts decided that he should not only have his damages, but recover possession of the land. By means of an elaborate series of fictions, the action for ejectment was made to serve the purpose of any person claiming title to land. If Smith wished to recover land from Brown, he commenced his action with a declaration, every word of which was untrue, setting forth that Smith had made a lease to John Doe; that Doe entered on the land; that Doe was wrongfully ejected by one Richard Roe, and claimed damages accordingly. Brown, the actual possessor, was admitted to defend the action, in place of the imaginary Roe, but only on agreeing to admit the truth of the story about Doe; so that the only question in dispute was whether Smith had a right to make the lease to Doe. This curious legal comedy was abolished by the Common Law Procedure Act of 1852, and the Judicature Acts have now substituted an action for the recovery of land for the action of ejectment. But the term ejectment is still commonly used to describe the various forms of process by which a person in possession of land or house property may be turned out by his landlord or by a rival claimant. See EVICTION.

Ekaterinburg, now SVERDLOVSK, a fortified town of Russia, on the eastern slope of the Urals, and on both banks of the Isset, 312 miles SE. of Perm by rail. It has wide, straight streets, with two cathedrals, a monastery, and a mint for copper coinage. It is the centre of the Ural mining districts. Its manufactures include machinery, soap, candles, and linen, and it has large iron and copper works, besides establishments for washing gold and cutting and polishing precious stones. Industries are mining, cattle-rearing, and (among the Bashkirs of the suburbs) the keeping of bees. It was at Ekaterinburg that Nicholas II. and his family were put to death, 16th June 1918. A university was founded in 1920. Pop. 70,000.

Ekaterinodar, a town of Russia, capital of the country of the Kuban Cossacks, on the Kuban River, about 100 miles from its mouth. It is surrounded on all sides by swamp and morass; it has a cathedral and a large military hospital, but its houses are mostly of earth, with low, thatched roofs. A university was founded in 1920. The town has been renamed Krasnodar. Pop. 143,000.

Ekaterinoslav, a government of Ukraine, reaching in the south-east to the Sea of Azov, with an area of 26,000 sq. m., and a pop. of about 2,000,000, mostly engaged in agriculture and the rearing of cattle. It forms, except in the north-east, a vast plain, with stretches of steppe, although most of the land is well watered; 53 per cent. is arable, and good crops are raised, while melons, apricots, peaches, and grapes do well in spite of the night-frosts. The climate is generally mild and healthy, the mean temperature over 70° F., although it has fallen in severe winters to 22° below zero. Minerals are abundant, and include valuable beds of coal; and the manufactures and trade are of importance.—The capital, EKATERINOSLAV, on the Dnieper, 323 N. by E. of Sebastopol by rail, has a cathedral, a public library, a fine park, and large

tobacco factories. The town ('Catharine's Fame') was founded in 1784 by Prince Potemkin for the summer residence of the Empress Catharine II. Pop. 164,000.

Ekhmîm, or IKHMÎM (the ancient *Apu* or *Khemmis*, and called by the Greeks Panopolis), is a fair-sized town of Upper Egypt (pop. 15,000, chiefly Copts, but including Roman Catholics) on the east bank of the Nile near Suhâg, and was formerly the capital of the 9th nome of the south country (see EGYPT). Ruins mark the site of the temple of the local deity, Khim, the Egyptian Pan, but there are few remains of any importance. Herodotus speaks of Khemmis as a large city with a temple dedicated to Perseus, and it was still a leading place of the Thebaïd in the days of Strabo; but the Arab conquest demolished the greater part. It was once famous for linen manufacture and masonry, and is still noted for its check cotton industry. Ekhmîm was the birthplace of Madame Blavatsky.

Ekowe, now ESHOWE. See ZULUS.

Ekron, the northernmost of the five great cities of the Philistines (q.v.), on the borders of Judah and Dan. Beelzebub (q.v.) was its god.

Elæagnaceæ, a family of dicotyledons, of which there are about seventeen species, all natives of north temperate countries. *Elæagnus angustifolia*, the so-called Oleaster, sometimes called Wild Olive, is a small spiny tree of the Mediterranean region, hoary with stellate hairs, and is frequently planted for the sake of its silvery-white foliage and its fragrant flowers. The Sea Buckthorn (q.v.), or Sallowthorn, is the only British species. The Silverberry, *Shepherdia argentea*, with pleasant fruit, and *S. canadensis*, have also been introduced to English parks from North America.

Elæis. See OIL, PALM.

Elæocarpaceæ, an order, or sub-order of Tiliaceæ, mostly East Indian trees. The fruits of some are eaten. The deeply wrinkled seeds or stones of the fruit of *Elæocarpus ganitrus* are made into beads for necklaces and bracelets in India. They are often called Olive Nuts.

Elæococca, a genus of Euphorbiaceæ, the seeds of some of which yield useful oils, that of *E. verrucosa* being used for food in Japan, and for burning in Mauritius. That of *E. vernicia* of China is used in painting.

Elæodendron, a genus of Celastraceæ. *E. croceum* yields the useful Saffron-wood of the Cape.

Elagabalus. See HELIOGABALUS.

Elam, a district of ancient culture, lying south of Assyria and east of Persia proper, apparently the same as the Susiana of Strabo. Its chief city, Susa (*Shushan*), early attained great importance in Mesopotamia. It appears that the primitive Semitic Elamites were overcome at an early period by a Hamitic or Cushite race from Babylon, called by the Greeks Cossæans.

Eland (*Oreas canna*), an antelope of Central and South Africa, the largest of the group, which has sometimes bred in Britain. It is a plump, strong, ox-like animal, stands about six feet high at the shoulders, and has a predominantly light-brown colour, varying to reddish above and yellowish below. The horns, present in both sexes, are about a foot and a half long, straight or slightly bent, and bear a spiral keel. There is a marked dewlap on the throat of the bull, and a dark short mane from the forehead backwards. The tail is ox-like, and ends in a tuft of black hair. The eland lives in small herds, especially on the treeless flats; it can attain considerable speed, and must be hunted on horseback. It is locally known as the *Impoof* or *Impoofoo*. The flesh is said to surpass beef, and the hide is also much valued. Once abundant all over South Africa, it is now restricted to the Kalahari Desert and a preserve in Natal. See ANTELOPE.

Elanet (*Elanus*), a genus of Falconidæ, including a number of kites, such as the Black-winged Kite (*E. cæruleus*) of Africa and India. Most of them feed on small prey, such as insects, snakes, and small mammals.

Elaphodus, a Chinese and Tibetan genus of deer, related to the muntjacs.

Elaphomyces, a genus of subterranean fungi of the truffle family.

Elaphure, or PÈRE DAVID'S DEER (*Cervus* or *Elaphurus davidianus*), a long-tailed deer kept in parks in China and now also elsewhere. The antler has no brow-tine.

Elaps. See CORAL-SNAKE.

El Araish (also called Laraish, Larache), a fortified Atlantic seaport of Spanish Morocco, at the mouth of the Wad Lekkus, 45 miles SSW. of Tangier. The harbour, once a resort of the Salli pirates, tends to silt up. The town has a citadel and other defences, a fine market-place, a mosque of some note, and a military railway to Alcazar. Its trade is extensive, especially in grain, beans, fruits, eggs, and wool. Ruins in the neighbourhood have been thought to be Phœnician. Pop. about 10,000.

El Arish, a fortified town of north-eastern Egypt, on the Mediterranean, at the mouth of the Wady-el-Arish, marks the boundary of Egypt and Palestine. It was taken by Kléber in 1799, and in 1916 was recaptured by the British from the Turks, who had seized it and made it their base. Pop. 20,000.

Elasmobranchii. See CARTILAGINOUS FISHES.

Elasmosaurians, gigantic marine saurians of the cretaceous period, whose remains have been found chiefly in New Jersey, United States. See REPTILES.

Elasticity is that property of matter which enables a body, whose form or bulk has been changed by force, to support without disintegration or further yielding the continued action of that force, and to recover its original form or bulk when left to itself. Any alteration in form or bulk of a body is called a strain, and the combination of forces producing the strain is called a stress. Now when an elastic body is strained, it becomes possessed of a certain power of doing work which it had not originally. As familiar examples of this we may mention the bent bow, the wound-up mainspring of a watch, and the compressed air of an air-gun. In these cases a certain amount of energy has to be spent to bring the substances into their strained condition. Then, on being allowed to recover themselves either suddenly or gradually by an appropriate withdrawal of the supporting stresses, these substances yield back, in the form of useful work, some of the energy originally expended. Again, in the phenomena of Sound (q.v.), we have constant illustrations of the elasticity of bodies. An elastic substance—a pianoforte string for example—is strained in a particular manner and then left to itself. It at once begins vibrating about its original position of equilibrium, the energy of strain being transformed into the energy of motion, and that again into the energy of strain, and so on until gradually it degenerates into heat under the influence of the viscosity of the air, the string itself, and whatever other elastic bodies may be in the vicinity.

Physically considered, sound is in fact a sub-section of elasticity. The power of conveying sound is possessed by all substances, whether solid or fluid; for such strains, then, all substances are truly elastic.

As regards fluids—i.e. gases and liquids, the only kind of elasticity that can exist is elasticity of bulk; for no portion of a fluid can sustain the action of a deforming force. Practically the only kind of stress we can apply to fluids so as to cause a change of volume is a pressure equal in all directions. It is found that at a given temperature, the volume of a given mass of fluid is determined by the pressure; so that, after being compressed by an increase of pressure, the fluid will recover its original volume when the pressure is brought back to its original value. Thus, all fluids are perfectly elastic. To discover how, under any circumstances, the pressure and volume are related to one another is clearly an elastic problem. Thus, we must regard Boyle's Law for gases, established by the Hon. R. Boyle (q.v.) for air in 1661, as the first experimental attempt to investigate the laws of elasticity (see GASES, and HYDRODYNAMICS). To the same class of problems belongs the determination of the compressibilities of liquids. Compression being defined as the diminution produced in unit volume of the substance by the application of a given extra pressure, compressibility is measured by the ratio of the compression to the related pressure, or, in more general language, by the ratio of the strain to the stress. Through considerable ranges of stress-values, this ratio is for most liquids constant. The reciprocal of the compressibility—i.e. the ratio of the appropriate stress and strain, is called the bulk-modulus of elasticity. It is the only modulus with which we have to do when the elasticity of fluids is being considered.

When we pass to the consideration of solids, we meet with another kind of elasticity, the elasticity of form. The resistance which a solid offers to a pure change of form, not involving a change of volume, is measured by its Rigidity (q.v.); and if for this change the body is truly elastic, the rigidity is measured by the ratio of the deforming stress to the resulting strain—i.e. it is the modulus of elasticity for this kind of stress and strain. A pure twist applied to a pillar, rod, or wire, is a strain which involves no change of volume. The resistance which such a pillar offers to torsion depends on its rigidity and form, but is independent of its compressibility. In most cases, however, when an elastic solid is strained by a particular kind of stress, the appropriate modulus of elasticity involves both the rigidity and the compressibility. Thus, when a wire is stretched by a longitudinal tension, it not only increases in length but also diminishes in section. The result is that any small cubical element becomes a brick-shaped portion somewhat greater in volume. It is usual to measure this kind of strain by the elongation simply, the contraction of the section being practically unimportant. The ratio of the tension to the elongation gives what is called Young's Modulus of Elasticity, a most important quantity in engineering. It is Young's modulus which also determines the resistance a beam or bar offers to bending. See STRENGTH OF MATERIALS.

The elasticity of solids is far from perfect—i.e. a very moderate stress well within the limits of rupture will produce a permanent set in the body, so that there will not be perfect recovery of form and dimensions when the stress is removed. It is difficult to fix accurately the so-called limits of perfect elasticity, since a small stress acting for a long time will produce a permanent set, which a much more powerful stress acting for a short time would not produce. So long, however, as the strains are small, experiment shows that the stresses are proportional to the corresponding strains. In other words, the modulus of elasticity is constant through considerable ranges of stress-values. This empirical law was first clearly enunciated by Hooke in 1678 in the words *Ut Tensio sic Vis;* and upon a generalised statement of Hooke's Law the whole modern theory of elasticity is based.

See Lord Kelvin's article 'Elasticity' in the 9th ed. of *Encyclopædia Britannica* (republished in his *Math. and Phys. Papers*); Ibbetson's *Mathematical Theory of Elasticity* (1887); Love's *Mathematical Theory of Elasticity* (2d ed. 1906); and, for a valuable compendium and criticism of the labours of other elasticians, the *History of the Elasticity and Strength of Materials* (Cambridge University Press, 2 vols. 1886-93), by Todhunter and Pearson; also the articles in this work on STRAIN, STRESS, STRENGTH OF MATERIALS, TORSION.

Elastic Tissue. See MUSCLE, TISSUE.

Elater, a genus of beetles in the Pentamerous sub-order, type of the family Elateridæ. They are familiarly known as 'click-beetles' or 'skip-jacks,' from their habit of jerking themselves with a slight noise into the air when they land or are placed on their backs. The body is arched upwards and suddenly straightened with a violent muscular exertion, which lifts the animal from the ground. The legs are too short for the ordinary method of righting the body. For the larvæ, see WIREWORMS; for phosphorescent, FIREFLIES. For elaters in botany, see HORSETAIL, LIVERWORTS.

Elaterite. See BITUMEN.

Elaterium, a drug obtained from the fruit of the Squirting Cucumber (*Ecballium Elaterium*, formerly *Momordica Elaterium*), a native of the south of Europe, common on rubbish in the villages of Greece and the Archipelago. The fruit breaks from its stalk, and violently expels its seeds with the surrounding mucus through the opening thus made. This remarkable phenomenon is not due to any true contractility, but simply to the tension due to osmosis; much, in fact, as ripe gooseberries burst after prolonged rainy weather. It is the thick green mucus surrounding the seeds which yields the elaterium. This is simply prepared by drying the sediment from the juice pressed from the newly ripened fruit.

Squirting Cucumber (*Ecballium Elaterium*).

Elaterium is a drastic hydragogue cathartic. Its active principle is a body called Elaterin, $C_{20}H_{28}O_5$, which is probably the most powerful purgative known, the ordinary dose being only from $\frac{1}{40}$ to $\frac{1}{10}$ grain. It is an exceedingly drastic purgative, used in dropsy. It acts as an irritant not only on the eyes, but even on the fingers of those who handle it. The use of elaterium was known to the ancients.

Elath. See AKABAH.

Elatma. See JELATOM.

El Azariyeh. See BETHANY.

Elba (Gr. *Aithalia*, Lat. *Ilva*), an island belonging to Italy, in the Mediterranean Sea, between

Corsica and the coast of Tuscany, from the latter of which it is separated by the channel of Piombino, a strait 6 miles in breadth. Area, 85 sq. m. The coast is bold and precipitous, the interior traversed nearly throughout by three mountain-ranges which reach a height of 3380 feet. The island is well watered, the climate mild and healthy; on the lower ridges of the mountains, and in the valleys, the vine, olive, and mulberry flourish, fenced in with hedges of cactus and agave. The chief industry is the mining of the rich iron ore, for which Elba has been famed from antiquity; serpentine and chalk, granite and marble also are quarried, while some salt is produced from the salt-pans along the coast. Much wine is made, and the tunny-fisheries are important. Porto Ferrajo, the capital, has a pop. of 12,000. Elba has been rendered famous in history as Napoleon's kingdom in exile from May 1814 till February 1815.

El Bassan, a town of central Albania, 75 miles SSE. of Scutari, with manufactures of copper and iron wares. It is the capital of a prefecture. Pop. 10,000.

Elbe (the Roman *Albis* and the Bohemian *Labe*), an important river of northern Europe. It originates in the confluence of numerous streams which rise on the southern side of the Riesengebirge or Giants' Mountains, a range on the northern border of Bohemia, and unite near 50° 46′ N. lat., 15° 32′ E. long., at an elevation of 2230 feet above sea-level. Its total length, including windings, is estimated at 725 miles; it is navigable for 525 miles, as far as Melnik, but for sea-vessels only up to Hamburg (84 miles); and it drains an area of over 55,000 sq. m., of which two-thirds is German territory. Of its fifty and more tributaries the most important are the Moldau, Eger, Mulde, Saale, and Havel (with the Spree); and in connection with these is a fine system of canals. From the base of the Schneekoppe, the Elbe flows south to Pardubitz, whence it proceeds west to Brandeis, and afterwards in a general north-west direction past Melnik, Leitmeritz, and Herrnskretschen, where it quits the Bohemian territory and enters Saxony. At this point it is 142 yards wide. It then meanders, in a generally north-westerly course, through Saxony, Anhalt, and Hanover, passing Pirna, Dresden, Meissen, Torgau, Wittenberg, Magdeburg, Harburg, and Hamburg, until it empties itself into the North Sea at Cuxhaven, where it attains a breadth of upwards of 10 miles. The estuary is defended by five forts. At this point the tide rises about 10 feet; it is perceptible over 100 miles up the river. The Elbe is divided into several branches between Hamburg on the north, and Harburg on the south, by the numerous islands that there interrupt its course; and between Hamburg and the sea the sandbanks and shoals leave only a very narrow channel, of four to five fathoms' depth, and carefully marked. The scenery of the valley of the Elbe, although generally pleasing, is not remarkable, except in the Saxon Switzerland, above Dresden, where the river's course is generally between fantastic sandstone cliffs. Its waters are stocked with abundance of highly esteemed fish. Steamboats ply from Dresden up the river to Melnik, and down as far as Riesa, as well as from Magdeburg to the sea. The navigation of the Elbe was formerly impeded by all manner of imposts and monopolies, but in 1870 all then existing tolls were abolished.

Elberfeld, one of the manufacturing capitals of Germany, is situated on both sides of the Wupper, an affluent of the Rhine, 16 miles ENE. of Düsseldorf. The old parts of the town are poorly built, straggling, and irregular, but the newer portion has numerous spacious and imposing buildings. The town is famous for its dyeing, bleaching, and calico-printing, also for its manufactures of cottons, woollens, silks, ribbons, thread, lace, buttons, machinery, iron and steel wares, pianofortes, paper, and carpets. Close by is Barmen (q.v.). The Wupper valley has long been noted for its interest in religious work, in missions and Bible societies; and since 1852 Elberfeld has had a singularly effective method of voluntary but systematic poor-relief, devised by the banker, Daniel von der Heydt. The city is divided into over 360 districts, each under an (unpaid) almoner; and the almoners, under a superintendent, form a committee which meets fortnightly to discuss cases and vote relief. The work is under the direction of a board comprising the mayor, four councillors, and four elected citizens. Relief is granted according to a scheduled rate for two weeks at a time; but every case is considered on its merits. Family earnings are taken into consideration, and tools may be provided. The system, though all its representatives are unpaid, is thoroughly organised, energetic, and efficient. The condition of the poor has improved; and whereas in 1855 17 per 1000 required assistance, only 7 or 8 were necessitous at the close of the century. The Elberfeld system has been introduced or partially imitated in many German and Austrian towns. See Julie Sutter, *Britain's Next Campaign* (1901). Pop. (1875) 80,599; (1910) 170,195; (1919) 157,218.

Elbeuf, a town of Seine-Inférieure, on the left bank of the Seine, 14 miles S. by W. of Rouen; pop. 20,000. The manufactures of cloths, flannels, billiard-cloths, and light woollens employ some 25,000 men here and in the neighbouring towns.

Elbing, a town of West Prussia, 48 miles ESE. of Danzig, on the navigable Elbing, which enters the Frisches Haff 5 miles to the north. The town, founded in the 13th century, is connected by canal with a tributary of the Vistula. Ships are built; and there are iron and brass rolling-mills, and tinware and cigar factories. Pop. (1875) 33,572; (1919) 67,127.

Elbow. See ARM.

Elburz, a mountain-range of Persia, running for 450 miles along the southern border of the Caspian Sea. It frequently divides itself into subordinate parallel ridges, enclosing extensive and fertile valleys; and unlike most Persian ranges, it has numerous prominent spurs, the highest peak being Mount Demavend (q.v.).—ELBURZ is also the name of the loftiest summit of the Caucasus (q.v.).

Elché, a town of Spain, 13 miles SW. of Alicante by rail, fringed by an encircling grove of nearly 100,000 palms, which gives the place an appearance half Moorish. It has a fine collegiate church, with a lofty tiled dome, and some trade in esparto, wine, dates, and palm-branches. Pop. 33,000.

Elchingen, a village of Bavaria, near the Danube, 5 miles NE. of Ulm, where on 14th October 1805 Ney defeated the Austrians under Laudon, winning thereby the title of Duke of Elchingen.

Elcho, LORD. See WEMYSS.

Elder (*Sambucus*), a genus of plants of the natural order Caprifoliaceæ, sub-order Sambuceæ, consisting chiefly of shrubs and trees, with pinnate leaves, small flowers of which the corolla is wheel-shaped and 5-cleft, and 3-seeded berries. The species are very widely distributed.—The Common Elder (*S. nigra*), the *Bourtree* of the Scotch, is a native of Europe, the north of Asia, and the north of Africa. It is found in all parts of Britain. It is a very large shrub, sometimes a small tree, with rather large leaves, and large terminal cymes of cream-coloured flowers, which are followed by small black—or rarely whitish—berries.

Its leaves and young shoots diffuse a narcotic odour, and it is said to be dangerous to sleep under its shade. The young leaf-buds are so violently purgative as to be considered dangerous. The inner bark has a bitter acrid taste. The leaves possess the

Flowering branch of Common Elder (*Sambucus nigra*): *a*, a flower; *b*, berries.

same properties in a rather milder degree. The flowers have a peculiar sweetish and rather sickening smell, but are used for making a distilled water —*Elder Flower Water*—which has a very agreeable odour, and is employed both in perfumery and confectionery. Distilled with water alone, they yield a volatile oil, which, on cooling, assumes a buttery consistence. A popular cooling ointment is made by boiling them in lard. They are also used for imparting a flavour to currant-wine and jelly. The clustered flower-buds are pickled, and used like capers. The French put layers of them in heaps or casks of apples, to which they impart an agreeable odour. A grateful wine, well known in England, especially about Christmas, is made from the berries; and in some places there are plantations of elder to supply the London market. It is generally drunk hot or *mulled*. The berries are subacid and sweetish, with an unpleasant flavour; but a rob or syrup made from them is an agreeable domestic remedy with country-people for colds, coughs, and sore throats, and is slightly purgative; it has some reputation also in a concentrated form as a cure in rheumatic, gouty, eruptive, and syphilitic disorders. In some parts of Germany the poorer people use them as an ingredient in soups. They are said to be used to no small extent in England in the adulteration of port wine and the manufacture of spurious port wine.—The wood of the elder is yellow; that of old trees is very hard and tough, takes a fine polish, is used by turners, and as a substitute for boxwood in making mathematical instruments and other articles. Tops of fishing-rods are sometimes made of it. The pith of the young shoots being very light, is generally used to make pith-balls for electrical experiments. Toys for children are also made of it; and few boys are unacquainted with the use of elder branches, from which it has been expelled, for making popguns. A musical instrument named by the Latins *sambuca* is supposed to have been made from the wood of this tree on account of its hardness. The elder is very useful as a screen-fence near the sea and in other exposed situations, as it grows with remarkable vigour, and makes great shoots, the destruction of the more tender and less matured parts of which in winter only tends to make it more bushy and useful for shelter. It is readily propagated by portions of its shoots stuck into the ground.—The Scarlet-fruited Elder (*S. racemosa*), a native of the south of Europe and of Siberia, much resembles the common elder, but has softer and more herbaceous shoots, remarkably large buds, and racemes of greenish-white flowers, which are followed by scarlet berries. It is a frequent ornament of shrubberies in Britain.—The Dwarf Elder, or Danewort (*S. Ebulus*), is a rather rare British plant, a coarse herbaceous plant, with fetid smell. The *inner bark* has been employed in dropsical complaints as a hydragogue cathartic. The leaves are avoided by cattle, moles will not come near any place in which they are laid, and they are said to drive mice and rats from granaries if strewed plentifully about their haunts for a time. *White elder ointment* is procured by boiling equal weights of lard and elder flowers, and pressing through a cloth.—*S. canadensis* and *S. pubens* are North American species; the former, which is the common American kind, much resembles *S. nigra*, and the latter in like manner approaches *S. racemosa*. Larger than either are the *S. glauca* of the Pacific states, and the *S. mexicana* of the south-west.

The elder is very prominent in European folk-lore, and innumerable superstitions cling to the tree, its twigs and leaves. The cross was reported to have been made of this wood. Judas was said to have hanged himself on an elder-tree; lightning will not strike an elder; twigs growing from the edge of decayed hollows in an old elder will ward off teething fits from children; in Denmark a spirit called the Elder-mother protects the tree and avenges injuries offered to it; warts are removed by being rubbed with elder twig; and, generally, the tree or a twig of it protects against witches and witch-craft.

Elder, an office-bearer in Presbyterian churches. The name is an exact translation of the Greek *presbyteros*, which occurs frequently in the New Testament, and from which the English word *priest* is derived; but there remains much division of opinion as to the precise meaning of the term (see BISHOP, INDEPENDENTS, and PRESBYTERIANISM). All are agreed indeed that *bishops* and all pastors of congregations are included among *elders* in the scriptural use of the term; but the ordinary use of it is now limited to Presbyterian churches, and in them it has become the usual designation of the office-bearers associated with the minister of each congregation in the care and oversight of the flock. In some Protestant churches elders are appointed only for a certain term of office; but more generally it is until death, resignation, removal from the bounds of the congregation, or deposition. The appointment of elders takes place variously; in the Established Church of Scotland they have generally been nominated by the kirk-session (consisting of the minister and elders); in the other Presbyterian churches of Britain and America they are elected by the congregation. The ordination of elders takes place in the congregation, but usually without imposition of hands; a difference between the mode of ordination of elders and ministers for which it is not easy to account, and which has certainly tended to produce a general impression that a greater difference of office subsists than the advocates of Presbyterianism admit. In the Established Church of Scotland, the elders have very generally discharged also the functions of Deacons (q.v.). According to the *Second Book of Discipline* of the Church of Scotland, it is the duty of elders to watch over the spiritual welfare of the people, to admonish, to visit the sick, to assist in the examination of persons seeking admission to the Lord's Table, &c. Elders along with ministers compose all the courts or assemblies of the Presbyterian churches, and have equal votes in all questions.

Eldon, LORD, Lord Chancellor. John Scott, better known as Lord Eldon, was born 4th June 1751, in Love Lane, Newcastle, of obscure but respectable parentage. Lord Stowell (q.v.) was his elder brother. Leaving the Newcastle grammar-school in 1766, John Scott entered University College, Oxford, with a view to the church, and the following year he obtained a fellowship. A run-away marriage, into which he entered with a Miss Surtees in 1772, nearly ruined him; however, by the advice of his brother, he returned with his wife to the university. Here, during the year of grace after his marriage, he lived on his fellowship and gains as a private tutor; and the year expiring without a college living falling vacant, he betook himself to the study of law. In 1776 he was called to the bar. By the death of his father, in the year of his call, Eldon found himself in possession of £3000. Success soon dawned on him; and, with success in his profession, his ambition expanded, he took to politics. A silk gown and a seat in parliament were but steps towards knighthood and the post of Solicitor-general, conferred on him by Pitt in 1788. In 1793 he became Attorney-general. In 1799 the office of Chief-justice of the Court of Common Pleas became his, as Baron Eldon; and in 1801 he ascended the woolsack. From this time till 1827, with little intermission, Eldon continued to occupy the woolsack under successive governments. In 1821 he had been made an earl by George IV. In 1834 he ceased to speak in parliament. After outliving almost all his immediate relations, he died in his eighty-seventh year, January 13, 1838, leaving behind him a fortune of over half a million sterling.

Eldon was a handsome man, of very winning and courtly manners. His career amply proves that he had the greatest talent, sagacity, and power of managing men. He was undoubtedly a great lawyer, and his judgments, which have been much praised for their accuracy, fill a small library; but he took so long to arrive at them, that he has been charged with having caused more injustice by delay than worse judges by the iniquity of their decisions. For literature, as for art, he had no feeling, and the style of his decisions is generally detestable. As a public speaker he is far from estimable. He was no statesman; for forty years he was a leading enemy of reform and religious liberty, and it may be said that his whole political stock in trade was zeal against the Roman Catholics. He is said to have added parsimony to his other defects; but it is certain he was capable of generous actions, and his devotion to 'Bessy' his wife was truly beautiful. See the Life by Twiss (1846), and Campbell's *Lives of the Chancellors.*

El Dora'do ('the Gilded Man'—afterwards transferred to a city or land) existed vaguely in the imaginations of the Spanish conquerors of America, whose avarice, feeding greedily on the marvellous accounts readily supplied by the natives—who were only anxious to get rid of their robber-guests—loved to dream of richer rewards than those of Mexico and Peru. But after Orellana's voyage down the Amazon, in 1540, the report was greatly embellished, and the locality of the fabulous region placed near the head-springs of the Orinoco. Many a soldier of fortune perished in the search, many a brave troop of adventurers brought but a fraction of their number back, before Manoa, the city of gold, was reluctantly relegated to the atlas of the poets, with the fabled king who, smeared with gold-dust, bathed annually in the sacred lake. Sir Walter Raleigh was one of those who sought in vain.

See Nery, *Le Pays des Amazones* (Paris, 1885); Von Langegg, *El Dorado* (1888); Bandelier, *The Gilded King* (N. Y. 1893); Petrie, *The Republic of Colombia* (1906).

Eleatic School. The group of ancient Greek philosophers so called begins with Xenophanes of Colophon, who settled in Elea, a Greek city of Lower Italy (whence the name), and includes Parmenides and Zeno, who both belonged to Elea, and also Melissus of Samos. In opposition to the physical philosophy of the Ionic school, and to the doctrine of Heraclitus (q.v.), who denied all being or existence, the Eleatic philosophers made the conception of pure being, unmixed with all marks or properties derived through the senses, the foundation of all their speculations. They argued the unity and immutability of all things, and, attacking the prevalent anthropomorphic mythology, they taught that God is the One, self-existent, unchangeable, and incomparable in any respect to man. Moreover, distrusting all knowledge acquired through the senses, they held that it is by thought only that we arrive at the truth; and Zeno's most subtle paradoxes were directed to prove this opposition between thought and sense. See separate articles on the principal philosophers mentioned.

Elecampane (*Inula*), a genus of Compositæ, allied to Aster. The only important species is the common Elecampane (*I. Helenium*), a native of damp meadows in the middle and south of Europe, rather rare in Britain, but not uncommon in the long-settled parts of North America. This plant was formerly much cultivated for its medicinal root, but is now comparatively neglected. The flowers are sometimes used to adulterate arnica.

Elecampane (*Inula Helenium*): *a*, flower.

Election, in Law, sometimes denotes the act of choosing, and sometimes the right of choosing. By the equitable doctrine of election in English law, one who accepts a benefit under an instrument, such as a deed or will, must adopt the whole deed, and conform with all its provisions. He is not entitled to take benefit under part of the deed without conforming to its other parts, and renouncing rights inconsistent with them. He must 'make his election' between the provisions of the deed and those of the common law. The analogous doctrine in the law of Scotland is that of Approbate and Reprobate (q.v.).

Election denotes in theological language the divine act by which certain individuals are chosen to salvation in Christ. It is defined in the seventeenth of the Thirty-nine Articles. See PREDESTINATION.

Election. See PARLIAMENT, and REPRESENTATION.

Electors (Ger. *Kurfürsten*), in the German empire, were those great princes who had the right of electing the emperor or king. In the earliest times, under the Carlovingians, the crown was

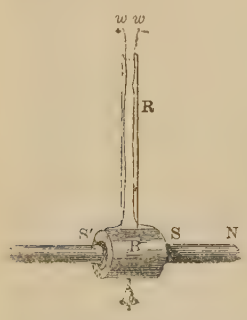
hereditary; afterwards Germany became formally an elective monarchy, but the election was practically almost limited to the reigning family. In the 13th century the right of election, for a time exercised by all the princes of the empire, became limited to the holders of the highest ecclesiastical and civil offices, some of which gradually became hereditary, and connected with territorial principalities, as in the case of the Hohenstaufens and of the Dukes of Bavaria, Saxony, Swabia, &c. Thus, there came to be seven electors, the spiritual electors of Mainz, Treves, and Cologne (as being the three chancellors of the empire), the elector of the Palatinate (as imperial steward), of Brandenburg (as chamberlain), Saxony (marshal), and Bohemia (imperial cup-bearer). During the Thirty Years' War, the right of the Palatinate was conferred on Bavaria; by the peace of Westphalia, an eighth electorate was established, Bavaria and the Palatinate being each allowed the full right; and in 1692 a ninth was added, that of Brunswick-Lüneburg (Hanover), but not without resistance by the electors and states of the empire, so that the new electorate was not fully recognised till 1710. In 1777 the number was again reduced to eight, the Bavarian electorate falling to the Elector Palatine. The electors held a very lofty position in the German empire. The Golden Bull (1356) describes them as 'the seven pillars and lamps of the holy empire.' They had many important rights, exemptions, and privileges, and royal dignity (but not the title of Majesty).

During the French ascendency great changes took place. Of the old electorates only that of Mainz was left, but three new ones—Baden, Württemberg, and Hesse-Cassel—and later one of Salzburg, were created. With the dissolution of the German empire the dignity of elector vanished, but the empty title continued to be used by the elector of Hesse-Cassel till 1866. See GERMANY.

Electra, daughter of Agamemnon and Clytemnestra, sister of Iphigenia and Orestes. After her father's murder by her mother, she saved the life of the young Orestes, and sent him to King Strophius to be brought up; and then helped him to avenge Agamemnon's death by slaying Clytemnestra. She was given in marriage by Orestes to his friend Pylades. Her story, treated also by Æschylus and Euripides, is the subject of a splendid tragedy by Sophocles; and Hofmannsthal's adaptation was the basis of the opera by R. Strauss (1909).

Electric Bells. See BELL.

Electric Clocks are either those in which the impulse is given to the pendulum directly by electric power, or those in which it is given by a weight or spring alternately liberated and restrained by electricity. Of the first kind, that invented by Bain (1840) is best known. In the ordinary clock, it is the clock that moves the pendulum; in Bain's clock, it is the pendulum that moves the clock. As the construction of the pendulum is the only part of it connected with electricity, we shall confine our notice to a general description of the pendulum action. The lower part of the pendulum arrangement is shown in the fig. The bob, B, consists of a bobbin of insulated copper wire, and is hollow in the centre; the wires *w*, *w* from both ends run along each side of the pendulum rod, R (the lower part of which alone is seen), and are in metallic connection respectively with the two springs from which the pendulum hangs. Two magnets or bundles of magnetic rods, NS, N′S′, are fixed at either side of the bob, and are of such dimensions that the hollow bob in its oscillation can pass a certain way over each without touching. The magnets have their like poles turned towards each other. The two springs of the pendulum rod are in connection with the two poles of a galvanic battery. In the connection between one of these springs and the battery there is a break (not shown in the figure) worked by the pendulum rod. When the pendulum is made to move, say, towards the right, it shifts a slider, so as to complete the connection between the poles of the battery. The current thereupon descends one of the wires of the pendulum, passes through the coil of wire forming the bob, and ascends by the other. In so doing, it converts the bob into a temporary magnet, the south pole towards the right, and the north pole towards the left. In this way, the south pole of the bob is repelled by the south pole, S, of the right-hand magnet; and its north pole is attracted by the south pole, S′, of the left-hand magnet, so that from this double repulsion and attraction both acting in the same direction, the bob receives an impulse towards the left. Partly, therefore, from this impulse, and partly from its own weight, the pendulum describes its left oscillation; and when it reaches the end of it, it moves the slider so as to cut off the battery current, and then returns towards the right, under the action simply of its own weight. On reaching the extreme right, as before, it receives a fresh impulse; and thus, under the electric force exerted during its left oscillation, the motion of the pendulum is maintained. So long as the electricity is supplied the pendulum will continue to move. The current required is exceedingly weak.



A very important application of Bain's pendulum was made by Jones of Chester (1857). Shortly after the invention of Bain's clock, Professor Wheatstone suggested that any number of such clocks could be made to move simultaneously by the same current of electricity. Jones turned this idea to account in the following way. A standard clock of the usual construction is made, by regulating the flow of a galvanic current, to control the action of any number of copying clocks, likewise of ordinary construction. The pendulum of the standard clock, itself in no way under electric control, on passing towards the right, touches a spring placed at the side, thereby completing the battery connection, and a current is transmitted to the copying clocks in a certain direction. On passing to the left side, the same takes place, but the current this time is sent through the circuit in the opposite direction. The pendulums of the copying clocks are made on Bain's principle, but have, of course, no break to move, as the primary pendulum performs that function. Let us suppose, at first, that all the pendulums are at rest; in this case no current is transmitted. Let the standard pendulum now be moved to the right, the right spring is touched, and a current at the same instant circulates through the bobs of the copying pendulums, and they thereby receive a simultaneous impulse towards the left. All the pendulums move then to the left; and on reaching the extremity of this oscillation, the standard pendulum touches the left spring, and the secondary pendulums are now impelled to the right. The motion of each secondary pendulum soon increases, until it reaches its proper extent. The pendulums once set a-going are, however, not intrusted solely to the stimulus of the electricity, but are moved by their own weights, as in ordinary clocks, so that if the electricity ceased to be sent to them, they would go on without it.

In the second class of electric clocks, the electricity is not charged immediately with the maintaining of the pendulum motion, but draws up the weight, or liberates the spring which discharges that function. This is the same principle as holds in what is known in horology as the 'remontoir' escapement. Ritchie of Edinburgh successfully combined the principles of Bain's and Jones's clocks, effecting the almost perfect control, by one standard clock, of a number of subordinate others. The pendulums of these controlled clocks vibrate by electro-magnetic action alone, and they consequently require no winding up.

Mr A. Steuart (*Proc. Roy. Soc. Edin.* xliii. 1923) describes a clock in which the electric motor that drives the hands (and a telescope or chronograph drum if desired) also raises a gravity arm, which descending acts on the pendulum. It is then arrested, and electric power passes to the motor while arm and stop are in contact. The current is interrupted when the motor raises the arm. The speed of the motor is governed by the time of contact, but its motion is maintained between contacts by a reduced current and by kinetic energy.

Electric Fishes. Electric organs are found in a few fishes; peculiar structures arising from a modification of muscular tissue, and capable under nervous control of a genuine electric discharge. The degrees of development vary greatly. The organs are powerful in the Electric Eel (Gymnotus), in the African Cat-fish (Malapterurus), and in the Electric Ray (Torpedo), in order of merit. They are weakly developed, or 'pseudo-electric,' as they used to be called, in all the Rays except Torpedo, and in several species of bony fishes (Mormyrus and Gymnarchus). Professor Cossar Ewart has demonstrated a very rudimentary electric organ in the common skate.

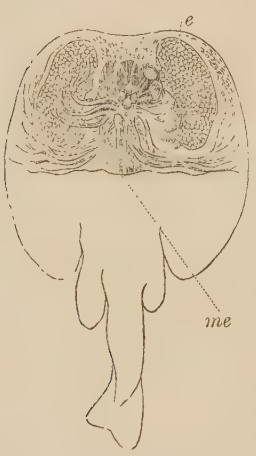


Fig. 1.—Electrical Apparatus of Torpedo (dissected): *e*, electric organs; *me*, spinal cord.

Structure.—It may now be regarded as demonstrated that all these electric organs are modified muscle-tracts. The associated nerve-endings are comparable to the ordinary terminations of a motor nerve on a muscle. The organs consist of a large number of rounded chambers or prismatic columns, separated by longitudinal and transverse partitions of fibrous connective tissue. In these partitions there are blood-vessels and nerves with very thick sheaths. The nerves lose their thickness, branch greatly, and finally fuse with 'electric plates,' or discs of modified muscular substance. Besides the essential electric plate, the compartment may contain a jelly-like substance or a fluid. Partitions, nerves, and the 'electric plate' form in all cases the principal structures.

Arrangement.—The electric organs not only occur in a well-developed state in three very widely separated fishes, but the arrangement in each case is different. (*a*) In the Gymnotus, which is abundant in the fresh water of Brazil and the Guianas, they replace the lower muscles along the sides of the tail. This is also the position of the weakly developed organs in the Rays (except Torpedo) and in the bony fishes already mentioned. As Gymnotus may measure 6 feet in length, and has a very long tail, there is little wonder that its electric discharge is emphatically dangerous. The whole apparatus is supplied with more than 200 spinal nerves; one inch in length contains over 200 chambers (Günther). (*b*) In the African cat-fish, which is not uncommon in tropical Africa, and is represented by *M. electricus* in the Nile, the organ is more diffuse. It forms a sheath almost round the body, lying between the skin and muscles, but is thickest along the lower sides. The innervation is remarkable, for there is but one enormous nerve for each side. This arises from a giant cell high up on the spinal cord, and distributes branches throughout the body. The fish is again very long, measuring about 4 feet, and ranks second in the series. (*c*) In the Electric Rays (Torpedo), which occur in the Atlantic and Indian oceans and in the Mediterranean, the organs are broad, bounded by the gills, the pectoral fins, and the head. The prisms, of which there are many hundreds in each battery, lie vertically, not longitudinally as in the two preceding cases; and the nerves, instead of coming from the spinal cord, arise directly from the brain. Four of the five principal nerves on each side 'are each as thick as the spinal cord.' It is noteworthy that the above electric fishes have all smooth skins.

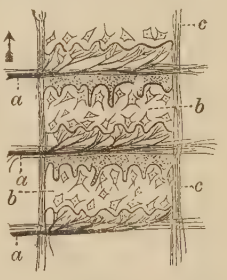


Fig. 2.—Section through Electric Chambers (greatly enlarged and semi-diagrammatic, from Wiedersheim and Parker): *a*, nerve breaking up into fibres; *b*, electric plates; *c*, connective-tissue walls of compartments.

Fig. 3.—Electric Prisms of Torpedo.

Function.—How the 'electric plates' come to be charged with electricity is not yet elucidated. The currents have all the usual characteristics of electricity: 'they render the needle magnetic, decompose chemical compounds, and emit the spark' (Günther). 'The side of the electric plate on which the nerve branches out is negative at the moment of discharge, while the opposite side is positive, and from the different arrangements of the parts the electric shock passes in different directions in the three fishes—in Malapterurus from the head to the tail, in Gymnotus in the contrary direction, in Torpedo from below upwards' (Wiedersheim and Parker). The activity of the organ is wholly dependent (*a*) upon nerve stimulus from the brain, and (*b*) upon a certain degree of freshness in the structure itself. If the connection with the brain be severed, no discharge can be produced, except of course by the artificial stimulus of the severed nerves. Or if numerous rapidly repeated discharges have been already evoked, the organ is exhausted, and requires rest and recuperation before it becomes again functional. Humboldt's graphic story of the capture of electric eels by letting them first exhaust themselves in attacking horses has never been confirmed. In natural life the strength of the shock varies with the degree of development reached by the organ, with the size, health, and humour of the fish, and with the amount of reserve energy within the structure. A ray measuring 2 to 3 feet in width is 'able to disable by a single discharge a full-grown man,' and yet the ray is the least powerful of the three. To receive the shock the

object must complete the circuit by a double contact with the fish either directly or through some intervening substance. When well developed, the organ may be useful to the fish in two ways—in paralysing or killing other fishes used as food, and in warding off the attacks of enemies.

The electric ray and eel were known to the ancients, and were used for curative purposes, 'the earliest electric machines employed by mankind.' Scientific research on the electric organs really began with Walsh's demonstration (1772) of the genuinely electrical character of the discharge. The subject has been much worked at by some of the ablest anatomists and physiologists, and certainly is not yet finished. The origin of the organs, useless when incipient, and the connection between this peculiar development and the ordinary electrical properties of muscle and nerve are unsolved problems.

See MUSCLE, NERVOUS SYSTEM; Günther's *Introd. to the Study of Fishes* (1880); and the works on comparative anatomy by Gegenbaur (trans. 1878) and Wiedersheim (1897). The best recent account of the production of electricity by living creatures is by S. Garten in Winterstein's great *Handbuch der Vergleichenden Physiologie* (Jena, 1910–14).

Electric Furnace, an apparatus consisting mainly of two carbon poles meeting in a crucible, and connected with a suitably powerful electric current. The electric furnace is capable of producing prodigious heat, and of reducing otherwise very intractable substances.

Electricity.* If a stick of sealing-wax is rubbed vigorously with woollen cloth it will be found capable of attracting small shreds of paper. This is the simplest experiment in electricity. Many other substances, such as resin, vulcanite, glass, &c., can be made to show the same phenomenon. To obtain the best effect with any given substance, a particular rubber must be chosen. For example, a cat's fur, slightly warmed, is very efficient in electrifying vulcanite or resin; while silk, amongst simple substances, should be used to excite glass. It is now known, however, that any two different substances, which can be rubbed together, become electrified by the friction. Thus, if wax and glass are rubbed together, they will both become electrified—i.e. capable of attracting light objects. And so, in the other instances, it can be shown by experiment that the cloth is electrified as well as the wax, the cat's fur as well as the vulcanite, the silk as well as the glass. Moreover, the two substances so electrified by mutual rubbing are found to attract one another, being indeed *oppositely* electrified—a term which the following experiment will elucidate.

Let two pieces of glass be electrified by rubbing each with a distinct piece of resin. The pieces of resin will also be electrified, and it will be found (1) that the pieces of glass repel each other; (2) that the pieces of resin repel each other; (3) that each piece of glass attracts each piece of resin. Exactly the same phenomena of attraction and repulsion will be shown—only much more powerfully because of the greater efficiency of the rubbing—if the pieces of resin are rubbed with cat's fur and the pieces of glass with silk.

Again, let a small light body, a pith-ball for example, be suspended at the end of a silk thread. This will be attracted by either the resin or the glass. But if it is allowed to come into contact with, say, the resin, it will immediately be repelled by the resin and strongly attracted by the glass. And if it should be allowed to touch the glass, it will thereafter be repelled by the glass and strongly attracted by the resin. By such contact the pith-ball itself becomes electrified; for it will repel a second pith-ball similarly treated. We are thus led to the following conclusions. Repulsion exists between bodies which are similarly electrified, and attraction between bodies which are oppositely electrified. Bodies, electrified by mutual rubbing, become oppositely electrified. A body, electrified by contact with an electrified body, becomes electrified similarly to that body. Substances which like silk-rubbed glass repel silk-rubbed glass and attract wool-rubbed resin are vitreously or *positively* electrified, while bodies which attract silk-rubbed glass and repel wool-rubbed resin are resinously or *negatively* electrified. The indication of the two kinds of electrification by opposite signs is very appropriate, but the application of the positive sign to one rather than to the other is a matter of convention and purely arbitrary.

To study electrical phenomena by means of metallic substances, it is necessary first of all to *insulate* them—i.e. to support them on glass, vulcanite, paraffin, &c., or to hang them by silk threads. The significance of the term insulation will appear from the following experiment. Hang two metal balls, one by a silk thread and the other by a wire, and touch them with a piece of wax strongly electrified by friction. On trial, the silk-suspended ball will be found electrified; but not so the wire-suspended ball. Thus we recognise two kinds of substances—viz. *insulators* and *non-insulators*. The latter are usually called *conductors*, and include all ordinary metals. Such conductors can be made to show electrification only when they are insulated.

When a body is sufficiently strongly electrified and brought very near another body originally unelectrified, a spark will pass between them even before they are made to touch. If this second body is the finger or knuckle, the spark will be accompanied by a peculiar sensation called an electric shock. Now let us take such a highly electrified conductor A, and bring pretty near to it a second insulated conductor B, but not so near as to cause a spark to pass. If, then, the finger be brought near enough to B a shock will be felt, a spark will pass between B and the finger, although B was originally not electrified. Thus B has become electrified by being brought into the neighbourhood of A. This mode of electrification is called electrification by *induction*. As Faraday clearly pointed out, it 'has the character of a first, essential, and fundamental principle,' and its thorough comprehension is of prime importance.

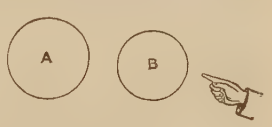


Fig. 1.

As it is our purpose to regard the whole subject from the Faraday point of view, it will be convenient to define certain useful terms. The *electric field* is any region of air, glass, vulcanite, or other non-conducting substance surrounding or containing electrified bodies. In it and through it the electric forces act; hence it is convenient to call such insulating substances *dielectrics*. To investigate the properties of an electric field it is generally necessary to bring into it a conductor, as in the experiment just described. In that experiment the induced electrical condition of B was studied by means of physiological sensation, partly optical, partly muscular. A far better way, however, of studying the phenomena of induction is to make use of the fundamental laws of attraction and repulsion between electrified bodies, as they are mechanically applied in such instruments as the gold-leaf electroscope, Coulomb's torsion balance, Thomson's (Kelvin's) quadrant electrometer, &c.

In the gold-leaf electroscope (invented by Bennet

* The word *electric* was coined by William Gilbert. See AMBER.

in 1787), two light strips of gold-leaf hang from the lower end of a metal rod, which passes vertically through an opening in the top of a glass bottle and expands above into a plate. If a piece of rubbed sealing-wax or other electrified body be brought near the plate, the gold-leaves will repel each other and diverge. In other words, the conductor, consisting of the plate, rod, and gold-leaves, has been introduced into an electric field, and has in consequence become electrified by induction. This is shown by the repulsion between the similarly electrified gold-leaves. The nearer the electrified body is brought, the stronger is the electric field surrounding the electroscope, the wider do the gold-leaves diverge. Here evidently the repulsion tends to lift the centre of gravity of each gold-leaf, and is finally balanced by the action of gravity. A cylinder of wire gauze, placed just inside the glass case, improves the action of the instrument. In another form of gold-leaf electroscope there is only one gold-leaf, the place of the other gold-leaf being taken by the continuation downwards of the rod to which the gold-leaf is attached. On electrification the single gold-leaf is repelled outwards from the rod towards another conductor which is kept in connection with the earth. Many sensitive forms of this type of electroscope have been constructed within recent years for the study of radio-activity and ionisation. The position of the gold-leaf, projected against a micrometer scale, can be measured with great accuracy, and quantitative results obtained with remarkable ease.

Fig. 2.

In Coulomb's torsion balance the force with which one small charged sphere is repelled by another similarly charged is balanced by the torsion of a wire, which acts as suspension to a horizontal insulating rod bearing the one sphere at one of its ends. By means of this apparatus Coulomb showed, in 1785, that two small charged balls repelled each other with a force which diminished as the square of the distance increased. By assuming that the force between two charges, e, e', on two small spheres is measured by the expression ee'/r^2, where r is the distance between the spheres, we obtain the definition of charge—the unit charge being such that when at unit distance from an equal charge it is repelled with unit force. This formula is the foundation of all quantitative measurements in electrostatics. The completely general expression is ee'/kr^2, where k is the dielectric constant or specific inductive capacity of the medium through which the force is being exerted.

Kelvin's quadrant electrometer consists of four hollow brass quadrants, which when fitted close together form a squat hollow cylinder bounded above and below by parallel plane faces. For electrical purposes they must, however, be drawn a little apart, so that when looked at from above or from below they have the appearance as shown in fig. 3—viz. that of a circular disc with two mutually perpendicular diametral clefts. Each quadrant is insulated on its own glass support; but each is joined to its opposite by a wire, A to A′ and B to B′ in fig. 4, so that electrically they go in pairs. From one of each pair a vertical rod leads to the outside of the case in which the whole is enclosed. These rods are called the *electrodes*, and their function is to bring the pairs of quadrants into electrical connection with external bodies. The inside corner of the top and bottom of each quadrant is cut away, so that at the centre a small circular space is left concentric with the external cylindrical surface of the quadrants. In the hollow space enclosed by the quadrants a light charged body (E in fig. 3, u in fig. 4) of a convenient shape hangs, its axis of suspension passing up through the circular central space just mentioned. The light body can rotate about this vertical axis only, and its motion is controlled by the torsion of the suspension. If the four quadrants are all connected together, the suspension makes the light body hang so as to lie with its longer axis of symmetry parallel to one of the diametral clefts separating the quadrants. If, however, the pairs of quadrants are disconnected, and by connection with external bodies brought into different electric conditions, electrical forces will at once act upon the charged body and rotate it until they are balanced by the resisting torsion of the suspension. The motion is shown and measured by means of a beam of light reflected from a small mirror fixed to the vertical axis of suspension of the body and moving with it.

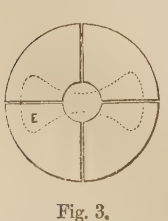


Fig. 3.

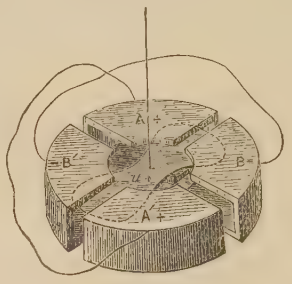


Fig. 4.

In the following experiments we shall suppose that all the conductors are of one metal, say brass; that they are at the beginning of every experiment insulated and unelectrified; that the electroscope or electrometer quadrants are likewise unelectrified at the beginning of each experiment; and that the dielectric is air.

Experiment I.—Set a cylindrical brass vessel on the electroscope; and let down into it, without coming into contact with it, a positively charged conductor A. It is convenient to hang this charged ball at the end of a short silk thread from the lid of the vessel, the lid itself being lowered or raised by means of a silk thread. As soon as the ball is brought inside the vessel the gold-leaves will diverge, as shown in fig. 5; and the vessel B, as regards outside objects, will behave as if positively electrified. Now touch B with the hand or with any non-insulating material connected to earth—in technical language, put the vessel to earth—and the gold-leaves will fall together, and all appearance of electrification will be destroyed. Remove the earth connection so as to insulate B once more, and lift away the lid and the attached ball, care being taken to prevent A coming in contact with B. The gold-leaves will again diverge, and the vessel B will be found to be negatively electrified.

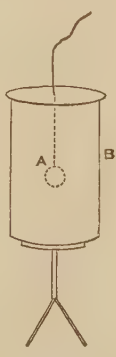


Fig. 5.

The nature of the charge on the vessel and gold-leaves is indicated at once by the approach of an electrified body. If a piece of rubbed sealing-wax or any negatively charged body is brought near, the gold-leaves, if

negatively electrified, will diverge still more; if positively electrified, will tend to fall together.

In thus charging the vessel B negatively by induction, we have in no way diminished the original positive charge on A; and we may use this same charge an indefinite number of times in charging negatively other bodies like B. In each body so charged by induction we have a new-formed source of energy, which has been derived from the energy spent in separating against their mutual attraction the positively charged ball and the negatively charged vessel.

Experiment II.—Begin again as in Experiment I., introducing the charged ball A into B, and putting B to earth, so that the gold-leaves fall together. Now connect A with B. No effect will be observed on the electroscope, even though, as in the former experiment, A should be removed. Thus the charge on A has been completely destroyed; hence there must have been on B, just before the contact was made, an equal but opposite charge. This is, in fact, the very charge which made its presence evident when, in Experiment I., the ball A was removed.

Thus, if a charged body A be completely surrounded by a closed vessel B, which is put to earth and then insulated, the charge induced on B is equal and opposite to the charge on A. To make this induced charge apparent we must remove A.

Experiment III.—Repeat Experiment I., and after having charged B negatively by induction, introduce A into another conductor C, initially without charge and insulated. If C also is resting on a gold-leaf electroscope, the gold-leaves will diverge with positive electrification as in the earlier stage of Experiment I. Bring A into metallic connection with C. If C *completely* surrounds A, no change will be observed on the electroscope, although a spark may be heard at the instant the contact is made. The ball A, if removed without again coming in contact with C, will be found to have lost all its charge; and if B and C are brought into metallic connection, all appearance of electrification on them also will be destroyed. In other words, the negative charge induced on B has been quite destroyed by union with the positive charge transferred to C. These charges, therefore, must be equal and opposite. Thus the charge originally on A has been wholly transferred to C.

We conclude, then, that when a conductor is electrified, its electrification resides wholly on the surface. Any portion of it removed from the inside will be found unelectrified if taken quite out of the influence of other electrified bodies.

This experiment, or one very similar to it, was performed in 1766 by Priestley, and in 1772 by Henry Cavendish, both of whom deduced from it that 'electric attraction and repulsion must be inversely as the square of the distance.'

Experiment IV.—To study in greater detail the properties of the electric field around a given charged conductor B, take two small insulated spheres and connect them by thin wires to the electrodes of the electrometer, each to one. Suppose these spheres to be at first in close contact at some part of the field; then, since the pairs of quadrants are in the same electrical condition, the electrometer will show zero deflection. Now gently separate the spheres, both insulated of course, and in general a deflection to the right or to the left will be obtained on the electrometer. By trial we may find the unique direction of separation which, for a given distance of separation, gives the maximum deflection. It will be found, however, that a separation of the spheres in directions at right angles to this unique direction does not cause any deflection on the electrometer. It is easier, indeed, to find the directions of separation for which there is no deflection than to find the direction of maximum deflection for a given separation. Suppose in fact that the one small sphere is fixed in position, and that the other, which we may call the exploring sphere, is moved away from contact with it in such a manner that the electrometer always shows zero deflection. The centre of the exploring sphere will describe a curve, and can be made by successive trials to describe an infinity of curves, all lying on a certain surface which passes through the centre of the fixed sphere. We shall call this the surface S. Now, with the exploring sphere on this surface, let the fixed sphere be shifted in towards B till the electrometer deflection is unity. Then shift the exploring sphere correspondingly until the deflection is brought back to zero again, and proceed as in the first position to trace out a second surface, which we shall call S + 1, and which will pass through the centre of the fixed sphere in its second position. Shift the fixed sphere once more till unit deflection is obtained, follow up with the exploring sphere, and trace out the third surface S + 2. In this way, step by step, the electric field may be supposed to be mapped out by a series of surfaces, differing in value by unity as measured on the electrometer scale. We may pass out to the surfaces S − 1, S − 2, S − 3, &c., as well as in to the surfaces S + 1, S + 2, S + 3, &c. If the electrodes of the electrometer terminate on any one of these surfaces there is no deflection; if they terminate on different surfaces the deflection is the difference of the name-values of the surfaces. Evidently the conductor B is such a surface, for if the electrodes terminate on it, all the quadrants, being in metallic connection, will be in the same electrical condition, and the electrometer will show no deflection.

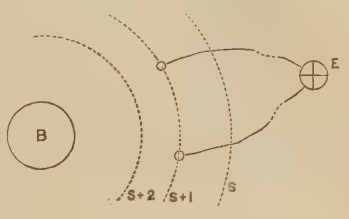


Fig. 6.

The surfaces we have just described are called *equipotential* surfaces, the term potential having in electricity much the same import as temperature has in heat or pressure in hydrodynamics. When a channel exists between two masses of fluid at different pressures, fluid will flow from where the pressure is higher to where it is lower. Similarly if we have two charged conductors whose electrical conditions as tested by electroscope or electrometer become changed after they have been connected by a wire and disconnected again, these two conductors are said to have been at first at different potentials. If they had been connected to the electrodes of the electrometer, each to one, the electrometer would have shown a deflection; and this deflection would have been a measure of the difference of potential. If the difference of potential is great, then the contact of the two conductors is evidenced by an obvious electrical discharge in the form of a visible audible spark.

Within an electric field we may suppose traced out, after the manner of the last experiment, a series of equipotential surfaces. To fix our ideas, let the one conductor be completely enclosed within the other—say a spherical globe within a concentric spherical shell—and let this outer shell be put to earth, and let us call its potential zero. The electric field exists only in the region between the shell and the globe, which we shall suppose to be at a high potential V. The symmetry of the system requires that the other equipotential surfaces will all be spheres concentric with the globe and shell. Now

we may compare this electrical system of globe, shell, and intermediate equipotential surfaces to a system of Contour (q.v.) lines representing a hill

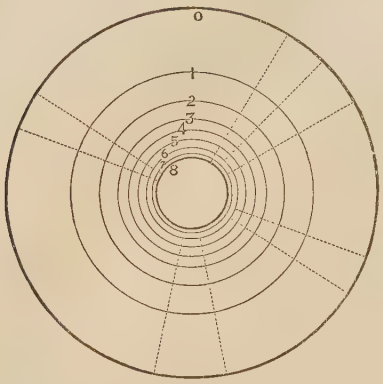


Fig. 7.

with a flat top rising up from the sea-level—the successive equipotential surfaces in the electrical system corresponding to successive equal-level lines in the geographical system. To carry one pound of matter from the sea-level up to the top of the hill requires so much work to be done against gravity (see ENERGY), and this amount of work is proportional to the height lifted through—i.e. to the number of contours crossed. So, in the electrical system, to carry a small positive charge from the shell to the globe will require so much work to be done against the electrical forces, and this amount of work will be proportional to the number of equipotential surfaces crossed. Further, exactly as the pound of matter taken to the top of the hill will add to the height of the hill, so will the addition of this small extra charge to the globe increase its potential.

We have assumed in the above discussion that the successive equipotential surfaces, experimentally determined by means of the quadrant electrometer, are really such that the work done in carrying a given small charge over the interval separating any two contiguous surfaces is the same. It is usual in treatises on the subject to begin with the dynamical definition of the potential at a point as the work done in carrying a unit of positive electricity from infinity to that point. It is then shown that the quadrant electrometer is an instrument so constructed as to fit in to this definition.

Assuming, then, that our equipotential surfaces have the property just mentioned, we are in a position to study the energy relations of the electric field.

Coulomb established by experiment that the force of repulsion between two similarly charged bodies was directly as the product of the charges. Hence, as the charge of the globe enclosed in the shell is increased, the electric forces in the field increase in the same proportion. Hence the work done in carrying a given charge from the shell to the globe against the electric forces increases in the same ratio. In other words, the number of equipotential surfaces in the field grows uniformly with the charge. If the potential of the globe is V, we may write the charge CV, C being a constant so long as the geometrical dimensions of the system remain unchanged. Since the shell is always kept connected to earth—i.e. at zero potential—there is a charge – CV distributed over the inside of the shell. To add a small extra charge to the globe may be regarded as equivalent to taking this small charge from the shell, carrying it across the dielectric, and distributing it over the globe. The work done in effecting this is evidently proportional to the charge taken and to the number of equipotential surfaces crossed. But as the extra charge is added, let us suppose, at a steady rate, the potential of the globe is increased at a proportional steady rate. Hence the whole work done in adding a given charge is equal to the product of the charge and the mean potential of the globe during the operation. Thus, in charging the globe from zero potential to potential V, we do an amount of work equal to half the product of the final potential V into the final charge CV—in symbols $\frac{1}{2}CV^2$ or $\frac{1}{2}QV$ or $\frac{1}{2}Q^2/C$, where Q is the charge, and C the constant which depends on the geometrical dimensions of the system.

We have already seen that positive and negative electrifications always coexist—that it is impossible to generate a given positive charge without at the same time generating as much negative charge. Faraday took implicit account of this truth in his conception of lines of electric force traversing the dielectric. Since no work is done against the electric forces in passing along an equipotential surface, we readily see that the electric force at any point is perpendicular to the equipotential surface there. If, starting from any point, we move always perpendicular to the equipotential surface through which we are for the moment passing, we shall describe a curve which at every point of it is tangential to the direction of the electric force there. Such a curve is called a Line of Force. Take any small area on an equipotential surface, and draw lines of force through its perimeter. These lines of force will form a so-called Tube of Force, whose section in general will vary as we pass along it. Following this tube of force backwards to its source, we shall finally come to a positively charged conductor; and following it forwards, we shall ultimately come to a negatively charged conductor. Every such tube of force has, in short, two ends. It springs perpendicularly from a positively charged area, and terminates, also perpendicularly, on a negatively charged area. According to Faraday's view, and to the view now generally accepted, it is along these tubes of force that electric induction takes place; so that the negative charge on the terminal area is exactly equal to the positive charge on the area from which the tube springs.

Suppose, now, that in the region between the globe and shell of fig. 8 an insulated conductor originally unelectrified is introduced; or, what comes to the same thing, suppose a marked-off region in the electric field to become conducting, this region will at once be reduced throughout to the same potential, and its surface will form part of an equipotential surface. But, since originally the potential in this region fell steadily as we passed outwards from the globe, a transference of charge must have taken place also outwards in order that the potential should become equalised throughout. The introduced conductor, in fact, acts as a channel along which electrification is transferred; so that, if tested, the end facing the globe will be found negatively electrified, and the farther end positively electrified.

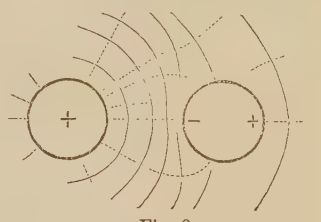


Fig. 8.

Now it is evident that the introduction of this conductor into the field has very much changed the configuration of the equipotential surfaces in its vicinity, the new configuration being something

like what is indicated in the diagram (fig. 8). As a consequence, the tubes of force, which are necessarily perpendicular to the equipotential surfaces, must also suffer a corresponding change of configuration. A certain number, springing from the globe, will fall perpendicularly on the nearer part of the introduced conductor, while from the farther part an equal number of tubes of force will spring and continue outwards to the shell. Where the tube ends on a conducting surface, there we find unit negative charge; and where it springs from a conducting surface, there we find unit positive charge.

Generally speaking, the effect of the presence of the introduced conductor is to crush the tubes of force in the neighbourhood closer together, and therefore (since this number remains constant) to compel an expansion of them elsewhere. The terminals of the tubes on the globe will obey the same tendency towards concentration and expansion. In other words, the charge Q, at first distributed uniformly over the globe, becomes redistributed and tends to accumulate on the side facing the conductor. The nearer the conductor and globe are brought, the greater will this tendency be; and at last, when they are near enough, the dielectric is unable to sustain the high electric tension along the ever-shrinking tube of force. It yields, a more or less sudden transference of charge takes place in the form usually of a spark, the potentials of the globe and conductor are practically equalised, and the tubes of force between them are annihilated. This is the phenomenon which is exhibited on a large scale in every lightning-flash, and on a small scale in every spark between electrified bodies.

Suppose, however, that before this catastrophe has taken place the conductor is joined by a wire to the surrounding shell, and consequently brought to zero potential. All those equipotential surfaces which at first enclosed the conductor—i.e. lay between it and the enclosing shell—will be shifted so as to lie between it and the globe. The tubes of force will shift correspondingly; and as no tube can now pass from the conductor to the shell, none will spring from it. Hence the charge on the conductor will be wholly negative. Now experiment shows that when the conductor is brought to zero potential in the way just described, a spark always passes at the instant the connection is made. This spark means so much energy in the form of light, sound, and heat, and must therefore mean a disappearance of energy in some other form. This cannot be other than electrical energy. But the charge on A has not changed, so that the number of tubes of force is exactly as before. The change must therefore be in the potential difference along the tubes of force; and since the shell and the conductor are at zero potential, the diminution must take place in the potential of A. Thus we see that the potential of a positively charged body is diminished if a conductor at zero potential is brought near it.

This result leads naturally to the discussion of *capacity*. The capacity of a conductor is measured by the ratio of its charge to its potential. Hence if, as in the experiment just described, we have a diminution of potential with constant charge, this is equivalent to an increase of capacity. The greater the capacity of a conductor, the greater the charge it can hold at a given potential. Hence if a number of conductors are at the same potential, the charges must be distributed amongst them directly as the capacities. The experiment just described shows how we may arrange matters so as greatly to increase the capacity of a given conductor. It is sufficient to have close to it another conductor at zero potential. Such an arrangement of conductors is called an *accumulator* or *condenser*; and the most familiar form of accumulator used in electrostatic experiments is the Leyden jar, so called from the city where, in 1745, its properties were accidentally discovered by Cunæus. About the same time, possibly a month or two earlier, almost exactly the same discovery was made by Kleist at Kammin in Pomerania. In its modern form, a Leyden jar is a cylindrical glass bottle, lined inside and outside with metal foil up to within a short distance from the top. A brass rod connected below with the inside coating passes upward through the cork or stopper, and terminates generally in a ball or knob. A Leyden jar, then, consists essentially of two conductors, the one almost completely enclosed in the other, and separated from it only by the thickness of the dielectric. If either conductor is put to earth, and the other insulated and charged, an opposite and nearly equal charge is induced on the former. If we could completely surround the one conductor by the other, the induced charge would, as we have seen, be exactly equal but opposite to the inducing charge. Leyden jars are indispensable for carrying out illustrative experiments in electricity.

Fig. 9.

The essential nature of the mode of action of an accumulator or condenser may be illustrated as follows: Take any charged conductor with its associated electric field. Let Q be its charge, V_0 its potential, so that $\frac{1}{2}QV_0$ is the measure of the electric energy stored up in the field. Having fixed our attention upon any equipotential surface V_1 enclosing the conductor, let us suppose this surface to become conducting. There will be no transference of charge over this surface, because it is from the very beginning an equipotential surface. There will be no change of the electric field either inside or outside the surface V_1; but these two regions will now be separated by a conducting surface. So far as the outside region is concerned, we may regard the charge Q as distributed over a conductor coextensive with the conducting surface V_1, and may quite disregard the existence of the original conductor at potential V_0. The electrical energy stored up in this outside region is therefore a $\frac{1}{2}QV_1$. Let us now connect this new-formed conductor to earth so as to reduce it to zero potential. By so doing we discharge the conductor, completely destroying the electric field outside of it and the $\frac{1}{2}QV_1$ units of electric energy stored up in it. This therefore is energy lost to the original system; and the energy stored up in the dielectric separating the two conductors becomes a $\frac{1}{2}Q(V_0 - V_1)$. Now, since the enclosing conductor has been reduced to zero potential, the quantity $(V_0 - V_1)$ must represent the new potential of the enclosed conductor.

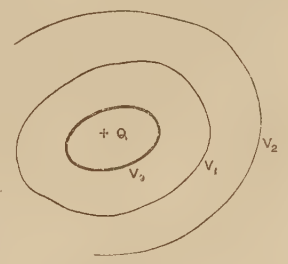


Fig. 10.

In short, the bringing of the enclosing conductor to zero potential, being a purely external electrical change, has in no way altered the *configuration* of the equipotential surfaces and tubes of force inside; it has simply *reduced the potential values* throughout by the same amount—viz. the potential of the enclosing conductor before it was put to earth. The potential of the enclosed conductor has fallen from V_0 to $V_0 - V_1$; and hence, as the charge Q has

remained unchanged, the capacity has increased in the ratio $V_0 - V_1 : V_0$. Thus, with either conductor fixed in size, the capacity of the system grows greater and greater as the thickness of the separating dielectric is diminished. It is easily shown that for a condenser built up of closely opposed surfaces, whether plates or cylinders, separated by a given dielectric, the capacity varies inversely as the thickness of the dielectric.

Let a sphere of radius a be charged with Q units of electricity; then, according to Newton's well-known theorem, the electric force at distance r due to this distribution is Q/r^2. Hence at a point close to the surface of the sphere the force is Q/a^2. The surface density on the conductor, or charge per unit area, is $Q/4\pi a^2$, and this may be written $F/4\pi$, where F is the electric force. Thus the electric force at a point close to the sphere is equal to 4π times the surface density.

This important relation has been established for the sphere, but it may be easily generalised for any form of conductor. Whatever form the conductor may have, the electric force in the interior is zero, the charge distributing itself in such a way as to effect a balance at all interior points. When the conductor is elongated in form this consideration requires that the surface density is greater at the ends than anywhere else; and, generally, the charge tends to accumulate towards pointed parts of a conductor. It is in the neighbourhood of such regions that we find the strongest electric forces.

This accumulation of electric charge towards the ends of a pointed conductor is well exemplified in the lightning-conductor, which is simply a very elongated piece of metal in contact with the earth. A charged body of air, such as we have accompanying a thunder-cloud, passes near it. The tubes of inductive force are at once concentrated on the elongated conductor; the electric force at the point becomes so intense that the air can no longer act as a perfect insulator; electrical discharge takes place along these very tense tubes of force; and in a more or less gradual manner the cloud is robbed of its charge, and the evil effects of a sudden lightning-flash minimised. On the same principle, electric discharge through air is facilitated by the use of pointed conductors, such as the combs which are so important a detail in machines for generating electricity by means of friction.

We have seen that the capacity of a condenser depends upon the distance between the surfaces or plates which compose it; it also, however, depends very materially on the nature of the dielectric. Suppose, for example, that we have a series of condensers, made of the same conducting material, and all exactly equal as regards their geometrical and space relations, but all differing as regards the dielectric which separates their plates. Thus let one have air as its dielectric, another plate-glass, another paraffin, another mica, and so on. Let them now all be brought to the same potential, then disconnected and tested as to charge. The charges will be found to be all different—being in the four cases we have mentioned approximately proportional to the numbers 1, 6, 2, 6.6. These four numbers are the values of what is termed the *specific inductive capacity*, or dielectric constant, of air, glass, paraffin, and mica. Thus by merely inserting a plate of mica between two plates of an air condenser, we increase the capacity by as much as if we had approached the plates in air through a distance equal to ·85 (=5·6/6·6) of the thickness of the mica.

We may now fitly consider the principles of action of the various machines that are used for generating electricity. The rubbed pieces of resin, sulphur, glass, &c. were gradually succeeded by spheres, cylinders, and circular plates of these materials, which, as they revolved against prepared rubbers, were kept in a constant state of electrification. Any insulated conductor brought near enough to a portion of such a cylinder or plate at a distance from the rubber will become charged, the dielectric strength of the air breaking down exactly as in the case of the lightning-conductor and the thunder-cloud. Such is the action of the ordinary frictional machine; obviously the conductor acquires a charge similar to that on the revolving cylinder or plate. The opposite charge on the rubber may be transferred to another conductor, which is usually put to earth. Le Roy's or Winter's plate machine is shown in the diagram (fig. 11).

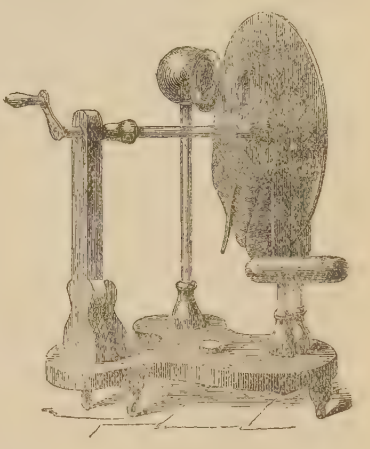


Fig. 11.

Essentially different in its action is the electrophorus, invented by Volta in 1771. In its most improved modern form it consists of two plates, one of metal, and the other of resin, vulcanite, or ebonite backed with metal. Insulating handles can be screwed on to the backs of the plates; and one plate at least must be so insulated. The surface of the ebonite is first electrified by friction, and the metal plate is brought into close contact with it. The metal plate, from its greater proximity to the negatively charged surface of the ebonite, will be at a lower potential than the metal back to the ebonite. If these are then brought into contact—conveniently effected by means of a metal pin passing through the ebonite—a transference of charge will take place, so that the metal plate when lifted away will be found positively charged.

In Nicholson's 'revolving doubler' we have the parent form of a number of rotatory machines which, like the electrophorus, depend for their action upon induction and convection. They make direct use of the principle of 'doubling' discovered by Bennet, by which the difference of potential between two conductors is indefinitely increased. Kelvin's replenisher, which is an important part of the quadrant electrometer in its perfected form, is perhaps the simplest and most compact of these machines. In it a turning vertical shaft of ebonite bears, at the ends of a horizontal cross-piece of ebonite, two metal pieces called carriers (*cc* in the diagram, which represents a horizontal section). These carriers rotate in the region between two insulated metal inductors (a, b) in the form of cylindrical segments. When the carriers are in position AB, they come into momentary contact with delicate springs attached to the neighbouring inductors; and when they are in position CD, they come into momentary contact with delicate springs connected by a metallic arc which is quite insulated from the inductors. Suppose a to be at a higher potential than b, and consider what takes place as *cc* rotates counter-clockwise, as shown by the arrows in the figure. In the position AB the carriers are well surrounded by the metal shields, and will part with nearly all the charge that may chance to be upon them. Just before they come

into contact with the springs in position CD, the two carriers are at different potentials. Hence at the moment of contact with the connecting springs, a transference of charge will take place from the carrier near a to the carrier near b. The former will thus acquire a negative charge, and will move on till it comes within the inductor b, to which it will give up nearly all its negative charge; while the latter will simultaneously give up nearly all its positive charge to a. Thus every complete revolution each carrier becomes once negatively charged and once positively charged, giving up its negative charge to the one inductor, and its positive charge to the other.

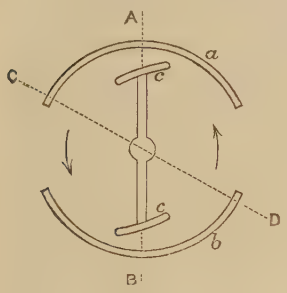


Fig. 12.

The same principles of induction and convection are made use of in the so-called influence machines, which in recent years have quite eclipsed the older frictional machine. These are generally known by the name of their inventors, such as Töpler, Holtz, Bertsch, Voss, and Wimshurst. Of these, the Wimshurst is one of the best known. It consists of two circular glass plates, mounted on a common spindle, and capable of rotation in opposite directions with equal speeds. Each plate carries twelve or sixteen strips of thin sheet-metal, fixed radially at regular intervals apart. These strips lie on the outside of the closely opposed glass plates. At the extremities of the horizontal diameter of the plates the main conductors are placed, insulated on glass or vulcanite pillars. Horizontal arms with the usual combs project inwards, embracing both plates as far as the inner ends of the metal strips. In front is fixed a diagonal conductor, called a 'neutralising rod;' and a similar rod is fixed behind at right angles to the one in front. These neutralising rods terminate at both ends in a small metal brush, which touches the metal strips or carriers as they pass. By this contact of brushes and strips, every strip on either plate is, very soon after it has

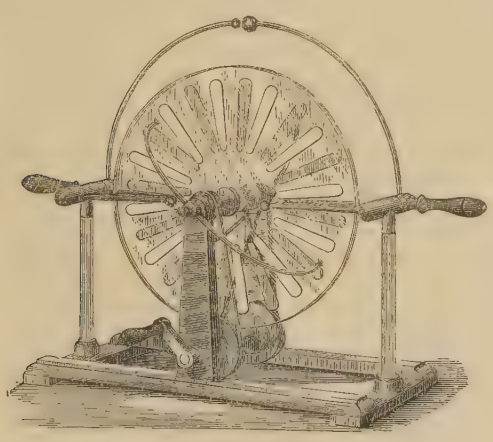


Fig. 13.

passed under the collecting combs, brought into metallic connection for a moment with the strip diametrically opposite it on the same plate. Suppose the principal conductors to be at different potentials; then—exactly as in Thomson's replenisher—the carriers as they leave the brushes of the neutralising rod will acquire a charge, negative or positive, according as they are nearer the positively or negatively charged main conductor. But, evidently, each carrier on the one plate will act as inductor to the carriers on the other plate; and a moment's consideration will show that this inductive action will everywhere accentuate the inductive action of the main conductors. Thus the positive conductor is being fed by the positive charges brought by the strips on the upper half of the one plate and on the lower half of the other; while the negative conductor is being fed by the negative charges brought by the strips on the lower half of the one plate and the upper half of the other. The main conductors are provided with arms, which reach out towards each other, and between whose terminal knobs discharge takes place.

So far we have confined our attention almost entirely to electrostatic phenomena—i.e. to phenomena connected with the existence of a steady electric strain in dielectrics. When compelled to deal with the transference of so-called charge from conductor to conductor, we had regard rather to the initial and final equilibrium conditions than to the intermediate condition of change. This condition of change, however, has clearly very important energy relations. In all cases of electrical discharge there is, in the language of Faraday, a concentration of the lines of force in a certain region of the dielectric, until that becomes, as it were, overstrained, and yields with a more or less evident appearance of part of the energy of strain in the form of light, sound, and heat. It can be shown that when a charge is allowed to pass from one conductor to another at a lower potential, there is always loss of energy, which is proportional to the square of the charge which passed.

Thus, let there be two insulated conductors of capacities C and C′, originally at different potentials. If they are brought to the same potential V by being connected by a thin wire of comparatively insignificant capacity, the original charges on the conductors will become redistributed, and the final charges will be CV and C′V. Whatever charge the one conductor has lost, the other has gained. Hence we may write the original charges as $CV + q$, $C'V - q$, where q is the charge which has been transferred from C to C′. Now the energy of any charged conductor is measured by half the charge into the potential or half the square of the charge divided by the capacity. Thus the final energy, after equalisation of potentials, is

$$\tfrac{1}{2}CV^2 + \tfrac{1}{2}C'V^2,$$

while the initial energy was

$$\tfrac{1}{2}\frac{(CV+q)^2}{C} + \tfrac{1}{2}\frac{(C'V-q)^2}{C'} = \tfrac{1}{2}CV^2 + \tfrac{1}{2}C'V^2 + \tfrac{1}{2}q^2\left(\frac{1}{C}+\frac{1}{C'}\right).$$

Hence, since $\frac{1}{2}q^2\left(\frac{1}{C}+\frac{1}{C'}\right)$ is always positive, we see that the initial energy is necessarily greater than the final energy. The loss of energy is represented by a quantity which is proportional to the square of the charge that has been transferred. If we look more closely into the significance of this quantity, we see that it represents the electrical energy of the system of two conductors of capacities C and C′ when they are charged each with q units of either positive or negative electricity; or, more particularly, it represents the work which must be done in carrying q units from the one to the other. This is an example of the general principle that the work done by the electric field

in compelling a transference or flow of electricity from one region to another is exactly equal to the work which must be done against the electrical forces in carrying an equal quantity of electricity back again.

It is convenient, especially when the flow of electricity is the subject of consideration, to use the term Electromotive Force instead of Difference of Potential. We may suppose it measured by means of the quadrant electrometer. Thus if the regions A and B are connected severally to the electrodes of the electrometer, the deflection will measure the electromotive force acting along any conducting channel which may be supposed to bring A and B into communication. The flow of electricity which this electromotive force compels will tend to bring A and B to the same potential; and in the ultimate vanishing of the deflection on the electrometer we have the evidence of such a flow having taken place. But we may suppose that, by some means, notwithstanding the conducting channel between A and B, their difference of potential is sustained, so that the electromotive force acting along the channel is kept constant. Then the electrometer will show a steady deflection, while at the same time a steady flow of electricity will take place along the channel. This flow, whose existence is indicated only indirectly by the electrometer, must be measured by some one of its direct effects.

These effects are conveniently grouped into physiological, thermal, chemical, and magnetic.

The electric 'shock,' experienced when the experimenter uses himself as a discharging conductor, is a familiar example of the physiological effect of an electric current. The electric discharge causes a muscular contraction. In 1786 Galvani observed that the limb of a frog, when touched simultaneously by two different metals in contact, was convulsed exactly as if subjected to an electric shock; and Volta, following up this observation, discovered in 1800 a new source of electromotive force which could sustain an electric current through a conductor for a lengthened period of time. From this dates the development of Galvanic or Voltaic or current electricity. The electric shock, however, depends upon *variations* in the amount of flow; a steady current produces no shock, except when it is beginning or ending.

In the electric spark there are thermal effects; and generally, since a transference of charge or flow of electricity means a loss of electric energy, an evolution of heat is a necessary consequence.

Towards the close of the 18th century the decomposition of water by an electric discharge was observed by Van Troostwijk and Deiman; while with Volta's electrical discoveries a new era in chemistry as well as in electricity was inaugurated.

None of these effects, however, give a ready method for measuring a steady electric current—i.e. the amount of electricity which is transferred across any section of the conductor in a second. For this we must go to the fourth group—viz. the magnetic effects of currents. This branch of the subject, which includes electro-magnetism, and as a consequence much of electro-dynamics, dates from 1820, when Oersted of Copenhagen discovered that every electric current tends to make a magnet set itself perpendicular to the direction of the current. To make the effect specially apparent, the wire conveying the current should be coiled again and again round the region in which the magnet is placed. The same current is thus brought again and again into the vicinity of the magnet, and has a proportionately greater effect. An instrument consisting of a coil of wire surrounding a magnet which is free to rotate in some plane passing through the axis of the coil is called a *galvanometer*. The coiled wire must be covered with gutta-percha, silk, or cotton thread, so that the contiguous coils may be insulated from each other; and, for ordinary purposes, the plane of the coil should contain the magnet when no current is flowing. We may suppose the magnet to be suspended horizontally under the influence of the earth's magnetic field; then the plane of the coil should contain the magnetic meridian (see MAGNETISM). The ends of the coiled wire are called the terminals of the galvanometer. When they are connected to conductors at different potentials, a current will flow round the coil of wire, and will indicate its presence by compelling the magnet to move out of its normal position of equilibrium. The tendency of the current in the coil is to make the magnet turn itself at right angles to the plane of the coil—i.e. to set itself along the axis of the coil, magnetic east and west. But this is resisted by the steady action of the earth's magnetic field. The result is a compromise, and the magnet is deflected from its normal position in the magnetic meridian through an angle which depends on the relative values of the current and the earth's magnetic force. Since the latter is practically constant, the angle of deflection will depend on the value of the current, being greater for the greater current.

In discussing the equalisation of potential in electrostatics, we purposely confined our attention to one metal only. The reason was simply because, in general, two different metals, or in fact any two different conductors, can never when in direct contact be at the same potential. The discovery of this fact we owe to Volta. Take, for instance, any four conductors BAXB, put them in series as in the figure, and connect the terminal members, which are of the same material, to the electrometer. According to the character of the conductors AXB, there may be, or there may not be, a deflection on the electrometer.

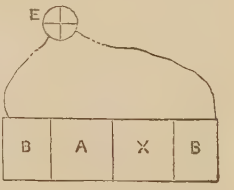


Fig. 14.

(1) If there is no deflection, the two B's are at the same potential; and yet, according to Volta's discovery, the three different substances are at different potentials. This may be shown at once by breaking the chain at any of the separating surfaces, when a deflection on the electrometer will be observed. During this act of separation the separating surfaces, one of which must of course be kept insulated, act like a condenser with a constant charge, the difference of potential changing because the capacity is changing. The reason why the B's are at the same potential is that, whatever be the differences of potential between B and A and between A and X, the difference of potential between X and B is always such as to restore B to its original value.

(2) If, however, there is a deflection produced on the electrometer, then we know that the two B's must be at different potentials, so that, if we connect them by wires to the terminals of the galvanometer, a current will be observed to flow. Such a combination of materials, in which two conductors of the same material are kept at different potentials by being linked together by at least two other and different materials, is called a voltaic or galvanic cell. If we join the two terminals either directly or by means of any other simple conductor, a current will necessarily flow round the circuit. But this current means a transference of charge from one conductor to another at a lower potential—i.e. a loss of electrical energy which is proportional to the square of the quantity transferred.

Hence, if, as is practically the case, the electromotive force or difference of potential remains fairly steady, it must be because electrical energy is supplied as fast as it is being lost. Consequently there must be in the circuit somewhere an original source of energy. In fact, it is found that a permanent electromotive force of the kind just described is always associated with a tendency to chemical action between two at least of the members of the chain; and that, when the circuit is complete and the current is flowing, chemical changes are going on within the cell.

There are innumerable forms of voltaic cells, built up in different ways of different materials. Copper and zinc dipping into dilute sulphuric acid is one of the simplest forms. When the cell is *closed*—i.e. when the copper and zinc are joined externally by a wire—a current will be obtained flowing in the wire from the copper to the zinc. At the same time the zinc will be dissolved in the acid; and it is from the energy set free by this chemical action that the electrical energy is derived. Such a single fluid cell is not, however, very steady in its action. We shall therefore take as a type of a good cell one of the class known as two-fluid cells; and of these we shall choose the Daniell cell. In its best form, the Daniell cell consists of copper and zinc plates dipping into saturated solution of sulphate of copper and semi-saturated solution of sulphate of zinc respectively—the liquids being also in contact but prevented from mixing by a porous septum. Connect the copper and zinc plates, or *poles*, as they are technically called, to the electrometer. A deflection will be produced which will measure the electromotive force of a Daniell cell when it is not being used for the production of currents—i.e. when it is *open*. We shall take this, provisionally, as our unit electromotive force, and we may suppose the electrometer scale graduated so as to show unit deflection when the poles of a Daniell cell are connected to the electrodes of the electrometer. The deflection is such as to indicate that the electrode connected to the copper is at the higher potential. Hence the copper is called the positive pole, and the zinc the negative pole.

Take now a second Daniell cell, connect its zinc to the copper of the first one, and connect the free poles to the electrometer. The electromotive force of the two cells so joined will be double that of one —i.e. equal to 2. And generally, when a number of cells are arranged in series (i.e. with the zinc of the first joined to the copper of the second, the zinc of the second to the copper of the third, and so on), the electromotive force of this battery, in terms of the electromotive force of one cell, is just the number of cells composing it. Theoretically there is no limit to the electromotive force obtainable by means of cells; practically the difficulty consists in keeping a large number of cells in good condition. With a large enough battery we can obtain effects in every way analogous to the effects produced with frictional electricity.

If, at the same time that the poles of a cell are connected to the electrometer, they are connected by stout short wires to the terminals of the galvanometer, the galvanometer needle will be deflected, while the electrometer deflection will be unchanged, or at the most diminished slightly. If thin long wires are substituted for the thick short connections, a very great diminution will be observed in the galvanometer reading, and perhaps a very slight increase in the electrometer reading, the apparent electromotive force of the closed cell approximating more closely to the electromotive force of the open cell. Thus we may alter the current at will by employing different lengths and different thicknesses of wires for transmitting the current; and yet the electromotive force between the poles of the cell is but slightly, if at all, affected. In other words, the current, as measured on a galvanometer, depends not only on the electromotive force acting along the channel, but upon some property of the channel itself—some property independent altogether of electromotive force.

This property we may indicate by either of two words — viz. Conductance or Resistance. These words denote contraries. Thus a body of small conductance has a great resistance, and a body of low resistance has a high conductance. Quantitatively, the one is the reciprocal of the other; and they are measured in terms of current and electromotive force by what is known as Ohm's Law, enunciated by Ohm in 1827. We now know (see *The Electrical Researches of the Hon. Henry Cavendish*, edited by Maxwell, 1879) that Cavendish had in 1781 established this law, and compared the resistances of iron wire and various saline solutions to electric discharge through them. He acted as his own galvanometer, and compared discharges by their 'shocks.' As regards the historical development of the science, however, it is to Ohm that we owe the full statement of the Law (1827). Since Ohm's day the law has been subjected to the severest experimental tests that the scientific mind could imagine, and has stood them all. It is really the basis of our whole system of electrical measurements. Ohm's Law in its modern form asserts that the resistance of a conductor is measured by the ratio of the electromotive force between its two ends to the current flowing through it. Thus, if E is the electromotive force as measured on the electrometer, and C the current as measured on the galvanometer, and if K, R measure the conductance and resistance respectively, Ohm's Law gives us these relations:

$$EK = C,\ E = CR.$$

The peculiar value of Ohm's Law lies in the fact that the measure of the resistance, though defined in terms of electromotive force and current, is always the same, so long as the physical condition of each conductor remains unaltered. The proportionality of current and electromotive force in a given circuit implies this.

If a steady current is flowing along a conductor of one kind of material, say a copper wire, the potential will fall off continuously as we pass along in the direction of the current. Let AB be the wire, and suppose the current to be flowing from A to B. Join B to one electrode of the electrometer; and let a wire from the other electrode be led to any point P on the wire. Then as the point of contact P is moved up towards A, the electrometer deflection will increase continuously.

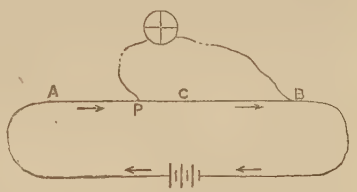


Fig. 15.

The measurement or, more strictly, comparison of resistances is one of the most important operations in the modern science of electricity. For this purpose we first choose a certain standard, say a particular length of a particular piece of wire at a certain temperature. It is obviously convenient to have a standard which can be exactly reproduced should the first standard be lost or in any way damaged. Hence scientific men of all nations have agreed to use as the unit of resistance or Legal Ohm the resistance of a column of pure mercury 106·3 millimetres long, of uniform cross-section, and of mass 14·4521 grammes, the temperature

being that of melting ice. This is the more practical way of expressing that the section should be a square millimetre.

Such a mercury standard, though fulfilling the very necessary condition of accurate reproduction, is not convenient for practical use. For this purpose copies of the ohm must be made in solid wires of some metal or alloy.

If we put any number of single ohms end to end in series, we shall get a whole resistance equal to as many ohms as there are conductors. This is easily shown to be an immediate consequence of Ohm's Law. For, since it is the same current that is flowing through all the single ohms, the fall of potential as we pass from beginning to end of any one is the same for all; hence the fall of potential as we pass along, say, three is three times the fall as we pass along one; hence, the current being the same for the three as for the one, the resistance of the three must be 3 ohms. A special case of this is that the resistance of a wire, otherwise constant in its physical relations, is directly as the length. The completely general statement is that the resistance of any single continuous channel is the sum of the resistances of its parts.

Suppose, however, that the single ohms are so arranged that they all begin at one point, A, in the circuit, and end at another point, B. Then it is clear that they must all be traversed not by the same current, but by equal currents. Hence there will flow into A and out of B a current equal to the sum of all these equal currents. Thus, if there are, say, three single ohms connecting A and B, the total current flowing into A and out of B must be three times the current flowing in any one of the branches. But for constant electromotive force the current is directly as the conductance, or inversely as the resistance. Hence the conductance of the threefold conductor between A and B is three times the conductance of any one of its components; or, otherwise, the resistance between A and B is one-third of an ohm. In like manner, the resistance of a wire, otherwise constant in its physical relations, is inversely as the area of its cross-section. The completely general statement is that the conductance of a multiple channel whose branches all begin at one point and end at another is the sum of the conductances of the branches. Conductors arranged in multiple arc in the way just described are generally said to be arranged *in parallel*.

Fig. 16.

The most obvious way of comparing the resistances of two conductors is to compare the deflections produced on a galvanometer when the conductors are inserted successively as part of a given circuit containing a constant cell and the galvanometer. But this method cannot attain a greater accuracy than is possible in reading the deflections; and the method is open to the further practical objection that the electromotive force of a cell varies slightly when the resistances of the circuit are changed. The comparison of resistances may, however, be effected by the method known as the Wheatstone bridge, without so much as a single measurement of either electromotive force or current.

Consider the case represented in fig. 17, in which the current from a battery is made to flow along two distinct channels from A to B. Along each the potential falls from its value a at A to its value b at B. Hence for any point P in the one branch there must be a corresponding point Q in the other which has the same potential, v, say. Let the points P and Q be joined to the terminals of the galvanometer, G. Because of the equality of the potentials at P and Q, no current will flow through the galvanometer, however strong the currents may be in APB and AQB. Thus, as no current flows between P and Q, the current in AP must be the same as the current in PB, and the current in AQ must be the same as the current in QB. Hence, by Ohm's Law, the resistances of AP and PB must be proportional to the electromotive forces acting along them—i.e. in the ratio $(a-v)/(v-b)$. Similarly the same ratio expresses the ratio of the resistances of AQ and QB. Thus the existence of no current in the galvanometer circuit—a condition which admits of the most delicate of tests—implies that the resistances of the four branches AP, AQ, PB, QB form a simple proportion, any one forming the fourth proportional to the other three properly taken. Two equal lengths cut off from a uniform wire have equal resistances. Let them be the branches AP, AQ. Let PB be the standard ohm. Then, by adjusting the length QB of a given wire till no current flows through the galvanometer, we obtain a copy of the ohm, accurate if the resistances AP and AQ are really equal to each other.

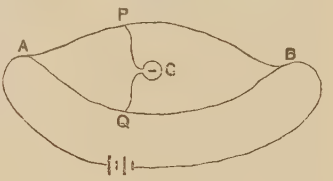


Fig. 17.

The resistance of metals increases with temperature; and this has led to the construction of what is known as the platinum thermometer, in which the resistance of a platinum wire, as indicated on a specially designed Wheatstone bridge and galvanometer, gives at once the temperature of the wire, and therefore of the region where the wire is. Recently Kamerlingh Onnes has found that at the temperature of liquid helium the conducting power of mercury, lead, and tin becomes suddenly so great as to render the resistance practically zero. When the metal is in this condition of supra-conductance, its conductance becomes markedly diminished when it is placed in a strong magnetic field greater than a certain critical value. In other words, when the resistance has become zero at a temperature of 2° or 3° Absolute, it recovers its finite value when the metal is placed in a strong enough magnetic field. That is to say, the influence of the magnetic field on the metal at very low temperatures is the same as a rise of temperature; both influences increase the resistance.

In non-magnetic metals at ordinary temperatures the effect of the application of a magnetic field is to increase the resistance or diminish the conductance. This is particularly in evidence when the magnetic lines of force are transverse—that is, at right angles to the direction in which the resistance is being measured. In the case of nearly all substances the change of resistance is very small, and is appreciable only in fairly strong magnetic fields. In the case of bismuth, however, the change of resistance in a transverse magnetic field is comparatively large; and the phenomenon has been utilised in the construction of a convenient apparatus for measuring strong magnetic fields. It consists of a flat spiral of bismuth, which when inserted into a strong magnetic field like the air-gap of an electro-magnet measures by its change of resistance the intensity of the transverse magnetic force.

The effect of magnetism in changing resistance is much more strongly marked in the magnetic

metals, iron, nickel, and cobalt; and there is the further peculiarity that in a transverse field the resistance of these metals is, in general, diminished, and not increased. When the magnetic force is applied along the direction in which the resistance is being measured, the resistance is, however, increased, as in the case of the non-magnetic metals. These phenomena have not as yet been wholly explained in terms of the electron theory of conduction.

The electrical resistance of substances is also affected by mechanical strain; but the effects are very small, and although of great interest in connection with electrical theory, they have no practical applications.

We have already seen that the passage of an electric current means a loss of electric energy. What becomes of this energy—i.e. into what other form is it transformed?—is a question which requires to be answered. It was early recognised that the electric current and electric discharge had a heating effect on the conductor along which the current flowed or the discharge took place; and in 1840 Joule published the important result that 'when a current of voltaic electricity is propagated along a metallic conductor, the heat evolved in a given time is proportional to the resistance of the conductor multiplied by the square of the electric intensity.' The heat so evolved fully accounts for the electric energy lost. Suppose we have an electromotive force E driving a current C through a resistance R. E is the measure of the work done in transferring unit of electricity along the channel. Now C is the amount of electricity transferred in a second of time. Hence the product EC measures the work done per second by the electromotive force in driving the current C. But by Ohm's Law

$$EC = RC^2;$$

and this is the very quantity which Joule showed appeared as heat in the wire.

If a very thin wire forms a part of a circuit, it is there that we shall best observe the effect of the heating. For the heat evolved per unit length of any conductor is directly as the resistance—i.e. inversely as the cross-section. But with the circuit all of one material, the rise of temperature is directly as the heat evolved and inversely as the mass heated; and the mass per unit length is directly as the cross-section. Thus the rise of temperature is inversely as the square of the cross-section—i.e. inversely as the fourth power of the diameter.

This is the principle of construction of the incandescent electric lamp, now so common a source of illumination (see ELECTRIC LIGHT). A thin filament of carbon is made to glow by the passage of a powerful current along it. To prevent the 'burning' away of the carbon in air, it is enclosed in a hermetically sealed glass vessel quite empty of oxygen.

So long as we are dealing with metals or simple conductors like carbon, the currents derived from the Daniell cells in the circuit do not appreciably change in value from the first instant onwards for several hours. If the currents are powerful enough, there will be slight diminution during the first few minutes, due to the heating of the conductors; for the resistance of nearly all metals increases with rise of temperature. But this effect will not in general be appreciable.

A very different set of phenomena confronts us when we introduce into the circuit a conductor like a solution of sulphuric acid, or of any sulphate, or indeed any ordinary chemical compound, either in solution or in a state of fusion. Such conductors can transmit currents only at the expense of their constitution; or, in the words of Faraday, in them 'the power of transmitting the electricity across the substance is dependent upon their capability of suffering decomposition.' Such substances—the whole terminology of the subject was introduced in 1834 by Faraday—are called *electrolytes;* the conductors by which the current enters and leaves the electrolyte, the *electrodes;* and the whole process by which chemical compounds are decomposed by means of electric currents is named *electrolysis.*

Take, for example, a dilute solution of sulphuric acid nearly filling a glass vessel. Dip into this electrolyte two platinum strips, some little distance apart and not touching. These are the electrodes; and it is important in such an experiment to choose as electrodes materials for which the electrolyte has no chemical affinity. In this respect platinum is, over all, by far the most satisfactory. Now connect the one platinum strip to one pole of a Daniell cell, and the other to one of the terminals of the galvanometer. The other terminal of the galvanometer and the other pole of the cell may be connected at will, so as to complete the circuit. When in this way the circuit is completed, a current will be observed flowing through the galvanometer; but this current will very soon become extremely feeble, and, even though it may not altogether vanish, will produce no continuous decomposition of the fluid. Let now a second Daniell cell be added as shown in fig. 18, where B is the battery of two Daniell cells, G is the galvanometer, and C is the electrolyte. Then the galvanometer will indicate the existence of a pronounced current, which during the first few moments will fall considerably below its original intensity, but will ultimately reach a steady value. At the same time small bubbles of gas will appear at the surfaces of both electrodes, and will form steady ascending streams in the electrolyte. These products, or *ions*, as Faraday called them, may be collected in separate vessels, as shown in fig. 20, where the gases accumulate at the top of test-tubes inverted over the electrodes, gradually pushing out the liquid which at first filled these tubes. It will be noticed that the volume of gas given off from the one electrode is twice that given off from the other; so that if the test-tubes are exactly the same size, the one will become quite emptied of liquid when the other is only half-emptied. The greater volume of gas accumulates over the electrode by which the current leaves the electrolyte. When tested, the gas which comes off in greater quantity will be found to be hydrogen, and the other oxygen. In fact, we have here separated from one another the constituents of water—H_2O. Thus, whatever the intermediate stages of the process may be, the final result of passing a current through dilute sulphuric acid is to obtain the chemical constituents of water.

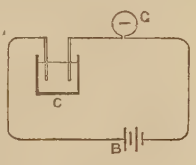


Fig. 18.

The characteristic points to be noticed here are that one Daniell cell cannot decompose water; that when two or more are used, the current markedly falls off in intensity during the first few moments; and that, when the current has become constant, steady streams of bubbles of gas ascend through the liquid from the surfaces of the electrodes, and from them only. These are some of the characteristics peculiar to electrolytic conduction; and, when present, any one of them is sufficient to distinguish an electrolyte from a simple conductor.

To study more closely the second point indicated, take two platinum strips *p*, *q*, thoroughly cleaned by heating in a flame to bright redness, dip them into the electrolyte, and connect them to the electrometer. The electrodes being both clean, platinum will have the same contact electromotive force with the electrolyte, so that they will be at

the same potential. Hence the electrometer will show zero deflection. Now put the electrolytic cell in circuit with the galvanometer and a battery of two or more Daniell cells; and suppose the current to flow from p to q through the electrolyte.

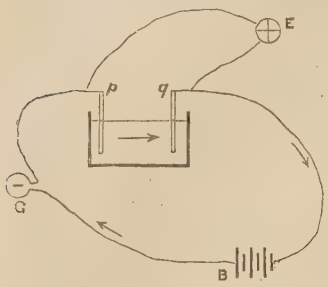


Fig. 19.

Then it may be observed that, as the current through the galvanometer falls off during the first stages, the difference of potential between p and q as measured on the electrometer increases. If we apply Ohm's Law to the portion between p and q, we see at once that the ratio E/C has considerably increased. This ratio, which for simple conductors measures the resistance, we shall speak of as measuring the Impedance. Impedance in fact is a more general term, synonymous with resistance for steady currents through metals and simple conductors, but including other quite distinguishable properties when electrolytes are the conductors, or when the current is variable.

After the current has become steady, let the circuit be broken. The galvanometer needle will swing back to zero; but the electrometer needle will swing back only a certain distance, and then continue slowly and more slowly back towards zero. Thus, after the current from the battery has ceased to flow, the electrodes in the electrolytic cell remain at different potentials, and will remain so for a prolonged period. This phenomenon is called the Polarisation of the Electrodes. From being in a state of electrical identity these electrodes have been brought, simply through the agency of a current, into a condition of electrical dissimilarity. In other words, the electrolytic cell has virtually become a voltaic cell; the electrodes have become poles at different potentials.

Let now the polarised cell be joined up in circuit with the galvanometer—i.e. let a wire be set in where the battery at first was. The electrode p being at a higher potential than the electrode q, a current will flow from p to q through the galvanometer, and from q to p through the cell—i.e. in a direction contrary to the direction of the current which first circulated in the circuit. As this current flows, the deflection on the electrometer will rapidly fall off, until very soon the potentials of p and q will be practically equalised, and the current will disappear. Thus, although the polarisation of the electrodes has imparted to the electrolytic cell at first all the virtue of a voltaic cell, this virtue is rapidly lost when it is used as a source of current, for there is nothing to sustain it permanently.

In this polarisation of the electrodes we have one explanation of the increased impedance of the cell. As soon as the current from an external source begins to pass through, decomposition begins in the electrolyte. The ions accumulate on the platinum electrodes, which become coated with oxygen and hydrogen gases. They are no longer platinum, platinum, dipping in an electrolyte; but oxygenised platinum, hydrogenised platinum, dipping in the same. The hydrogenised platinum, which is that by which the original current left the electrolyte (q in fig. 19), behaves like the zinc in an ordinary cell, but behaves like the zinc only so long as it is hydrogenised, and therefore oxidisable. When, then, the polarised electrolytic cell is included in a circuit otherwise free of electromotive force, a short-lived current will flow at the expense of the electromotive force of polarisation, its energy being derived from the reunion with their appropriate associates in the water molecule of the oxygen and hydrogen clinging to the platinum electrodes.

As we have seen, the electrolysis of dilute sulphuric acid results in the appearance at the electrodes of oxygen and hydrogen. The oxygen is given off where the current enters the electrolyte, and the hydrogen is given off where the current leaves the electrolyte. An obvious and simple experiment will show that the amount of water decomposed in a given time is proportional to the current as measured on the galvanometer. Thus we may compare currents by the quantities of a given electrolyte which they decompose in a given time. Faraday's voltameter, as shown in fig. 20, is intended for this purpose. As compared with a galvanometer, the voltameter has the obvious disadvantage that it cannot measure a current at once, but only after the current has been flowing for some time. Hence it measures only the average current during this time; so that unless we know the current to be very constant we cannot draw sure conclusions from the indications of the voltameter. When, however, we arrange matters so that the current is steady, we have in electrolysis a convenient means of measuring a current in terms of a quantity of matter decomposed. Not only is the amount of any electrolyte decomposed proportional to the strength of current used, but the amounts of different electrolytes decomposed by the same current have a definite numerical relation to one another—a relation which Faraday showed to have a most essential connection with the known laws of chemical combination.

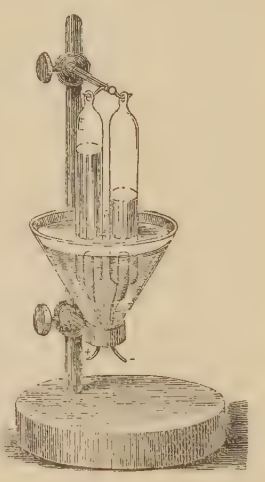


Fig. 20.

Let us take, for example, three electrolytic cells—the first, an ordinary voltameter with dilute sulphuric acid as electrolyte; the second, a V-shaped tube containing fused silver chloride with a silver wire for negative electrode and a piece of carbon for positive electrode; and the third, a solution of sulphate of copper with copper electrodes. Let these electrolytic cells be put in series, and a sufficiently strong current passed through them. In the first—the voltameter—oxygen and hydrogen will collect; in the second, chlorine will appear at the carbon, and may be collected, while silver will be deposited on the silver wire; and in the third, copper will be deposited on the negative electrode, while the positive electrode will gradually dissolve away. After the current has flowed for some time, measure the amounts of gases collected, and the amounts of silver and copper deposited. The last two are easily measured by simply weighing the electrodes before and after the process—the increments of mass of the silver and copper which acted as the negative electrodes in the silver and copper salts respectively giving at once the amounts deposited on them. Suppose, for example, that 2 milligrammes of hydrogen and 16 milligrammes of oxygen have collected in the voltameter; then it will be found that 70·8 milligrammes of chlorine

have collected over and on the carbon, 216 milligrammes of silver have been deposited on the silver, and 63 milligrammes of copper on the copper electrode. Now these numbers measure what are called the chemical equivalents of these substances—they are proportional to the quantities which enter into similar combinations. Thus, in hydrochloric acid, for every 2 grammes of hydrogen there are 70·8 grammes of chlorine; in cupric chloride, for every 70·8 grammes of chlorine there are 63 grammes of copper; and so on, right through all the related compounds of these substances. See ATOMIC THEORY.

During electrolysis the products of decomposition appear only at the electrodes, and nowhere else. The electrolyte consists in fact of two groups of components, chemically bound together everywhere throughout the liquid. But the steady appearance of the ions at the electrodes shows that the two groups of components must be steadily travelling in opposite directions through the electrolyte. Hence it follows that although these molecular groups seem to be chemically bound together everywhere throughout the liquid, the individual component groups are constantly changing their associates. For example, in the case of the electrolysis of fused silver chloride any individual silver molecule is handed on, so to speak, from chlorine molecule to chlorine molecule till it reaches the negative electrode and is deposited there. At the same time, each individual chlorine molecule passes in the other direction from union with one silver molecule to union with the next, until finally it reaches the positive electrode and becomes free —i.e. there is constant dissociation and recombination going on in the substance of the electrolyte. It is now generally believed that in every electrolyte there is always a certain number of free ions at any given instant. The individual ions which are free at one instant are in combination with their oppositely charged associates at another; but on the average there is always a certain number of both kinds of ions free. The feeblest electromotive force is sufficient to compel a certain drift of ions, which we may suppose to be conveying the current of electricity by a kind of convection through the liquid. When the ions reach the electrodes, they no longer find ions of the opposite kind to combine with, and begin to accumulate on the electrodes. But for this a finite electromotive force is necessary; for with the accumulation of ions on the electrodes a reversed electromotive force—the so-called electromotive force of polarisation—begins to show itself. This grows with the accumulation of the ions up to a certain point; and if the external electromotive force is not greater than the electromotive force of polarisation so produced, the current will cease to flow, or at least be so enfeebled as to be practically useless in causing electrolysis.

The ions, as they appear at the electrodes, may not be the real components of the electrolyte which are being urged in opposite directions through the liquid. In the case of fused silver chloride, the ions are no doubt these very components; but in the case of dilute sulphuric acid, we have no right to regard hydrogen and oxygen as the real original products of electrolysis. Indeed, we know by experiment that the purer the water the greater its resistance; so that we have every reason to believe that absolutely pure water is a non-conductor and cannot be electrolysed. Probably the secondary actions which in the case of dilute acid transform the real original ions into oxygen and hydrogen may be somewhat similar to what is certainly part of the action when a solution of sulphate of soda is electrolysed. The components of the molecule Na_2SO_4 are Na_2 and SO_4—i.e., sodium and what is called sulphion. The sodium ions drift with the current, the sulphion ions against it. But the sodium ion, when it appears at the negative electrode, gives up its charge and at once acts chemically on the water, forming soda, Na_2O, and liberating hydrogen, H_2. Again, at the positive electrode, the sulphion, not being able to exist in the free state, breaks up into SO_3 and O; and then the sulphuric acid is dissolved up in the water, and oxygen is given off. Thus, again, the constituents of water appear as the ions, exactly as in the case of the dilute acid. Here, however, the molecule of the electrolyte is not really Na_2SO_4, but has so much water united with it. Thus there may be a direct decomposition of water, as well as the sulphate of soda. Whatever the real process of electrolysis, it is certain that in many cases secondary chemical actions quite mask it. These secondary actions do not, however, affect the accuracy of the law of electrolysis. Whatever be the apparent products of decomposition, these, if they can be caught and measured, will appear in quantities proportional to their chemical equivalents. It is further evident that if one electro-chemical equivalent of an electrolyte is decomposed, it must be decomposed into components chemically equivalent to one another and to it. Hence it is enough to measure carefully the electro-chemical equivalent of one of the ions or products of decomposition. By means of a table of chemical equivalents we shall then be able to calculate the electro-chemical equivalents of given electrolytes. So many are the causes, both physical and chemical, which tend to disturb the perfect accumulation of the ions on or over the electrodes that the accurate experimental determination of the electro-chemical equivalent is in certain cases a matter of great difficulty. Large copper electrodes in copper sulphate yield fairly good results; but the only completely satisfactory combination is a particular solution of nitrate of silver with pure silver electrodes. The electrolysis of this electrolyte is accompanied by an accurate transference of so much silver from one electrode to the other. In other words, the one electrode loses as much as the other gains, a degree of perfection which is hardly ever attained in other cases. Recent independent determinations by Kohlrausch and Rayleigh agree to the fourth significant figure; so that we may safely say that the unit of current known as the ampère will reduce out of a solution of nitrate of silver 1·118 milligrammes of silver per second. This, therefore, is the electro-chemical equivalent of silver. Now in chemical combinations 216 grammes of silver correspond to 18 grammes of water and to 65·4 grammes of zinc. Hence a simple calculation gives ·0932 milligramme as the electro-chemical equivalent of water, and ·3388 milligramme as the electro-chemical equivalent of zinc.

The unit of current which has just been mentioned, the ampère namely, is one-tenth of the electro-magnetic unit of current, which will be discussed farther on. Meanwhile it will be sufficient to indicate experimentally what magnitude of current the ampère is. If an ampère is passing along a conductor of 1 ohm resistance—say a column of mercury 106·3 centimetres long and 1 square millimetre cross-section—the electromotive force along the conductor—i.e. the difference of potential of its ends—will be the quantity known as 1 volt; and the volt is such that the electromotive force of a Daniell cell is about 1·08 volts. In connection with electric lighting, these units—the volt, the ampère, and the ohm—are in universal use.

Intimately connected with electrolysis is the theory of action of the ordinary galvanic or voltaic

cell. For, whenever such cells are being used for the production of electric currents, there are going on within them chemical actions essentially electrolytic. Take, for example, the Daniell cell with its copper and zinc plates dipping respectively in solutions of copper and zinc sulphates. When the cell is closed, the current flows externally from the copper to the zinc, and internally from the zinc through the zinc and copper sulphates to the copper. The electrolysis of these electrolytes is a necessity, with the result that the zinc is gradually dissolved away, and copper deposited on the copper electrode. The net chemical result is the removal of copper from the sulphate and the substitution of an equivalent of zinc. But this chemical reaction is accompanied by the liberation, as heat, of a certain amount of energy. It is this energy which is the source of the electric energy when the replacement of copper by zinc in the sulphate is effected in the particular arrangement known as the Daniell cell. Now, according to Thomsen's determinations of heats of combination, the consumption of 1 gramme of zinc in a Daniell cell means the evolution of 8053 gramme-degrees—i.e. an amount of heat that would raise 8053 grammes of water 1° C. in temperature. Hence the consumption of an electro-chemical equivalent of zinc—i.e. ·3388 milligramme—means the evolution of 2·728 gramme-degrees of heat. This, then, is the energy which is associated with the production of one unit of electricity. To reduce it to dynamic units we must multiply by the factor $4{\cdot}2 \times 10^7$, which is the number of units of energy equivalent to the heat required to raise the temperature of 1 gramme of water 1° C. Thus we find $1{\cdot}146 \times 10^8$ as the energy which a Daniell cell liberates per second when it produces a current of 1 ampère. If E is the electromotive force associated with this unit current, then E measures the work done per second by the current; and assuming that this is the energy liberated in the cell, we find $E = 1{\cdot}146 \times 10^8$ electro-magnetic (C.G.S.) units of electromotive force—i.e. 1·146 volts, according to the definition of a volt. This is slightly higher than the real value of the electromotive force of a Daniell cell, but it is close enough to warrant the conclusion, first enunciated by Kelvin (1851), that the electromotive force of any electro-chemical apparatus is, in absolute measure, equal to the dynamical equivalent of the chemical action that takes place during the passage of unit current for unit time. There are many cases of galvanic combinations for which this principle fails to a degree which cannot be even approximately referred to errors of experiment. Some other principles, either chemical or physical, must be involved.

We are now able to see why it is that one Daniell cell cannot effect an electrolysis in which the constituents of water appear as the ions. It is simply because the heat developed in the formation of an equivalent of water by direct union of its constituents is about half as great again as the heat evolved in the combustion of an equivalent of zinc in a Daniell cell. Hence to decompose an electro-chemical equivalent of water requires more energy than is supplied by the combustion of an electro-chemical equivalent of zinc in the cell.

The general principle here indicated may be stated thus: A current i flowing through a given electrolyte decomposes i electro-chemical equivalents in unit time. But this requires a definite amount of work done, which we may write ie, where e measures the work which must be done to decompose one electro-chemical equivalent. Hence the energy of the current must be *at least* ei, or, in other words, e measures in absolute measure the smallest electromotive force with which distinct electrolysis can be effected.

All the phenomena which accompany simple electrolysis are encountered in the action of galvanic cells. The poles, like the electrodes, become, or tend to become, polarised. This is especially the case in single-fluid cells, in which the apparent electromotive force very markedly diminishes during the first few moments of action, due to the reversed electromotive force of polarisation produced by the accumulation of the ions on the poles. In the so-called constant elements, such as the Daniell, the Bunsen, or the Grove, all of which are double-fluid cells, the ion is either of the same nature as the pole at which it appears, or is dissolved in the fluid so as not to accumulate. By such means the electromotive force is kept fairly constant so long as the strengths or characters of the solutions do not greatly alter. The chief conditions to be fulfilled by cells which are to yield strong steady currents are (1) small polarisation, (2) a plentiful supply of electrolyte, (3) a small resistance. This last condition is obtained by using large surfaces for the electrodes, which are opposed to each other as closely as the arrangements of the cell will permit.

The difficulties of measuring the true resistance of electrolytes, and therefore of galvanic cells, have already been touched upon. We must here confine ourselves to the chief results which experiment has established. As compared with metallic conductors, the specific resistance of electrolytes is very great. Then, again, rise of temperature diminishes the resistance of electrolytes, whereas, except for selenium, phosphorus, and carbon, it increases the resistance of simple conductors. Finally, in the case of solutions in water of such compounds as sulphuric acid, nitric acid, sulphates, chlorides, nitrates, and so on, there is in general a definite solution which conducts better than any other solution of the same substance—i.e. a definite percentage composition which is associated with a minimum specific resistance. In all cases a condition of infinite resistance is approximated to as the solution is taken weaker and weaker; and in some instances (sulphuric acid, for example) the same condition of infinite resistance is hinted at for infinitely strong solutions—i.e. for the pure non-hydrated substance.

The polarisation of the electrodes during electrolysis has within the 20th century acquired a great practical importance in connection with the construction of secondary batteries or accumulators. An accumulator is simply a polarised electrolytic cell capable of supplying a steady current for a lengthened time. Theoretically, of course, all polarised electrolytic cells are accumulators; but usually the currents they supply are short-lived and feeble. It was not till 1860 that Planté constructed an accumulator which could supply a really efficient current. The Planté secondary cell is formed by the electrolysis of dilute acid with lead electrodes. With sufficiently strong currents, the result of the electrolysis is that the positive electrode becomes covered with peroxide of lead (PbO_2), while lead accumulates in a spongy form on the negative electrode. When the polarisation has been carried on to a sufficient extent, the cell is said to be charged, and it will be found to have all the properties of a true galvanic cell of low resistance and fairly high electromotive force (about 2 volts). On being closed, it will supply a current sufficient to keep a thin wire glowing for several hours. At the same time, the peroxide of lead will become reduced to a lower oxide, and the spongy lead will be oxidised, while the sulphuric acid present gives rise to other reactions. During the greater part of the discharge of the cell the electromotive force remains very constant, and only begins to diminish as the depolarisation approaches completion. When the

charged cell has thus, through use, lost nearly all its accumulated electrical energy, it is put into circuit with a primary source of current energy and re-charged. The modifications of construction introduced by Faure in 1881 gave a great impulse to the development of accumulators as a practical source of electrical energy. Instead of using merely lead sheets as electrodes, Faure covers them first with a layer of minium or red lead. With these as electrodes the electrolysis of dilute sulphuric acid is effected, the result being, as before, the formation of peroxide of lead at the positive electrode or spongy lead at the negative electrode. Re-charging from a prime source restores the peroxide of lead and the spongy lead as in the first charging. As part of the recent development in electric lighting, the efficiency of accumulators has been greatly increased; and they are now largely used as the direct source of power. A battery of Bunsen or other cells may be used for charging purposes; but if the wasteful voltaic cell had been our only prime source of electric energy, the secondary cell could never have assumed the practical importance it has. It is because we can generate electric energy dynamically and economically that we find a use for the accumulator, which is simply an arrangement for the storage of so much electrical energy in a form convenient for future purposes.

Of all the thermal effects produced by currents, the Joule Effect is the most conspicuous and by far the most important. But there are other thermal effects which are associated with the transference of electricity, and which are readily distinguished from the Joule effect by what is known as their reversible character. Thus the Joule effect always means a rise of temperature in the conductor whatever the direction of the current through it; whereas these so-called reversible effects mean a rise of temperature when the current passes in the one direction, and a fall when it passes in the other. If at any part of a circuit, in which a current is flowing, a fall of temperature is observed, we are probably safe in regarding this cooling effect as one of these reversible effects. We may test this directly by reversing the current; but occasionally the conditions of the experiment may prevent the application of this test. Thus in some cases a galvanic cell, in circuit with a large external resistance, is found to cool. Since the current due to a given galvanic combination must always flow in the same direction through the cell, it is impossible, of course, to apply the test of reversal. Other galvanic cells, again, when similarly joined up with a high external resistance, are found to rise in temperature under conditions in which the true Joule effect is inappreciable. Such thermal effects seem to be true reversible effects; and upon them Helmholtz based his explanation of the apparent failure, in many instances, of Kelvin's dynamical theory of the electromotive force of a battery (see above). In most cases the electromotive force is smaller than what the chemical reactions imply; but in some it is greater. In the former there is intrinsic heating in the cell; in the latter there is cooling—exactly the relations which the principles of energy require. For, as in the latter case, if the electrical energy generated is greater than the *chemical* energy supplied, it must borrow heat from the surrounding substances to make up its surplus energy. The further fact that those cells, which either heat or cool of themselves, have electromotive forces which vary with temperature points to these being truly reversible thermal effects. An electromotive force which grows with temperature is associated with a cooling effect in the cell as the current is flowing, while an electromotive force which diminishes with rise of temperature is associated with a heating effect. This must be so; for in all cases of transformations of energy, the final effects react so as to resist the changes that lead to them. We find simple applications of the same dynamic principle of reaction in the other reversible thermal effects of electric currents. These are intimately connected with the subject of thermo-electricity, which we shall now discuss.

Thermo-electricity dates from 1821, when Seebeck discovered that a current was generated in a circuit composed of copper and antimony, when the junctions were at different temperatures. With a sufficiently delicate galvanometer, the same phenomenon may be shown not only with any two different metals, but also with the same metal in two different conditions. Thus a stretched, twisted, or (if possible) magnetised wire will give thermo-electric currents with a piece of the same wire which has not been so treated. Slight impurities cause distinct changes in thermo-electric properties; indeed, thermo-electric currents may often be obtained in a circuit of two wires, which no other physical or even chemical test can differentiate. The fundamental fact of thermo-electricity is that, in a circuit built of two or more different conductors, a current is in general generated when one junction at least differs in temperature from the others. For the sake of definiteness, consider a circuit of the two metals iron and copper, with their junctions at A and B, and with a delicate galvanometer included for the measurement of current. If A and B are at different temperatures, a current will in general be set up in the circuit; and for moderate temperatures up to 250° C. or so, this current will flow from copper to iron through the warmer junction, and from iron to copper through the colder junction. Now this current i must derive its energy, ei, from some source; and the only source that exists is the heat which is available in virtue of the unequal distribution of temperature. In virtue of thermal conduction and radiation, the tendency is towards an equalisation of temperature, the warmer junction losing heat, and perhaps the colder junction gaining heat. But if this heat is also being partly drawn upon to sustain an electric current, the equalisation of temperature will be hastened because of this transformation into electric energy. Hence we should expect the thermo-electric current to be associated with, at any rate, a cooling effect at the warmer junction. That such an effect really does exist was established experimentally in 1834 by Peltier—hence the name Peltier Effect. He showed that heat is absorbed or evolved at the junction of two different metals across which any current is made to pass; and that if the direction of this current is the same as that of the thermo-electric current that would be produced by heating the junction, the effect is absorption of heat—i.e. cooling; and *vice versâ*. Thus, in a copper-iron circuit at moderate temperatures, the thermo-electric current is associated with a cooling effect at the warmer junction, and a heating effect at the colder junction

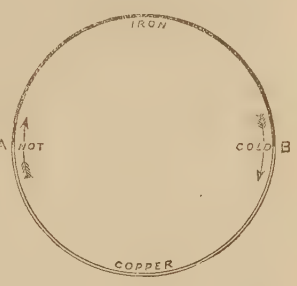


Fig. 21.

The Peltier effect is defined as the heat absorbed by the passage of unit of electricity in the proper direction across the junction; or otherwise, the

heat absorbed per second by the passage of unit current. Let p be the Peltier effect at the warmer junction of a thermo-electric circuit, and p' its value at the other junction. Assuming that the Joule and Peltier effects are the only thermal accompaniments of a thermo-electric current i, we find for the whole amount of heat absorbed the quantity pi, and for the whole amount of heat evolved $p'i + ri^2$, where r is the resistance of the circuit, and where the heats are estimated in dynamic units. If we suppose these to be the only transformations of energy involved, we have at once

$$pi = p'i + ri^2 \text{ or } p - p' = ri.$$

In the latter equation, the difference of the Peltier effects appears as the electromotive force associated with the current i. From this point of view the Peltier effect is to be regarded as an abrupt change of potential at the junction of the two metals.

Thus we may suppose thermo-electric currents to be explained in terms of the Peltier effects, regarded as electromotive forces at the junctions. But the striking phenomenon of thermo-electric inversion, discovered by Cumming in 1823, necessitates, as Kelvin first showed, the supposition of other than Peltier effects for a satisfactory explanation of thermo-electric currents. Take, for example, the copper-iron circuit, keep the one junction B at a steady temperature of, say, 10° C., and raise the temperature of the other junction A steadily and indefinitely from 10° C. to about a dull red heat. As the temperature of A rises, the current setting from copper to iron through A will increase to a maximum, then decrease to zero, and finally become reversed. The temperature at which this maximum current is obtained is a definite temperature for a given pair of metals, being quite independent of the temperature of the other junction. It is called the Neutral Point. If, within the range of a few degrees, the temperature of the one junction is as much above the neutral temperature as the temperature of the other junction is below it, there is no current. For copper-iron the neutral point is about 275° C.; for zinc-iron, about 210° C.; for cadmium-iron, about 160° C.; and so on. By an application of the second law of Thermo-dynamics, Thomson (Kelvin) in 1851 showed that the existence of the thermo-electric neutral point in the case of two metals like copper and iron required the existence of reversible thermal effects other than the Peltier effect. In this way he was led to the discovery of the Thomson Effect, or the reversible thermal effect which accompanies the passage of an electric current along a wire of varying temperature. For example, when a current passes from cold to hot in copper there is absorption of heat; while heat is evolved if the current passes from hot to cold. On the other hand, for iron, things are just reversed; cooling is associated with the current that flows from hot to cold, and heating with the current that flows from cold to hot. The Thomson effect is said to be positive in copper, and is therefore negative in iron. Cadmium, zinc, silver, gold, nickel between the temperatures of 250° C. and 310° C., and iron above a dull red heat, have, according to Tait's experiments, their Thomson effects also positive. Platinum, palladium, potassium, sodium, cobalt, nickel below 200° and above 320°, and probably iron again above a bright red heat, are examples of metals having negative Thomson effects. The extraordinary change of sign in the Thomson effect, which Tait discovered to exist both in nickel and iron at certain temperatures, is an extremely interesting phenomenon, and seems to be connected with other properties peculiar to these magnetic metals—such as their loss of magnetic susceptibility and the manner in which their electrical resistances change with temperature.

In comparison with the electromotive forces of voltaic cells, the electromotive forces that can be obtained with thermo-electric circuits are very small. Thus copper-iron with one junction at 275° C., and the other at 0° C., has an electromotive force of only ·0022 volt. The electromotive force of an iron-nickel pair with junctions at temperatures 0° C. and 200° C. is ·008 volt; and the electromotive force of a bismuth-antimony pair with a difference of temperature of 50° C. is about ·005 volt. Bismuth and antimony are, because of their high mutual thermo-electromotive force, ordinarily employed in the construction of the thermopile, a valuable instrument for indicating and measuring small variations of temperature. It consists of alternate strips of bismuth and antimony forming a continuous zigzag chain, as indicated in fig. 22. They are arranged in compact form so that the successive junctions alternate, now on this side, now on that side, forming two plane faces looking opposite ways. If a source of heat is brought opposite to the one face, the junctions ending there are heated by radiation, while the alternating junctions on the other face remain at the temperature of the air.

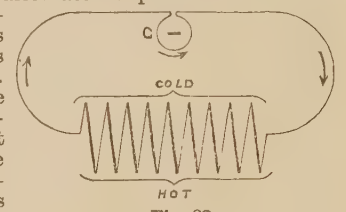


Fig. 22.

Returning now to Oersted's discovery of 1820, let us trace the development of electro-magnetism and the closely associated group of phenomena included under the term Magneto-electricity.

Ampère, starting from Oersted's observation of the action of an electric current on a neighbouring magnet, showed that the essential properties of magnets could be demonstrated by means of coils of wire along which currents were passing. In short, every current has associated with it a magnetic field, the distribution of whose lines of force depends on the form of the circuit conveying the current. See MAGNETISM for the simpler illustrations of Ampère's laws. In all cases the lines of force associated with an electric current form closed curves which the current threads. In the neighbourhood of a straight wire conveying a current the lines of force run in concentric circles round the wire. If the wire is curved the lines of force become crushed together on the concave side of the wire and drawn apart on the convex side; and if the wire is made into the form of a closed plane curve—a circle, for example—every line of force will pass perpendicularly across the plane space within the circle. The one which passes through the centre will be straight, and will pass to infinity along the axis of symmetry. All the others will form closed curves embracing the circuit, those which pass nearer to the centre within the circle extending to farther distances in the space outside. Such a circular circuit is, in fact, the nucleus of a magnetic field, which at distances great compared to the diameter of the circle is very similar to the field associated with a bar magnet set at the centre of the circle and perpendicular to its plane. Ampère proved that a small plane circuit was, as regards its magnetic effect at distant points, identical with a small magnet whose magnetic moment was proportional to the product of the area of the circuit and the strength of current flowing round it. If we place ourselves in front of the circuit so that the current appears to be flowing clockwise round it, the northern magnetic aspect of the circuit is on the farther side.

Ampère also showed that the magnetic effect of a closed circuit conveying a current could be calculated according to the following rule. Each small element, ds, of the circuit, with current C flowing through it, may be supposed to produce at a point distant r from the element, and lying in a direction making angle θ with the element, a magnetic force which is equal to $Cds \sin \theta/r^2$, and acts in a direction perpendicular to the plane containing r and ds. The vector sum of all the forces due to the elements which build up the circuit is the magnetic force due to the circuit. Attention must be paid to the sense in which each elementary force acts. Thus in the figure it is clear that the forces at P due to ds and ds' must be oppositely directed. The simplest way to determine the direction is to remember that the lines of force due to a straight current circulate right-handedly with reference to the direction of the current. In the figure the force due to Cds is towards the farther side of the paper, and that due to Cds' is towards the nearer side.

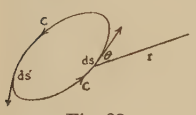


Fig. 23.

Let us apply the rule to find the magnetic force due to a circular circuit at any point in its axis of symmetry. Let the circle be perpendicular to the plane of the paper, and let OP be the axis of symmetry. Let us suppose further that, as viewed from P, the current C in the circuit is circulating clockwise. According to Ampère's rule the magnetic force at P due to the element at A is perpendicular to AP, and since the element itself is perpendicular to AP so that $\sin \theta$ equals unity, the value of the force is Cds/AP^2, and the component of this along PO, where O is the centre of the circle, is

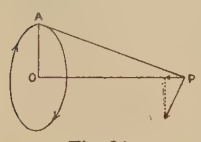


Fig. 24.

$$\frac{Cds}{AP^2}\frac{OA}{AP} = \frac{Cds\,a}{r^3}.$$

Every element of equal length will give the same value of the force. Hence the whole force along PO due to the whole circuit is $2\pi Ca^2/r^3$. The components of the forces at right angles to PO obviously balance; hence $2\pi Ca^2/r^3$ is the measure of total resultant force. The force at O, the centre of the circle, is $2\pi Ca^2/a^3 = 2\pi C/a$.

Thus the unit current flowing in a circular circuit of unit radius will produce a magnetic field of value 2π or 6·2832 at its centre. We are thus able to measure currents in terms of the same units in which we express magnetic forces. The unit of current just defined is called the electro-magnetic unit. Its value depends on the definition of magnetic force, and may be regarded as based upon the law that two magnetic poles of strength m and m' repel each other with the dynamic force mm'/r^2, where r is the distance between the poles. More generally in a medium of magnetic permeability μ the law of force is $mm'/\mu r^2$. See MAGNETISM.

As already stated, the electrostatic unit of charge is defined in terms of the law of force ee'/r^2; and the electrostatic unit of current will be the current produced when unit charge passes in unit time. There are thus two distinct ways of defining units of current and of charge—viz. the electro-magnetic and the electro-static. When a given current is measured in both units, it is found that the electro-magnetic unit of charge contains a very large number of electrostatic units of charge, and that this number is identical with the number which measures the velocity of light. For example, if the fundamental units are the centimetre, gramme, and second, and if the electro-magnetic and electrostatic units are expressed in terms of these fundamental units, then it is found that the electro-magnetic unit contains almost exactly 300 million electrostatic units. Now 300 million centimetres or 300,000 kilometres per second is very approximately the velocity of light.

There are various experimental methods for determining this ratio of the two units. It will suffice to indicate one of the simplest in theory. Let a condenser of known capacity K be charged to potential V, both numbers being given in electrostatic measure; and let this charge KV be discharged through a galvanometer of suitable type producing a deflection of measurable magnitude. If the electro-magnetic constant of the galvanometer is known—i.e. the magnetic field produced in its heart when unit current flows through it—the charge KV can be expressed in electro-magnetic measure. The number so obtained divided by the electrostatic measure KV gives the ratio required. This conclusion that the ratio of the two units of electric charge is the velocity of light was one of the foundations on which Maxwell built his brilliant hypothesis that light is an electro-magnetic phenomenon. We shall return to this farther on.

The action between an electric current and a magnet is mutual. When the coil is fixed, as in the earlier forms of galvanometer, the magnet moves. But it is sometimes more convenient to allow the coil to move and keep the magnet or the magnetic field fixed. Thus in Ampère's electrodynamometer the magnetic field is established in the heart of a fixed coil, within which is suspended a movable coil capable of turning about a vertical axis. The coils are arranged with their axes at right angles to one another. The same current is then passed through both, and the strength of the current measured in terms of the deflection of the movable coil, the turning effect of the magnetic field being balanced by the torque due to the bifilar suspension of the movable coil. Kelvin's Ampère Balance is constructed on the same principle, the main difference being that the electro-magnetic action on the movable coil is balanced by the couple due to a weight which can be slid along a horizontal lever suitably graduated.

In his Siphon Recorder for recording telegraphic signals along the first Atlantic cable, Kelvin used as his galvanometer a light coil suspended in the strong field between the opposing poles of a powerful magnet. The axis of the coil was adjusted at right angles to the magnetic lines of force. When a small current was passed through the coil, the coil at once responded by a rotation to one side or the other according to the direction of the current. D'Arsonval's galvanometer is constructed on exactly the same lines, the movable part being a light coil set in a strong magnetic field.

In all such cases each element of the current may be regarded as acted on by a force which drives it in a direction perpendicular to the current and to the lines of force of the magnetic field in which it lies. We may calculate the whole force acting on a circuit placed in a magnetic field by supposing that each element Cds is acted on by a force equal to $CdsH \sin \theta$, where H is the magnetic force at the region occupied by Cds, and θ is the angle between Cds and H. The direction in which Cds is urged has the same relation to the rotation by which Cds may be made to lie along H as forward motion has to the clockwise rotation of a right-handed screw. This rule can be easily deduced from the equivalent statement that parallel currents attract each other and oppositely directed currents repel.

Let a vertical wire hang within the air-gap of a powerful electro-magnet, and let it be connected up

so as to become when desired a part of a circuit conveying an electric current. When the current is allowed to pass, the portion of the wire in the strong field will be driven at right angles to the lines of force and parallel to the opposed faces of the poles of the electro-magnet. By an ingenious arrangement in which the electro-magnetic force urging the wire to the side was balanced by gravitational forces brought into play by the motion of the wire, Kelvin showed how to measure powerful magnetic fields when a known current was passed along the wire. Conversely, when the field is known the displacement of the wire will be a measure of the current. This is the principle of the String Galvanometer, which is much used in physiological investigations.

In 1831, six years after Ampère had presented to the world the complete theory of electro-magnetism, Faraday made the discovery which opened up the vast realm of magneto-electricity—i.e. the production of electric currents by magnetic changes. In 1847 Helmholtz showed that the fundamental fact of magneto-electricity could be deduced as an illustration of the Conservation of Energy from the facts of electro-magnetism.

Imagine a closed plane circuit conveying a current to be set with its plane parallel to the lines of force of a magnetic field, and let it be capable of free rotation about an axis perpendicular to the lines of force. If left to itself the circuit under the influence of the electro-magnetic force will at once begin to turn so as to set its plane perpendicular to the magnetic field. It will swing round towards this position with increasing kinetic energy. To account for the energy we must assume either that the voltaic cell or other original source of electromotive force is drawn upon more briskly while the circuit is moving, or that the current itself is diminished in intensity as the circuit swings round. It is the latter supposition which falls in line with Faraday's discovery. With a sufficiently sensitive galvanometer included in the circuit this fall off may be observed. Not only so, but if the circuit contains no original source of electromotive force, and if it is then moved mechanically from parallelism with the lines of force towards the position of perpendicularity, a current will be observed to flow in the circuit while the change is being made. This current is called an induced current, and exists only while the number of lines of magnetic force which pass through the circuit is altering.

Change in the magnetic field relatively to a circuit may be made in a variety of ways—e.g. by approach of a magnet with one pole nearer to the circuit than the other, by withdrawal of the magnet again, by approach or withdrawal of the circuit from a pole of a magnet, by starting a current in a neighbouring coil and so establishing a magnetic field in the region occupied by the circuit, by suitably moving the circuit in the neighbourhood of a coil carrying a current, and so on. In all such cases the induced current is sustained by an electromotive force which at each instant is equal to the rate of change in the number of lines of magnetic force included by the circuit.

In many practical applications the magnetic change is made to take place abruptly, and what we obtain is a rapidly varying electromotive force which within a very short time rises to a pronounced maximum and falls off to zero. The result is a correspondingly short-lived electric flux or discharge of electricity round the circuit, the measure of the flux being the ratio of the total change in the number of lines of force embraced by the circuit to the resistance of the circuit. What is considered here directly is not the electromotive force, but the successive values of the rapidly changing electromotive force summed up through a short interval of time. Following the analogy in dynamics, we may call this time-integral of the electromotive force the electromotive impulse. Then, just as the electromotive force is numerically equal to the product of the resistance and the current, so the electromotive impulse is numerically equal to the product of the resistance and the electric flux.

The electric flux may be measured experimentally by means of a ballistic galvanometer or a flux-meter. In the most familiar form of ballistic galvanometer a slow-swinging magnetic needle is suspended, as free as possible from retarding forces, in the heart of a closely wound coil. When a short-lived electric flux passes round the coil the momentary magnetic field acts on the needle and gives it a sudden rotation about its suspending fibre. Before the needle has appreciably left its original position of equilibrium the acting magnetic field has ceased, and the needle swings to a limiting position through an angle in terms of which the magnetic impulse can be expressed. The needle immediately swings back again towards and through the zero position.

In Gassiot's form of flux-meter the D'Arsonval type of galvanometer is made use of. The delicately suspended rectangular coil moves with its vertical strands in the air-gaps formed between a central cylinder of soft iron and the concentrically shaped poles of a strong magnet. The arrangement is illustrated diagrammatically in fig. 25, in which the central pillar of iron is shown by a circle embraced by the semicircular lines representing the poles. The straight lines drawn diametrically across the central pillar represent the upper horizontal strands of the coil whose vertical strands pass down through the air-gaps on each side. The mechanical details of the suspension of the coil need not be considered here, as all we aim at is the illustration of electro-magnetic and magneto-electric theory.

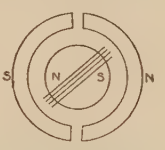


Fig. 25.

When a current flows along the vertical strands, downwards in one and upwards in the other, the electro-magnetic forces generated will act on the vertical strands and drive the whole coil round in one or other direction. On the other hand, if no current is flowing at first in the coil, and if the coil is compelled by some external means to move round the axis of suspension, an induced current is at once produced in the coil due to the fact that the vertical strands are cutting across the lines of force. In accordance with the general law of energy, this induced current is opposite in sense to the current which if supplied to the coil would make the coil rotate in the same direction. Hence the electro-magnetic action of the induced current is such as to resist the motion which has generated it; and very quickly the coil is brought to rest. In virtue of this damping action automatically produced by the coil moving in the magnetic field, there is nothing resembling the free swinging about a position of equilibrium such as characterises the motion of the needle in the earlier form of ballistic galvanometer. The greater the angular momentum with which the suspended coil is started, the further will it rotate before the damping action of the induced current brings it to rest. This initial angular momentum is proportional to the electric flux which has passed momentarily through the coil. Before the coil has well started the original electric flux has ceased to flow; but the coil continues to swing round, cutting across the lines of force. The induced currents generated by this motion react upon the coil, which is quickly brought to rest after being deflected through an angle determined

by the initial angular momentum—i.e. by the original electric flux. From that position the coil slowly creeps back towards the true zero, being retarded by induced currents generated by the motion.

Some of the phenomena just described illustrate what is known as Lenz's Law—viz. that the electro-magnetic effect of the induced current resists the magnetic change which has produced the current. Thus, when a magnet is made to approach end on towards a coil, the current induced in the coil will be such as to repel the nearer end of the magnet. On withdrawal of the magnet, the induced current will flow round the circuit so as to attract the nearer end. Again, let us place two coils close together, say the one lying within the other, and let matters be so arranged that a current may at will be sent through one of them. Then, at the instant at which this current begins to flow in what is known as the primary circuit, an associated magnetic field is generated, and round the other or secondary coil an electromotive impulse will act equal to the change in the number of magnetic lines of force included in the circuit. The electric flux accompanying the creation of this electromotive impulse will set round the secondary circuit in a direction opposed to that of the current in the primary circuit. The secondary current lasts only during the process of change, and is practically instantaneous, vanishing as soon as the primary current becomes steady. If now the primary circuit is made discontinuous, so that the circuit ceases to flow round the circuit, the associated magnetic field vanishes, and there acts round the secondary circuit an electromotive impulse equal and opposite to the electromotive impulse which acted when the primary current was established. This is the principle of the Induction Coil (q.v.), an indispensable piece of apparatus in the study of the effects of induced currents.

An ordinary galvanometer included in the secondary circuit will show equal and opposite deflections when the primary is first made and then broken. When the primary current is established and broken in rapid alternation, these equal and opposite induction fluxes will follow each other so rapidly that the galvanometer needle will remain practically unaffected. There will be an initial temporary deflection accomplishing the first establishing of the primary, and an equal and opposite temporary deflection when the current is finally broken; but no definite deflection between times, simply because the rapidly alternating induced fluxes balance as regards their effect on the galvanometer needle.

When the secondary circuit is not completely closed by a continuous chain of conductors, but is interrupted by an air-gap, a different set of phenomena will be observed. Provided the field established by the primary is strong enough, an electric spark will pass across the air-gap at the instant at which the primary current is broken; but no spark will be observed at the instant the primary circuit is made. Thus when, by means of an interrupter such as is familiar in most forms of induction coil, the primary current automatically makes and breaks itself in rapid alternation, the sparks across the air-gap occur in rapid succession, but only at the instants of the breaking of the primary. The reason for this may be briefly expressed as follows. Before a spark can pass in air, the electrodes which are the opposing ends of the secondary circuit must be at a definite difference of potential, whose value depends on the length of the air-gap, the forms and condition of the opposing conducting surfaces, and the pressure of the air. This necessary minimum difference of potential is produced by the variation in the magnetic field, and only when this variation is sufficiently rapid will the accompanying electromotive force attain a high enough value to produce the spark. Consider now the typical arrangement of primary and secondary coils as shown in fig. 26. The more nearly coincident the secondary coil is with the primary, the greater will be the electric flux induced in the secondary for a given electric current in the primary; and at the make of the primary the induced current in the secondary sets round in the opposite direction. But a similar induction takes place in the primary itself at the instant the current is started; and its effect as observed is to retard the growth of the primary current, which takes a short but finite and measurable time to attain its full value.

Fig. 26.

On the other hand, when the primary current is broken the interval of time during which the magnetic change takes place is much shorter than when the current is being established, the rate of change attains a higher value at some moment of this interval, and the corresponding induced electromotive force reaches a higher momentary intensity. The electromotive impulse round a closed secondary circuit has the same value at make and at break of the primary; but at the break the impulse goes through its successive values more quickly, and therefore touches a higher value of electromotive force. Consequently when an air-gap is introduced the greater intensity reached by the electromotive force at the more abrupt break is able to overcome the insulating power of the air. This at the more gradual make of the primary the induced electromotive force is unable to do.

The self-induced electromotive force when a current is being established in a coil is evidenced simply in the retardation of the growth of the current to its final steady value. But when the continuity of the circuit is broken and the current is made to cease, the self-induced current at break shows itself as a distinct spark at the point where the circuit is broken. Should an iron-cored electromagnet be included in the circuit, so that the lines of magnetic induction are greatly increased, the self-induced spark becomes correspondingly intense. This self-induced flux, or 'extra current,' as it is sometimes called, establishes a momentary magnetic field within the circuit at the very instant the original field due to the steady current is disappearing with that steady current. But this rapid rise-and-fall in the magnetic field does not affect the total value of the induced electromotive impulse round a neighbouring secondary circuit. It affects the law of progression in the successive values of the electromotive force which build up the impulse. The value of the electromotive impulse which produces a spark across the air-gap of an interrupted secondary circuit depends entirely upon, and is numerically equal to, the number of lines of magnetic induction which have disappeared on the breaking of the primary circuit. But the form of the discharge depends on the other electrical properties of the circuit—viz. its resistance, capacity, and self-inductance. This last-named quantity is measured by the number of lines of magnetic force included in the circuit when unit current flows round it. A similar quantity is the mutual inductance of two circuits, which is measured by the number of lines of force established within one of the circuits when unit current flows round the other. These coefficients of self and mutual in-

duction depend entirely upon the geometrical forms and relative positions of the two circuits.

To illustrate how the form of the discharge depends on the various electrical constants of the circuit, it will suffice to describe the simplest case, first worked out by Kelvin, then Professor William Thomson, in 1853. He showed that under certain conditions the discharge of a charged Leyden jar or other condenser was periodic. That is to say, the original potential difference between the two coatings does not simply fall off to zero in a continuous flux in the same direction like a flow of water from a lake to the sea-level. On the contrary, the discharge comes with such a rush that it overshoots the zero-mark, like a pendulum swinging past its lowest position. After a short but measurable interval of time the coating at first positive becomes negatively charged, and the coating at first negative becomes positively charged. The difference of potential, in short, changes sign, reaches a maximum in the other direction, and then discharges the Leyden jar back again towards the original state of matters.

Suppose we have a U-shaped tube with a stop-cock at the bend which we may open or shut at will. Let it first be shut, and let water be poured into the one limb. When the stop-cock is opened the water will rush through and begin to fill the other limb. The levels of the water in the two limbs will rapidly approach equality, but because of the momentum of the moving water the equality of level will be overshot, and the water will not come to rest in the U-tube until after a few oscillations of level in each limb. This is analogous to a periodic oscillatory discharge. If, however, we use glycerine instead of water in the U-tube and carry out the same experiment, the equality of level will be reached without any appreciable oscillation. The glycerine, on account of its viscosity, will gradually and with increasing slowness fill up the originally empty limb after the stop-cock is opened. This is analogous to an aperiodic discharge.

In this hydrokinetic experiment we see that the character of the motion which follows a disturbance is fundamentally influenced by the physical properties of the fluid, the motion being periodic or aperiodic according as the viscosity is small or great. Similarly the discharge of a condenser may be oscillatory and periodic or non-oscillatory and aperiodic according to the electrical constants of the condenser and the associated conductors. As Kelvin first showed, when a condenser of capacity C is discharged through a coil of resistance R and self-inductance L, the period of the oscillatory discharge is given by the expression,

$$2\pi \Big/ \sqrt{\frac{1}{LC} - \frac{R^2}{4L^2}} = \frac{4\pi L}{\sqrt{4L/C - R^2}}.$$

When the quanitites C,R,L are such that the expression under the square-root is negative, the period becomes imaginary, and the discharge is non-oscillatory. That is, when R^2 is not less than 4L/C the discharge is aperiodic, and the potential difference between the two coatings of the condenser or Leyden jar diminishes continuously towards zero. But when R^2 is less than 4L/C the discharge is oscillatory and the period is given by the expression shown above. Suppose, for example, that the condenser is a Leyden jar, and that the internal coating is positively charged. Then after half the periodic time measured by the formula the inner coating will have acquired a negative charge, in another half-period a positive charge, and so on. While this alternation in sign of the opposite charges on the two coatings is proceeding the amount of the difference of potential at every half-period diminishes. In other words, the discharge is oscillatory with rapidly diminishing amplitude.

We have seen how Maxwell, led by various considerations, came to the conclusion that light was an electro-magnetic phenomenon, transmitted as a vibratory motion through the ether. If this hypothesis be correct, it should be possible to obtain electro-magnetic waves differing from light waves only in their wave-length and periodic time. The practical realisation of this, first distinctly suggested by Fitzgerald, and shortly afterwards brilliantly carried out by Hertz, depends upon the theory of the periodic discharge which has just been explained. Not only did Hertz construct a convenient vibrator, but he solved the problem of constructing what might be termed an 'electric eye'—i.e. a form of apparatus sensitive to the influence of electro-magnetic waves. Knowing what the period of his vibrator was, he formed a simple circular circuit with a tiny air-gap, which for electro-magnetic variations had the same period as the discharge of the vibrator. In other words, the receiver or detector was 'in tune' with the vibrator; and, in accordance with the principles of resonance, when the receiver was placed suitably in the line of propagation of the electric disturbance it responded to these by showing small sparks across the tiny air-gap.

Hertz's early form of detector was soon superseded by more delicate forms, the most familiar being of the type which Oliver Lodge called 'coherer.' It was discovered by Branly that the electrical resistance of a column of metallic filings loosely pressed together becomes greatly diminished when electro-magnetic radiation falls upon it. To restore the original resistance of the column it is sufficient to shake the filings. When the coherer forms part of a circuit which includes a galvanometer and battery, the arrival of an appropriate electro-magnetic disturbance diminishes the resistance of the coherer, causing a greatly increased current in the coherer circuit, with a corresponding increase in the galvanometer deflection.

By use of the coherer or other delicate detector many of the results obtained with considerable difficulty by Hertz can be readily demonstrated, such as the reflection and refraction of electro-magnetic waves, their polarisation, and the speed of their propagation. In these respects they behave in practically the same way as waves of light; and thus the physical similarity of the two kinds of wave motion, the optical and the electrical, is practically established.

The vibrator is an arrangement of small capacity attached to the secondary coil of an induction coil. The spherical knobs of the vibrator are brought to a suitable distance from each other, and across this air-gap the secondary circuit of the induction coil is discharged. The primary circuit is provided with an automatic make and break, the result being that a torrent of sparks passes across the air-gap. But every spark is an oscillatory discharge, whose period is practically determined by the expression $2\pi/LC$, the term $R^2/4L^2$ being made negligible in comparison with 1/LC. Each spark is therefore the source of a short succession of electric waves which are propagated through space. If these waves reach in sufficient intensity the position of a coherer suitably arranged in circuit with battery and galvanometer, the coherer will show their presence by momentarily increasing in its conductance and allowing a current to pass through a galvanometer or other instrument for indicating its presence. This is, in fact, the basis of the method of wireless telegraphy, which Marconi and others have developed with great success during recent years; see TELEGRAPH.

One of the most important uses of the induction coil is to produce electrical discharge in air or other gases at greatly reduced pressures; see VACUUM TUBE and RÖNTGEN RAYS. The remarkable pheno-

mena associated with electric discharge through vacuum tubes have been to a large extent successfully co-ordinated in terms of the modern electron theory. The underlying hypothesis of this theory is that electricity consists of distinct charges associated definitely with particles or corpuscles. Of these some are charged negatively, some positively, being distinguished as negative and positive electrons respectively. It has been found possible to co-ordinate many phenomena on the assumption that each electron is the nucleus of an electric field in virtue of its charge, and a magnetic field in virtue of its motion. Any electron in motion will be influenced by both the electric force and the magnetic force at the point of space occupied. Broadly stated, the interaction between moving electrons and magnetic fields is the same as that between current elements and magnetic fields according to the laws established by Ampère.

We pass from the case of the current elements to that of moving charges by substituting for the element Cds the product, ev, of the charge e into its speed v. Thus the magnetic force at distance r due to the electron is $ev \sin\theta/r^2$, where θ is the angle between r and the direction of motion of the electron. Also the electro-magnetic force acting on the electron when placed in a magnetic field, in which ϕ represents the angle between the magnetic force H and the velocity of the electron, is $ev\mathrm{H} \sin\phi$, driving the electron at right angles to the magnetic force and to the direction of motion of the electron.

In the electron the charge e is associated with a mass m; and any force acting on the charge e will produce an acceleration depending also on this mass.

These three connected quantities, the charge of the electron, its velocity, and its mass, are linked together by electric and magnetic relations, from which it has been found possible to estimate their values. To show how this may be done, consider the case of a discharge through a gas at very low pressure, such as may be obtained in a Crookes's vacuum tube. The experiments to be described prove that the kathode rays may be regarded as consisting of streams of negatively electrified particles discharged from the kathode through the enlarged dark space. Their average straight course through this space is indicated by the position of the fluorescent patch, ab, on the wall of the vacuum tube where the particles impinge. Now if this stream of electrified particles is subjected to a transverse electric field or to a transverse magnetic field, the fluorescent patch shifts its position, indicating a deflection of the kathode rays. The direction of this deflection under either of the applied fields named is such as would occur if the kathode rays were composed of negatively electrified particles. There seems to be, indeed, no escape from the conclusion that these rays consist of negative electrons repelled from the kathode with high velocities. The velocities are not all the same; for it is observed that when there is deflection the fluorescent patch becomes more extended than when there is no deflection. This is immediately explained by the consideration that under the influence of a transverse electric or magnetic force of given magnitude the more quickly moving particles suffer less deflection.

Fig. 27.

Let us suppose that the kathode rays are projected horizontally from left to right, and that two insulated plates are placed in the tube, the one above and the other below the stream of kathode rays. When these are brought to different potentials, the upper plate being, say, at the higher potential, a downward electric force, F, will be established. The upward action of this electric force upon a negative electron of charge, e, will be $\mathrm{F}e$.

Now apply a magnetic field by means of opposing poles of a strong electro-magnet placed the one in front of, and the other behind, the vacuum tube. The magnetic lines of force will pass horizontally across the kathode rays, and if suitably directed will deflect them downwards. The value of the deflecting force on each electron will be $\mathrm{H}ev$. By proper adjustment of the vertical electric field, F, and the transverse horizontal magnetic field, H, we may obtain a balancing between the effects of these forces, in which case we shall have

$$\mathrm{F}e = \mathrm{H}ev, \text{ or } v = \mathrm{F}/\mathrm{H}.$$

The balancing will be indicated by the non-existence of any deflection of the fluorescent patch or of either limit of it. By such experiments the velocity of the electrons constituting the kathode rays has been proved to vary from about 20,000 to 50,000 kilometres per second, or, on the average, about one-tenth of the velocity of light.

The velocity, v, having been determined, it becomes a comparatively easy matter to measure the ratio of the charge to the associated mass in each electron—i.e. e/m. This is done by measuring the deflection under the influence of only one of the fields, either the electric or the magnetic. The more convenient force to use is the magnetic, for not only is it more easily sustained, but it can be measured with greater accuracy than is possible in the case of the electric field.

Let the magnetic force act horizontally and transversely on the horizontal stream of electrons. The acting force $\mathrm{H}ev$ is always at right angles to the direction of motion, and must equal the centrifugal force mv^2/r, where r is the radius of the circular path which will be described by each electron if the speed is not changing. Hence

$$mv^2/r = \mathrm{H}ev, \text{ or } e/m = v/\mathrm{H}r.$$

The radius r is determined by measurement of the deflection D in a distance x, being given to a sufficient approximation by $r = x^2/2\mathrm{D}$. See fig. 28. Thus r, H, and v being known, the ratio e/m is determined. In the case of a kathode discharge in a rarefied gas, this ratio e/m is found to remain practically the same whatever the nature or pressure of the gas, although the speed v may, as noted above, vary within fairly wide limits. Expressed in electro-magnetic units, the value of e/m is about 18 million.

Fig. 28.

By such experiments we realise that the dark space round the kathode is filled with streams of negative electrons projected from the kathode with velocities varying from a sixteenth to a sixth of the velocity of light.

Let us now consider the behaviour of the positive electrons. From the analogy of electrolysis we should expect them to be moving from the anode towards the kathode. The most effective method of demonstrating their presence is to provide an escape for the positive electrons by a fine channel which perforates the kathode and passes back behind it. The experiments are difficult to make, and the results are complex and not easy of interpretation. But the one undoubted fact is clearly established that the speed of the positive electron is much less than that of the negative electron. The ratio e/m for the positive electrons has many values, with a superior limit of 10,000. Since the charges on the negative and positive electrons are equal and opposite, it follows that the mass associated with the

positive electron is at least 1800 times the mass associated with the negative electron.

It has been noted that in kathode discharge the ratio e/m has much the same value for the negative electron, whatever the nature of the gas filling the vacuum tube. It is quite otherwise with the positive electrons. For them the ratio e/m varies through wide limits, and depends upon the nature of the gas through which the discharge is passing. The electric discharge through gases may be compared with the process of electrolysis in liquid conductors. In the latter case the complex molecule is split into two ions, the positive and the negative, which travel in opposite directions through the liquid, and which convey the charges that constitute the current. In electric discharge through gases, the molecule of the gas is dissociated into a negative electron having a small mass and a positive electron whose mass is very slightly less than the mass of the original undissociated molecule. These move in opposite directions in the electric field between the electrodes. Under the influence of the electric force in the neighbourhood of the kathode, the negative electrons, in virtue of their small mass, acquire a high velocity; and on the average the velocities acquired by the positive and negative electrons in the same electric field will be in opposite directions, and will be approximately inversely as the associated masses. This conception gives a general explanation of the broad features of the phenomenon of the electric discharge through gases, but there are many subsidiary features which are not easy of co-ordination in terms of the simpler forms of the electron theory.

According to the view here presented, it is not the gas itself which conducts electricity. The discharge through a vacuum tube is really an electric convection, and the whole evidence goes to show that the negative electron is the important and unchanging agent. Each negative electron carries the same electric charge, and has the same associated mass—so long, at any rate, as the velocities are not too great. In order to measure this charge, e, on each electron, we must in some way estimate the number of electrons, n, which are involved in transferring a measured total charge, ne, to a suitably arranged conductor.

Now electrons may be produced by other means than by electric discharge through gases. For example, the Röntgen Rays (q.v.), which originate at the glass wall of a vacuum tube as a result of the impacts of the electrons, have the property of producing electrons in the air through which they are passing. The Röntgen rays, by their action on a non-dissociated or neutral molecule of a gas, causes dissociation, and the gas becomes what is called 'ionised'—i.e. filled with electrons which make the gas act like a conductor. When a charged gold-leaf electroscope is placed in this ionised gas it rapidly loses its charge, whether that charge be positive or negative. The charged electroscope attracts towards it electrons of opposite charge, and the mating of these opposite charges produces a state of neutrality.

Having in this way ionised a mass of air, Sir J. J. Thomson caused the positive electrons to be attracted towards a conductor having a known negative charge. The diminution of the charge gave the measure of the total charge on the positive electrons. The negative electrons left in the air had therefore a total charge of the same numerical value. This determined the product ne.

In order to measure n, the number of electrons present, Sir J. J. Thomson made use of an ingenious modification of the method of dust-counting as employed by Dr John Aitken. In his well-known experiments on the formation of clouds, Aitken proved that in saturated air which is being slightly cooled, say, by expansion in an air-pump receiver, fogs are formed by the water condensing as small drops on dust particles; and he showed how the number of dust particles in a cubic centimetre of air could be measured by counting the drops collected on a glass surface. When no dust particles exist in the air, the cooling is unaccompanied by the formation of fog. At a later date, however, C. T. R. Wilson showed that when the cooling is sudden and considerable, fogs may again be produced in dustless air, but only when the air is ionised. In other words, electrons act as nuclei, round which small drops of water condense in saturated pure air when the air is cooled by a sudden expansion. Each drop of water, as soon as it is formed round an electron, begins to fall, soon attaining what is called its limiting terminal velocity when the weight of the drop is just balanced by the resistance of the air. Now Stokes showed long ago how the size of the drop could be measured in terms of this terminal speed; and Sir J. J. Thomson, by observing the rate of descent of the upper part of the cloud formed in the negatively ionised air enclosed in a vessel and cooled sufficiently by expansion, was able to calculate the size of the drops. But the whole amount of vapour changed into liquid could be estimated from the fall in temperature of the saturated air. Hence the number of the drops became known, being simply the ratio of the whole amount of condensed vapour to the size of each drop; and since each drop corresponded to one electron, the number of the electrons also became known.

Thus the number of electrons being known and the whole charge ne, the value of e, the charge on each electron, is also determined. It is found that the negative electron has the same charge whether it is derived from ionised air, hydrogen, oxygen, or carbonic acid. Not only so, but it is the same value of charge as that found associated with the negative electron in the kathode rays and with a hydrogen atom obtained by electrolysis — i.e. $3{\cdot}4 \times 10^{-10}$ in electro-magnetic units.

As already noted, the assumptions are that an electron is the centre of a field of electric force, and, when in motion, the nucleus of a field of magnetic force. As the electron moves it carries its own electric field with it; and we may suppose that the motion of the lines of force generates at each point a magnetic force, and with the magnetic field so generated in the region surrounding the moving electron will be associated part of the energy. This may be compared to the hydrodynamic case, in which a body moving through a frictionless fluid transfers kinetic energy to the fluid in such a manner that the whole kinetic energy of the system may be expressed in the form $(m+m')v^2/2$, where m is the mass of the body, and m' an additional mass depending on the density of the fluid and the form of the body.

Now a similar expression can be obtained for the kinetic energy associated with a small charged particle in motion, and the additional mass m' is found to depend on the velocity of the charged particle as well as upon the charge. Thus part of the apparent mass of an electron in motion is electro-magnetic in its origin, and possibly the whole mass may be so. In 1881, before the modern electron theory had been imagined, Sir J. J. Thomson proved that a charged body in motion experienced an apparent increase of mass, and that this apparent mass increased indefinitely as the velocity approached that of light. The velocity of light was therefore the highest possible limit to the velocity of a charged body.

These views have received corroboration from

the study of the values of e/m in the case of electrons moving with higher speeds than can be acquired in the dark space round the kathode of a vacuum tube. Such swiftly moving particles of small mass constitute the β-rays which are shot out from radium with velocities approaching that of light. They may be studied in the same way as the electrons which constitute the kathode rays—i.e. by measuring the deflection in a transverse electric or magnetic field. As first observed by Kaufmann, the ratio e/m diminishes by about one-half as the velocity increases from 240,000 to 280,000 kilometres per second.

As proved by the direction of their deflection in an electric field, these β-rays of high velocity consist of negatively charged particles. The α-rays, on the other hand, consist of positively charged particles which are also projected with high velocities. The so-called γ-rays, again, suffer no deflection in an electric or magnetic field. They seem to be identical with the Röntgen rays, which under certain circumstances coexist with the streams of rapidly moving particles. In the β-rays, then, we recognise the same electrons as those which constitute the kathode rays. For velocities which do not approach close to the velocity of light, the ratio e/m is practically the same for all negative electrons; but when the velocity approaches that of light—and β-ray particles have been observed with a velocity of 290,000 kilometres per second—the ratio e/m markedly diminishes. This can only be on account of the increase in the virtual mass. The distribution of energy in the electro-magnetic field shows that this increase has an electro-magnetic origin, and for rapidly moving electrons the greater part of the mass has this character.

The mechanism of the radium atom which enables it to project with high velocities an apparently endless stream of electrons has not yet been clearly imagined; but the effect of all radio-active bodies on the surrounding gas is the same—they ionise the gas so that it becomes conducting. This ionisation may be explained as due to the collision of the swiftly moving particles emitted by the radio-active body with the molecules of the gas which thus undergo dissociation. Free ions are produced in quantity, and by means of these the electric charge is transmitted through the gas. Gradually with the coming together of oppositely charged ions the gas will lose its ionised state, and become practically non-conducting as at first.

Ionisation may also be produced by means of incandescent solids. For example, when platinum is heated to a red heat it begins to emit positive ions, for which the ratio e/m has various values. When heated to a higher temperature the platinum will begin to emit negative ions also, and these will become greatly in excess as the temperature is raised to a white heat. Ultimately the negative ions emitted are identical with the negative electrons of the kathode rays.

We are thus led to conceive of a material atom as being built up of negative and positive electrons in a condition of rapid movement. When a negative electron escapes, the remaining part of the atom becomes positively charged. If, as in the case of radium, a positive electron also escapes, the atom is left neutral. The electrical test for the existence of these electrons is much more delicate than any other possible test, whether chemical or optical; and nearly all the knowledge we now possess of the properties of radio-active bodies is the result of refined electrical tests, which were first imagined and applied by Sir J. J. Thomson and his Cambridge school.

It is clear that if the moving electron is to be the fundamental assumption, magnetism is to be explained as the results of definite motions of electron streams. Ampère, indeed, suggested that a magnetic molecule might be regarded as a small electric circuit. What the modern electron theory does is to give an insight into a possible mechanism for this small electric circuit. Imagine a negative and a positive electron to approach one another under the influence of their mutual attraction with such velocities as will leave them circling round each other somewhat after the manner of the earth and moon. On account of its much smaller mass, the negative electron will describe its orbit with much greater velocities than those of the positive electron; and the magnetic character of the system will be determined by the motion of the negative electron. This system is called a doublet. It will not be deflected by an electric field; and in a magnetic field it will behave like a small magnet whose north pole is on that side from which the negative electron would appear to be moving clockwise.

Moreover, such a doublet will have a certain periodicity, and will start electro-magnetic waves, which, if the frequency is high enough, will become waves of light. The luminous rays from an incandescent vapour may be supposed to be due to vibrating doublets, or even more complex systems of electrons. When a powerful magnetic force is made to act upon such systems, the periodicities will be affected in such a way that instead of only one frequency there may be several of nearly the same value. A single bright line in the spectrum of such a constituted vapour might become doubled or trebled. It can be mathematically shown that under the assigned conditions an effect of this kind is necessary; and we have the experimental demonstration of it in the Zeeman Effect. Zeeman, indeed, was led to look for the phenomenon as a consequence of the electron theory as presented by Lorentz of Leyden.

The existence of magnetic doublets in the kathode discharge has been proved by Righi. Having placed the kathode at one end of a long vacuum tube, and the anode at the end of a short branch tube perpendicular to it, he obtained under suitable conditions of pressure and of magnetic force a glow discharge in the long tube, projected at right angles to the line joining the kathode and anode. This discharge Righi has called the Magnetic Rays. They experience no deflection in an electric field, but are influenced by a magnetic pole brought near. The phenomena are somewhat complicated; but the broad features can be explained in terms of electron doublets produced, probably under the influence of the magnetic field, in the neighbourhood of the kathode. These magnetic rays act as if they consisted of a stream of electrically neutral bodies which were at the same time magnetic molecules. The simplest electrical representation of such a body is the electron doublet.

In recent years an extensive literature bearing on electricity and magnetism has sprung up, and the modern electron theory is making itself felt even in the more elementary works. The standard works in English are the *Experimental Researches of Faraday* (3 vols. 1838–44–55); Kelvin's *Reprint of Papers in Electrostatics and Magnetism* (1872); Clerk Maxwell's *Electricity and Magnetism* (1873; 2d ed. 1881). These, though previous to the introduction of the conception of the electron, had and still have a profound influence in the development of the science. Among the more recent works may be mentioned Sir J. J. Thomson's *Conduction of Electricity through Gases* (1903); J. H. Jeans's *Electricity and Magnetism* (1910); E. T. Whittaker's *History of the Theories of Æther and Electricity* (1910); Rutherford's *Radio-Activity* (1904; new ed. 1912); G. A. Schott's *Electro-Magnetic Radiation* (1912); N. R. Campbell's *Modern Electrical Theory* (2d ed. 1913); Thomson

and Poynting's *Electricity* (1914). W. C. D. Whetham's *Theory of Experimental Electricity* (1905; 2d ed. 1912) gives a clear account of the theory without demanding too high a knowledge of mathematics.

For convenience of reference, we give an epitome of the arrangement of the article. Electrostatics takes up about half of the article, and is followed by Electrokinematics, Electrolysis, Thermo-electricity, Electromagnetism, and Electrons, in that order:

Electrification.
Electroscope, electrometer.
Fundamental experiments.
Potential.
Equipotential surfaces, lines of force.
Capacity; concentric spheres.
Specific inductive capacity.
Instruments for generating electricity.
Loss of energy at discharge.
Transference of charge, current.
Galvanometer.
Electromotive force.
Resistance, Ohm's Law.
Joule's Law.
Electrolysis.
Energy relations of voltaic cells.
Secondary batteries.
Reversible thermal effects of currents.
Thermo-electricity.
Electro-magnetism and magnēto-electricity.
Electrons.

Electricity, ANIMAL. See ELECTRIC FISHES.

Electricity, ATMOSPHERIC. That the atmosphere, occasionally at least, is in a state of electrification is readily shown by the well-known phenomena of thunder-storms, and that the electrical conditions found on such occasions are the same as that obtained in any laboratory experiment with electrical apparatus was proved by Franklin in 1752 by his famous kite experiment. But since then it has been shown by numerous observations that the atmosphere is constantly in a state of greater or less electrification; that it is sensibly electrified not only during thunder-storms, but also during the prevalence of calm, clear weather. The observations made on the electrical condition of the atmosphere have mainly been the determination of the potential (see ELECTRICITY) of the earth's surface at a given time and place, or of the difference between the potential at a point in the air and that at the nearest point on the earth's surface. The distinction between these two determinations may be made clear by an example. If, for instance, a spherical ball be placed on the top of a rod of conducting material in connection with the earth, and having been lifted from that position by an insulated handle or carrier, be taken to an electrometer, with which to measure its potential, we would get by the latter an estimate of the potential of the earth's surface at the place formerly occupied by the rod and ball. If, on the other hand, we imagine a conductor placed at a given point in the air to become insulated, and then to throw from its surface portions of its mass, it would soon be reduced in potential so as to be in electrical equilibrium with the surrounding air—i.e. it will assume the potential of the air at the point. By afterwards finding the potential of this conductor we obtain a determination of the potential of the air at the point, or, what comes to the same thing, of the difference between the potential of the earth and that of the air at the given point.

The first of these methods was employed by Delmann in an extensive series of observations, but it has been by the second that more accurate observations have recently been made. It is, moreover, capable of being so adapted that a continuous record by means of photography may be obtained. Thomson (Lord Kelvin), in his experiments in the island of Arran, employed two forms of this second mode of experiment. In one he used a burning match or spirit flame on the end of a long vertical insulated conducting rod; the products of combustion continually carry off electricity so long as the potential of the rod is different from that of the air surrounding the flame. The potential of the conductor is thus quickly brought to be the same as the air at the flame. To the lower end of the rod a small portable electrometer is usually attached, from the readings of which the difference between the potential of the earth and that of the air at the flame may be deduced. The other method depends on the same principle. It consists in insulating a can of water which has a long tube projecting from the lower part of its side. The can is usually placed near to and inside the window of a room, while the projecting tube passes through the window. Water is allowed to trickle slowly from the end of the tube at a nozzle, usually a few feet from the window-sill. As each drop falls it carries with it a small charge of electricity, and this goes on until the potential of the can is reduced to that of the air at the nozzle of the tube; this potential is afterwards found by means of the electrometer.

Thus Thomson (Lord Kelvin) found that the difference of potential for a point 9 feet from the ground was equivalent to that of from 200 to 400 Daniell's cells. This represents a resultant force perpendicular to the earth's surface of from about 22 to 44 Daniell's cells per foot. He also found that the electrical conditions were subject to much variation, due no doubt to the motion overhead of electrified cloud-masses, at no great distance from the ground. But generally in calm clear weather the electrometer readings indicated a high positive potential, increasing so markedly before and during east and north-east winds as to be of some value in forecasting the weather. Other observations, chiefly in Europe, show that the potential of the air reaches two maxima and two minima each day, and that the hours of these maxima and minima are different for different seasons of the year. For instance, at Brussels, the two maxima in summer were found to be at 8 A.M. and 9 P.M.; in winter, at 10 A.M. and 6 P.M.

As to the causes of atmospheric electricity, many theories have been propounded, but most of them assume to begin with either some small initial charge of electricity in each vapour particle in a cloud, or some charge of electricity more or less permanent, on the earth's surface. We have only space to mention one or two of the more notable speculations. One which has held a place for some time past is that in which the evaporation going on at the surface of the sea and lakes is made the origin of atmospheric electricity—that in the formation of vapour the particles assume an opposite charge to the mass of liquid which they leave. But it has recently been shown that a much higher temperature is required for such electrification than that which ordinarily is found in large masses of water on the earth's surface. Again, in the condensation of vapour has been sought the source of the phenomena; but that it should be so is difficult to believe, for the very reasons which make the previous speculation somewhat plausible. Some physicists have assumed that the earth has a permanent negative electric charge, and that clouds coming in contact with mountains become charged. That this may be so in special localities is highly probable, yet the original earth's charge is not explained. Thomson (Lord Kelvin) assumed, to begin with, that the lower layers of the atmosphere have a permanent positive charge, which is diffused by convection currents into the upper layers. Atmospheric electricity has also been set down as the result of the friction of dry air against moist air; or, again, by some to the friction of the air in passing over the earth's surface. But this

theory is discredited by the general observation that thunder-storms are more frequent in calm than in windy weather.

The true cause of atmospheric electricity has therefore not yet been discovered. But if any theory can rationally explain a mode by which each small vapour particle in a cloud may become electrified, even with an excessively small charge, the main difficulty would be got over, and the rest would be comparatively easy. The potential of each spherical particle is directly proportional to the quantity of electricity with which it is charged; and when several spheres unite together to form one sphere, the potential of the single sphere is proportional to its surface, compared with the smaller particles of which it is composed. When it is remembered that the number of particles in a drop of water is reckoned at many thousands of billions, it is easy to conceive how a thunder-cloud may have a very high potential, even although the particles may originally have had an extremely small charge.

Meanwhile, it would appear that a widely extended series of observations on the electrical conditions of the atmosphere, together with experiments on a much larger scale than is usual in a laboratory, are necessary requisites before much more light can be thrown on the subject. See LIGHTNING, THUNDER.

Electricity, MEDICAL. The three forms of electricity — Static, Galvanic, and Faradic — are employed in medicine.

(1) *Static.*—This form has been little used of late years, chiefly owing to the inconvenience and uncertainty of the apparatus required for its production. The old frictional and even the Holtz machines were most uncertain in their action, and depended for their efficiency on various conditions of the atmosphere, &c. The recent invention of the Wimshurst machine is increasing the interest in the use of static electricity for medicinal purposes. This instrument being independent of atmospheric conditions is specially well adapted for occasional use.

(2) *Galvanic.*—The current derived from the galvanic battery is largely employed in medicine. As in almost all cases the current requires to traverse the skin, the electrical resistance of which is high, a battery of a considerable number of elements is required to yield sufficient electric pressure. The elements usually employed are some form of the Leclanché or the bichromate element, and batteries containing from 30 to 50 of these are found most convenient. These should yield an electric pressure of from 40 to 70 volts when in good working order. As portability is a consideration, the cells are usually made small, and as the external resistance is considerable and the circuit closed for a comparatively short time, the smallness of the elements is not an objection. When, however, the external resistance is reduced by special appliances, and the current passed for a considerable period, as in the electrolysis of tumours, larger elements must be used, and those of pint or even quart capacity are found convenient. The battery should possess a *collector* by which the cells may be added to the circuit one by one; and the larger-celled batteries should also possess a *rheostat*, by which the external resistance may be varied with perfect gradations so as to avoid the transmission of shocks while the current is being increased or diminished. Until recently the only measure of the amount of electricity employed was the number of cells in the circuit. This is obviously an unreliable guide. The electromotive force of the cells varies with the exhaustion of the fluid and polarisation of the plates, and the resistance of the external circuit varies with the condition of the skin as to moisture, vascularity, and locality, the size, distance between, and the polarisation of the electrodes. And as the amount of current passing depends on an absolute relation between the electromotive force and the resistance of the current, neither of which under these conditions can be known, this method is quite useless. The unit of current strength in ordinary electric measurement is the *ampère.* This is, however, much too large a unit for medical purposes, and the thousandth part of this, termed the *milliampère*, is employed. Galvanometers calibrated in milliampères are now largely made for medical purposes, so that when one of these is introduced into the circuit the exact amount of current passing at a given time can be read directly. As currents varying from 1 to 300 milliampères are now regularly employed, the instrument should be capable of indicating between those limits. Further, the instrument should be as near as possible aperiodic (dead-beat). Such an instrument should therefore be included in the circuit whenever it is advisable to estimate the current strength employed. Effects can only be compared provided we know the amount of current producing them, and this can only be determined by the milliampère-meter. The efficiency of the current depends, however, not only on its amount, but also on its *density.* This character depends on the diameter of the conductors which bring it in contact with the body. The current-density varies inversely as the sectional area of the conductor. Thus a current of 200 milliampères, conveyed to the body by two conductors whose terminals are 10 inches in diameter, may be borne with little inconvenience and produce little appreciable effect, but if one of the conductors be reduced to, say, 1 inch in diameter while the same current is passing, the density of the current at the electrode is greatly increased, the pain would be intense, and vesication and tissue destruction would follow in a very short time. Currents of large amount and of great density are thus employed in the electrolysis of tumours, &c.

Well-insulated flexible wires of suitable length are employed for conveying the current. These terminate in electrodes of various kinds and sizes according to the object in view. For ordinary purposes (galvanisation of muscle, nerve, &c.) discs, plates, or cones of brass or carbon covered with flannel or wash-leather are employed. For conveyance of large currents large pads of moist clay, flannel, sponge, &c., 10 or 12 or more inches in diameter, are employed externally, while the current is concentrated by a platinum or steel needle on the part to be affected. In all cases electrodes to be applied to the skin should be thoroughly soaked in a solution of salt in warm water in order to diminish the resistance of the circuit and the pain of the current.

(3) *Faradic.*—For the production of the faradic current a simple form of induction coil is employed. The primary coil of thick wire is wound round a tube in which slides a bundle of iron wire. The secondary coil of fine wire fits over this. In the best forms of instrument the strength of the current can be regulated both by the sliding of the iron bundle in and out of the primary, and also by the sliding of the secondary over, or off and away from the primary. The induced or faradic current is generated in the secondary coil only when the primary current begins to flow and ceases to flow. See ELECTRICITY. It is convenient to have attached to the induction an automatic electro-magnetic make-and-break, usually called the interrupter. The result is that the primary circuit is no sooner made than it is broken, and no sooner broken than it is made again. This goes on in rapid alternation, and is accompanied by the pro-

duction of induced currents, first in one direction, then in the other. Since the breaking of the primary is a more abrupt process than the making of it, the induced current at break goes through its successive values with corresponding rapidity, and has a more intense physiological effect than the induced current at make.

Physiological Effects of the Galvanic Current: (a) *On Sensory Surfaces.*—When a current of from 10 to 15 milliampères is applied to the skin by electrodes of 1 or 2 inches in diameter, a prickling followed by a burning sensation is experienced. If the current is gradually diminished and the electrodes removed, the skin will be found to be bright red, showing increased vascularity. While the current is being diminished it will be noticed that the sensation first disappears under the positive pole, and while being increased first appears at the negative one, thus indicating the greater exciting effect of the latter. (b) *On Motor Apparatus.*—If a large sponge electrode be applied to the spine in the dorsal region, and a smaller conical one be applied to such a muscle as the biceps in the upper arm, it will be found that if a current of sufficient strength be employed, the muscle will be thrown into contraction at the moment of making and breaking the current. The strength of current required to produce this effect will depend (1) on the pole applied to the muscle; (2) on whether the current is made or broken. In a state of health it is found that muscular contraction occurs with those conditions in the following order: (1) current closed—negative on muscle; (2) current closed—positive on muscle; (3) current opened—positive on muscle; (4) current opened—negative on muscle. Thus the weakest current capable of producing contraction will act when the current is closed with the negative on the muscle (1); and stronger currents will be required to produce contraction under the conditions 2, 3, 4. Or conversely, if a muscle contracts with an opening current, the negative being on the muscle (4), more and more powerful contractions will be obtained by altering the conditions with the same current to 3, 2, and 1.

Electrolytic Effects.—If a broad surface-electrode be applied to any part of the body and connected to one pole, and the other pole connected to a platinum or steel needle inserted into, say, a fibroid tumour of the uterus, or applied to any mucous surface, and a current of 15 to 250 milliampères passed, tissue in contact with the electrodes will be decomposed. Owing to the extent of the external electrode and small density of the current, the result here will be inappreciable, but it is very obvious at the internal one. Thus, if the electrode is positive, the products of decomposition will be strongly acid in reaction (turning litmus red), and the tissue round the electrode will be condensed, and contract round it. If the internal electrode is now negative, the products of decomposition will be strongly alkaline in reaction, and the tissue will be rapidly broken up, a loose frothy material escaping from the electrode, which will move freely in a sinus formed by the electrolysis. The negative pole while liberating alkaline products has much more marked disintegrating influence than the positive.

Physiological Effect of Induced Currents: (a) *On Sensory Apparatus.*—When a weak current from the secondary is applied to the skin, the sensation is that of gentle prickling or tingling. As the strength of the current is increased the sensation becomes more and more painful, but has never the burning character of the galvanic current. (b) *On Motor Apparatus.*—If one or both poles are applied to a muscle, and a single shock of sufficient strength sent, a single muscular contraction will be produced. If the shocks are repeated with sufficient slowness, a series of single contractions will follow; but if the rate of transmission is increased, the muscle will be thrown into a state of tetanus or continued contraction, the effect of one shock not having passed before the next has reached the muscle.

Diagnostic Uses of Electricity.—Galvanic and faradic currents are employed in the diagnosis of various nervous and muscular disorders. In certain diseases of the spinal cord and the cerebro-spinal nerves it is found that the normal phenomena of muscular contraction are much altered. Thus it may be found that a muscle may fail to respond to faradic stimuli of any strength, and yet continue to respond to interrupted galvanic stimuli; and again it may respond to galvanic stimuli in an order different to that indicated in a previous paragraph as normal to health. These abnormal phenomena are termed the 'reactions of degeneration.'

Therapeutic Uses of Electricity.—Only the most general indications of these can be given. The *static* form is of value in the treatment of various nervous disorders—e.g. old-standing neuralgia, chorea, hemi-anæsthesia, hystero-epilepsy, and hysteria. *Galvanism* is used in acute neuralgias, such as tic-douloureux, sciatica, &c.; in atrophy of muscle following hemiplegia, diabetes, writers' cramp, &c.; in spinal irritation, chronic myelitis; in the enlarged and stiffened joints of chronic rheumatism and rheumatic arthritis, and in lumbago; in chronic pharyngitis, in glandular laryngitis (clergyman's sore throat), naso-pharyngeal catarrh, chronic tonsillitis; and in other diseases associated with chronic inflammation and defective nutrition. *Faradism* is employed in general nervous exhaustion associated with insomnia, in functional disorders of the generative organs, in the acute stage of articular rheumatism, giving great relief to the inflamed and painful joints, in incontinence of urine from atony of bladder and sphincter, in irritable and painful prostate, in hysterical aphonia, neurasthenia, &c.

Galvanism in Electrolysis.—Nævi and aneurisms are frequently cured by electrolysis of their contents. Needles insulated to within a quarter of an inch of their points are plunged into the tumour, and through these the current is passed. Coagulation takes place round the needles, and forms a nucleus round which further clotting occurs, resulting in obliteration of the nævus, or strengthening of the walls and filling of the sac in an aneurism. For uterine hemorrhage a current of 100 to 250 milliampères is employed, a thick platinum wire carrying the *positive* current to the mucous membrane of the uterus, a large surface-electrode lying on the abdomen. The positive current is a powerful hæmostatic, and properly applied this method checks most cases of hemorrhage. So also fibroid tumours of the uterus are treated by similar high currents applied in the same way. But the disintegrating effect of the negative pole is preferred either lying in the uterine cavity or introduced into the substance of the tumour. Various inflammatory conditions both outside and inside the uterus are similarly treated. All these effects depend (1) *on the strength of the current*, which is obtained by the use of a sufficiently large pressure (30 to 40 cells = 40 or 60 volts), and a large surface external electrode which diminishes the resistance of the skin; (2) *on the density of the current* at the part to be affected, which is obtained by the use of an electrode consisting of a small platinum or steel needle.

In conclusion, a word may be said regarding the much advertised 'galvanic' and 'magnetic' belts. There is no doubt that galvanic chains, such as Pulvermacher's, are capable of giving a more or

less continuous current of electricity, and it may be that in some cases their use has been followed by benefit. But the irregularity of their action, and the impossibility of directing or controlling the current, render their use entirely hap-hazard. Moreover, very troublesome ulcerations have been produced in the skin by prolonged contact of the negative pole. On the other hand, there is not the least evidence that the so-called 'magnetic belts' have any influence whatever on the tissues or functions of the body. They consist of pieces of watch-spring, or of crinoline steel, more or less magnetised, sewn between layers of flannel or other material, and adapted to different parts of the body. It has never been shown that even powerful magnets have any influence on the bodily functions, and it cannot be believed that these appliances are of any use whatever. Any relief from pain which may follow their application is most probably due to the heat-conserving property of the flannel or other material in which the bits of steel are sewn.

Electric Light. The electric light, like light from most other sources, is produced by raising a body to a temperature so high that some of the radiations it throws out have a wave-length short enough to affect the retina. A slightly heated body gives radiations of long wave-length only; they may be detected, as any radiations may, by their heating effect when they fall on an absorbent surface, but the eye is not sensitive to them. When the body is made hotter the whole energy of the radiations increases, but the short waves increase in greater proportion than the long waves, and when the temperature is sufficiently raised the body begins to give out light. So long as the source is just hot enough to be luminous the light is nearly all red; as the temperature rises there are added more and more of the other colours, of shorter wave-length, towards the violet end of the spectrum. In the flame of a candle or of a gas-jet particles of solid carbon form the luminous source: their temperature, which is determined by the condition that they radiate energy as fast as work is done upon them by the process of combustion, is so low as to make the red and yellow constituents of the light preponderate. A higher temperature has the double advantage of giving whiter light, and of giving it accompanied by a smaller proportion of non-luminous infra-red rays, and therefore with less expenditure of energy in proportion to the amount of light produced.

One way of heating a body to a high temperature is by forcing a strong current of electricity to pass through it. The energy expended depends on the strength of the current and on the electromotive force which is required to make it pass, and this energy takes the form of heat. By selecting a conductor which offers considerable resistance to the passage of the current, it is practicable to produce so much heat in a small space that the temperature reached is only limited by the melting or volatilising of the heated body.

Arc Lighting.—The earliest means of applying the electrical current to the production of light was discovered in 1810 by Sir Humphry Davy, who found that when the points of two carbon-rods, to which the terminals of a powerful battery were connected, were brought into contact and then drawn a little way apart, the current continued to pass across the gap, forming what is known as the electric arc. The electric arc (fig. 1) is brilliantly luminous. The points of the carbon-rods become highly incandescent, and in addition the space between them is filled by a sort of flame, or cloud of particles of white-hot carbon. As the temperature of the arc is much higher than that of any ordinary flame, its efficiency as a source of light is exceptionally great, and it is specially rich in highly refrangible (or short wave-length) rays. The carbon-points being exposed to the air gradually burn away, and in addition to this there is a transfer of carbon particles across the arc from the positive to the negative rod, which has the effect of making the positive rod waste about twice as fast as the negative rod. The end of the negative rod becomes somewhat pointed, and a crater-like hollow forms on the end of the positive rod. As the points waste away the arc lengthens, and would presently break and the current would cease to pass if the rods were not pushed nearer together. Should the arc break it can be re-established by bringing the rods again into contact, and again drawing them a little way apart. Arc lamps are devices for holding the carbon-rods, so that they are first brought into contact and drawn apart, to establish or 'strike' the arc, and are then 'fed' together, continuously or at short intervals, to prevent the distance between the points from growing too long.

Fig. 1.

It was not until the development of the Dynamo-electric Machine (q.v.) as a means of producing the electric current economically on a large scale that the electric light came to be of commercial importance. Before that, however, various contrivances had been devised for automatically striking the arc and regulating its length. As early as 1847 a lamp was patented by W. E. Staite, in which the carbon-rods were set vertically one over the other, the upper one being held fixed, while the lower rod was fed upwards by the intermittent action of clockwork, which came into gear whenever the current across the arc became reduced below a certain limit of strength through the lengthening of the distance between the carbon-points. Similar devices were proposed by Foucault and others; but the first really successful arc lamp was Serrin's, patented in 1857, which has had its main features reproduced in many later forms. In 1858 a lamp designed by Duboscq was used to show the electric light, for the first time at sea, from the South Foreland Lighthouse, where the current to feed the lamp was generated by the large magneto-electric machine of Holmes; and this experiment was followed a few years later by the permanent establishment of electric lighting there and at Dungeness and other lighthouses. The invention of the self-exciting dynamo in 1867 paved the way for the development of electric lighting on a commercial scale. The Jablochkoff candle (1876), in which the arc was formed between the ends of a pair of parallel carbon-rods separated by a layer of insulating material which was slowly consumed as the carbon burned down, did good service in accustoming the public to the new illuminant, and the invention of simple and effective arc lamps by Brush and others brought about its wide adoption in 1878–79 for lighting large rooms, streets, and spaces out of doors. In the following year the future of domestic electric lighting was

secured by the introduction of the incandescent lamp.

The rate at which energy is expended in the electric arc is measured by the product of the current and the electromotive force required to maintain it passing across the gap. If the current be measured in ampères and the electromotive force in volts, their product gives the rate of expenditure of energy in watts, and may be reduced to horse-power by dividing by 746. It is found that the electromotive force between the points is nearly constant whether much or little current is passing, which shows that the opposition to the passage of the electric current across the gap is different in kind from the resistance of an ordinary conductor. However short the arc be, it requires an electromotive force of from 30 to 40 volts to maintain it; when the arc is lengthened the electromotive force necessary to keep up the same current is increased, but not in proportion to the length. It is not found practicable to maintain the arc with less than a certain strength of current. Hence the power consumed in an arc lamp is necessarily considerable, and the lamp can be employed to advantage only where a large amount of light will be serviceable. The ordinary continuous current arc lamps which are most extensively used take from three-quarters to one horse-power, and have an illuminating effect equivalent to something like 1000 candles. It is impossible to speak with any precision of the candle-power of an arc lamp, because its light differs enormously in colour from that of a standard candle. A comparison of the blue rays of the arc with the blue rays of the candle will give a figure nearly three times more favourable to the arc than if the comparison be made between the red rays.

The alternating current lamp is somewhat less efficient, requiring about 1·12 watts per candle. This is because the continual change of polarity keeps both carbons pointed, which results in as much light being thrown upwards as downwards. The temperature attained is also not quite so high, for the hottest point in the arc, instead of remaining stationary, changes its position with each reversal of current. On the other hand, 'choking coils' can be used in place of series regulating resistances required for direct current lamps, which enables the pressure at the terminals to be adjusted to the proper amount with a smaller expenditure of energy.

In so-called enclosed arc lamps a smaller globe inside the usual one practically excludes fresh air from access to the incandescent carbons, with the result that these burn away at a much slower rate, and remain flat-ended instead of becoming conical. Such arcs are longer, and give a more uniform illumination. The pressure required is also greater, being some 80 volts, which enables a single lamp to be connected in series with only a small steadying resistance across 100 volt mains. The efficiency of an enclosed arc is, however, markedly inferior to that of 'open' arcs, the power consumption being about 1·5 watts per candle with continuous current, and almost 3 watts per candle when the current is alternating.

In 1899 Bremer produced his flaming arc lamp, which is easily recognisable by its yellow tint and absence of shadow. The yellow tint is obtained by adding certain metallic salts during the manufacture of the carbons. The entire absence of shadow is because there is no lower carbon to obstruct the light. Both carbons are fed downwards through tubes inclined at a small angle on either side of the vertical, and meet in an inverted cup termed the 'economiser,' which shields the arc from draughts, limits the supply of oxygen, and acts as a reflector. A magnetic field is made to act upon the arc in such a way as to blow it out into the shape of a fan, the electro-magnetic effect on the arc being similar to what would be experienced by a conductor carrying current. The efficiency of these lamps is very high, being of the order of 6 candles per watt.

Early in 1903 the Cooper-Hewitt mercury vapour arc lamp made its appearance. In its simplest form it consists of a sealed glass tube about 1 inch in diameter and 3 or 4 feet long, according to the voltage. The tube is highly exhausted, and contains little else than mercury vapour. The current is led in at opposite ends of the tube through suitable electrodes. To start the arc, the tube is tilted in such a way as to cause a fine thread of mercury to flow from one end to the other. The light is well diffused along the whole length of the tube, but is of an unpleasant greenish tinge.

A peculiar property of the mercury arc is that it will not persist unless the cathode or negative electrode is a pool of mercury, a portion of which is kept hot or 'alive.' This is because the mercury cathode has to supply a continuous stream of mercury vapour which carries the discharge by becoming ionised. The anode or positive electrode, however, need not consist of a mercury pool. It usually takes the form of an iron or carbon terminal connected to the leading-in wire, and so arranged that it is prevented from getting hot.

To obtain a steady discharge through a lamp constructed on this plan it is evidently necessary to supply it with direct current, the mercury electrode being connected to the negative pole.

If an alternating current is used, current can only pass during that phase of the current in which the mercury pool is the negative electrode and the iron or carbon the positive electrode. This unilateral conductivity or 'valve action' dependent upon the different nature and temperature of the electrodes has made it possible to develop the *mercury arc rectifier*, whereby a steady direct current can be derived from a three-phase alternating source of supply.

In the larger sizes of mercury arc rectifier the glass bulb is replaced by a steel container suitably insulated.

The efficiency of the mercury rectifier is high, the chief loss being a constant drop of about 15 volts in the arc. Moreover, the efficiency is well maintained at light loads. As the pressure drop is constant, the efficiency of the mercury rectifier shows to advantage when the d.c. voltage is high, such as 1500 volts, now widely used in France for traction purposes.

Incandescent Lighting.—In early attempts to produce light by the incandescence of a heated conductor, wire of platinum and of other refractory metals was employed; but these become melted or disentegrated at too low a temperature to let them serve as efficient sources of light. Carbon-rods also had been used, but the matter was not brought to a practical issue till 1879, when Mr Edison (and, almost at the same time, Mr Swan) made lamps in which the incandescent conductor was a fine thread or filament of carbon, enclosed in a glass globe, from which the air was exhausted as completely as possible. The filament was originally formed by carbonising a thread of paper, cotton, bamboo, or other vegetable fibre; it is now more usually made by forcing a semi-fluid preparation of cellulose through a die, bending and drying the thread, and heating it to a very high temperature, surrounded with plumbago, in a crucible. The ends of the filament are attached to short conducting wires of platinum, which are sealed into the globe. By making the filament longer or shorter, thinner or thicker, the lamp is adapted to be used with more or less electromotive force, and to give more

or less light. The lamp has a limited life, for the filament undergoes a slow process of disintegration, which finally breaks it. As in the case of an arc lamp, the power consumed is measured by the product of the current and the electromotive force or difference of potential between the terminals. In ordinary use incandescent lamps with carbon filaments consume from 3 to 4 watts per candle of light, and last for some 1000 hours. One may force them to a higher efficiency by increasing the electromotive force, so that the temperature of the filament is further raised, and the light is much increased with the expenditure of but little additional power. But this shortens the life of the lamp, and tends also to make a deposit of carbon particles form on the inside of the glass.

A new departure in incandescent lighting was made in 1897 when Professor Nernst introduced the lamp which bears his name. As long ago as 1877 Jablochkoff had discovered that the oxides of certain rare earths, which are non-conductors when cold, become conductors when raised to a high temperature. The filament of the Nernst lamp is composed of oxides of zirconium, thorium, and cerium, which behave in this manner. Owing to its incombustible nature, there is no need to enclose the filament in a vacuum. To start the lamp burning, the filament must be heated from some outside source, such as a Bunsen flame or electrically heated platinum resistance coil, until its temperature is raised to some 700° C. Current then begins to flow, which by its heating effect further raises the temperature of the filament, thereby improving its conductivity and allowing more current to pass. At this stage the external source of heat can be withdrawn, while the filament, heated more and more by the increasing current, quickly attains a dazzling brightness. As the temperature is very high, about 2500° C., a high efficiency is to be expected, and tests have shown that the power consumption may be as low as 2 watts per candle. As the conductivity of the filament increases very rapidly with the temperature, it is found necessary to put a steadying resistance of fine iron wire in series. This resistance is designed to work at a red heat, and in this way a fairly constant total resistance is maintained.

The complications necessary to provide a heater which shall automatically disconnect itself when the lamp starts burning makes the lamp expensive and liable to get out of order, added to which the useful life of the filament is seldom more than 500 hours. These drawbacks have seriously hindered the commercial success of the lamp, and the introduction of metallic filament lamps may be said to have led to its being almost entirely superseded.

It had long been known that certain refractory metals could withstand higher temperatures even than carbon, but no way had been found of working these metals into fine wires suitable for lamp filaments. In 1903, however, means were devised for drawing fine wires of tantalum. Lamps employing filaments obtained in this way have a consumption of only 2 watts per candle, and give an illumination approaching daylight in colour value. Almost at the same time a method was introduced for squirting filaments of osmium, the most refractory metal known. These lamps give a white light, with a consumption of only 1·5 watts per candle. A disadvantage to this type of lamp is that the filaments are very fragile.

In 1910 Messrs Siemens introduced incandescent lamps with filaments of drawn tungsten. At first they were only obtainable in small sizes for low pressures, but soon the range was extended, and lamps were produced of moderate candle power for normal pressures. These lamps take only 1 to 1·25 watts per candle, and are capable of withstanding a considerable amount of rough usage and vibration.

In 1913 it was announced that an organised research conducted in the laboratories of the General Electric Company of America had resulted in the production of a new metal filament lamp consuming only half a watt per candle. The chief peculiarities of the lamp are that the bulbs are not exhausted, but are filled with some inert gas such as nitrogen, and the filament of drawn tungsten is used wound in the form of a fairly close spiral. The high efficiency and intensely white light result from the extremely high temperature to which the filament is raised. If such a high temperature were permitted in a bulb which was exhausted of air in the usual way, it would quickly blacken owing to the evaporation of the filament. The presence of an inert gas reduces the amount of evaporation, though it has the disadvantage of augmenting the amount of heat conducted away from the incandescent filament. In virtue of the spiral form given to the filament, however, the loss of heat by conduction through the gas is prevented from seriously detracting from the enhanced efficiency resulting from the extremely high temperature to which the filament is heated.

The claim that these gas-filled lamps only consume half a watt per candle has proved to be too optimistic. To obtain a satisfactory life it is necessary to run them at a somewhat lower temperature corresponding to a consumption of 0·65 to 1 watt per candle-power according to size. Compact filaments as used in gas-filled lamps have decided advantages for projection work.

The *pointolite* or arc-incandescent lamp forms an intermediary between incandescent and arc types. In this lamp an arc is maintained within a hermetically-sealed glass bulb. The light is emitted from a little solid ball of tungsten, so approaching closely to the ideal of a point-source of light. The efficiency attained is of the same order as that previously quoted for gas-filled lamps. An important and interesting feature is the ingenious method of striking the arc. This is accomplished by ionising the gap between the electrodes. The emission of ions is obtained by electrically heating a little rod of certain rare earths by closing an auxiliary starting-circuit which is interrupted as soon as the gap between the electrodes has been rendered sufficiently conductive to start the arc.

An important difference between carbon filaments and metallic filaments is that the metallic filaments have a much lower specific resistance, and hence must be made longer and finer than a carbon filament suitable for the same pressure. This requires that very special attention be given to the method of supporting the metal filaments, and makes it difficult to produce a satisfactory metal filament lamp of low candle power for high pressures. Another distinction between carbon and metallic filaments is that the resistance of a metallic filament increases with rise of temperature, whereas that of a carbon filament falls. The result is that the brightness of metal filament lamps is less seriously affected by small variations of pressure, since the resistance changes in the direction calculated to preserve a uniform flow of current.

Incandescent lamps work well with either continuous or alternating currents. They are now made of all sizes, from the miniature lamps of one candle power or less which are employed in surgery, up to lamps of two or three thousand candle power. When a number of them are used together they are almost always grouped in parallel. In the electric lighting of a house, for instance, positive and negative main conductors, consisting of insulated copper wire, are led from the dynamo, and to these the

positive and negative branches are respectively connected, whose ramifications extend to every room. Wherever a lamp is to be placed a positive and a negative leading wire must come, and each lamp forms, as it were, a bridge between the positive and the negative side of the system. The difference of potential is nearly the same for all; it is a little less in the case of the more distant lamps, because a certain fall in the difference of potential is incurred through the resistance which the leading wires themselves offer to the passage of the current. This loss has to be kept within reasonable limits by making the sectional area of the leading wires great enough, and no serious difficulty is experienced in doing this when the lamps all lie within a few hundred feet of the source. But the difficulty becomes serious when distribution is attempted on a large scale. Not only is the loss of energy in the conductors then a large part of the whole energy supplied, but it may give rise to wider variations in the potential than can be tolerated. If the number of lamps in use in any district were nearly constant, so that a nearly constant current would flow through the mains leading to that district, it would be easy to allow for the fall of potential in those mains. But this fall is itself a variable quantity, depending on the amount of the local demand; and to keep the potential sufficiently constant requires mains of large size, the cost of which becomes prohibitory when the area of distribution is much extended.

In such cases it is necessary to resort to other methods of distribution than by a simple system of parallel mains and branches. A sufficient number of sub-centres may be taken over the area to be lighted, and each of these made the starting-point of a system of parallel conductors, the sub-centres themselves being fed from the central source, through independent mains, with currents which are regulated to produce the necessary potential at each sub-centre. Even then, however, if the sub-centres are widely distant from the source the loss of energy in the mains will be serious. In distribution over a large area there is an obvious advantage in very high potential, for the same amount of electrical energy is then conveyed by a smaller volume of current, and consequently with less loss in the conductors. An obvious way of utilising mains having a higher difference of potential between them is to employ two lamps in series. Objections to this simple expedient are that lamps can only be switched on in pairs, and if one of them breaks or becomes disconnected, the other lamp is also extinguished. These drawbacks have been ingeniously overcome by Hopkinson's 'three wire system,' for a description of which the reader must be referred to some of the works mentioned at the end of this article.

Another method also widely adopted is to convey the electric energy to sub-centres in the form of small currents at a high potential, and convert it there into low-potential currents suitable for domestic use. Two plans of doing this have been put in practice—one, by means of storage batteries, is suitable for continuous currents; the other, by means of transformers, is suitable for alternating currents.

Storage Batteries are cells consisting of large sheets or grids of lead, superficially coated with oxide, which are immersed in dilute sulphuric acid, and are polarised by the passage of the current. Peroxide of lead is formed on the positive plates, and spongy metallic lead on the negative. After being charged by the passage of the current the cells will act for a time as electric generators, giving a current in the opposite direction until the plates again become inactive, when they may be again charged. The electric energy given out when the cells are discharging is somewhat less, but need not, if the cells are slowly charged, be very much less, than the energy expended in charging them. Each cell has an electromotive force of about two volts, and its internal resistance is made low by grouping a number of pairs of plates in parallel within a single cell (fig. 2). When such cells are used to convert an electrical supply from high to low potential, they are grouped in series while they are being charged, and the groups are then broken up into sections which may be discharged separately or connected in parallel for discharge. Apart from this use of storage batteries in electric lighting, they form a most valuable, but unfortunately very costly, adjunct in domestic and other installations for steadying the electromotive force of the supply when used as a shunt across the terminals of the dynamo, and for storing electricity for use during intervals when the dynamo is not running. Small storage batteries have been successfully employed as a means of providing portable electric lamps for use in houses, carriages, and especially in mines. The miner's lamp is a small storage battery weighing a few pounds, and is enclosed in a watertight case no bigger than an ordinary lantern, in the front of which is fitted a small incandescent lamp protected by a stout glass cover.

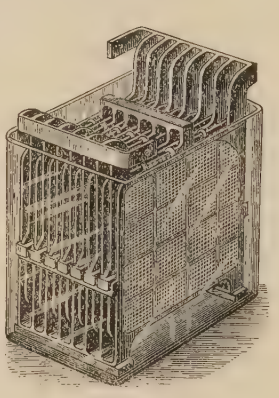


Fig. 2.

Transformers are induction coils, consisting of a core of soft iron on which two coils of insulated copper wire are wound. When alternating currents are made to pass through one of these, called the primary coil, they produce corresponding periodic alternations of magnetism in the iron, and induce alternating currents of corresponding period in the other or secondary coil. The effect of the iron is to increase the coefficient of mutual induction between the two coils. When the number of windings in the secondary coil is small compared with the number of windings in the primary coil, the electromotive force induced in it is correspondingly smaller than the electromotive force impressed upon the primary; and this is taken advantage of in practice in the conversion of a high-potential into a low-potential supply for electric lighting. In order that the iron core should have as much magnetic susceptibility as possible, it is made in the shape of a ring or some other closed (poleless) magnetic circuit, and to prevent waste of energy by the induction of currents in the substance of the iron, the core is laminated by being built up of thin plates or of wire, and in modern transformers a special steel alloy is generally used in place of iron, which combines permanently good magnetic properties with a high specific electric resistance. Even then, however, there is some waste of energy in the core on account of what is called magnetic hysteresis in the periodic changes of magnetism it undergoes, and some further waste occurs through the heating of both the primary and secondary coils in consequence of the resistance they offer to the conduction of the currents.

Notwithstanding these sources of loss the efficiency of a modern transformer is seldom less than 95 per cent., and in transformers of large size, such

as 1000 kilowatts capacity and upwards, working under favourable conditions, as much as 98·5 per cent. of the energy expended in the primary coil may be given off in the converted currents from the secondary.

It is common practice to immerse transformers in a tank containing mineral oil. The oil helps to keep the transformer cool by conducting the heat away to the walls of the tank, and also improves the insulation. Transformers immersed in oil in this way have been constructed to give pressures as high as 1,000,000 volts for testing purposes.

In early practice the current was in many cases reversed as often as 200 times per second, which fact is generally expressed by simply saying that the 'frequency' (meaning frequency of complete alternations per second) was 100. A frequency of 50 has now become very general for lighting and power purposes, but the still lower frequency of 25 is still found in many districts. Frequencies below 40 are unsuitable for lighting on account of the flickering which then becomes apparent at each reversal of the current.

Distribution of electricity for the purpose of lighting by means of transformers, high potential being used in the conveyance of the currents from the distant source, with conversion to low potential before use, was first effected on a fairly large scale in America.

Powerful electric 'search-lights' have long since become indispensable for naval purposes; see NAVY.

Among the minor adjuncts in electric lighting, an important part in guarding against possible risk of fire is played by the 'cut-outs,' whose function is to interrupt the current in any main or branch conductor should it ever exceed a safe strength—as might happen in the event of an accidental cross-connection or short-circuit being formed between the wires. The usual form of cut-out is a safety fuse, consisting of a short piece of foil or wire made of lead or of some fusible alloy which any dangerous excess of current will melt, and so interrupt the current, in that portion of the system which is guarded by the cut-out, before any damage is done. Cut-outs are generally put at the junction of branch with main wires, as well as in the mains themselves. Where the amount of current to be passed is large, an electro-magnetic cut-out is often preferred to a fuse.

Numerous forms of *meter* have been devised for measuring and recording the quantity of electricity supplied to consumers, some suited for continuous currents only, and others for alternating as well as continuous currents. Space does not admit of any description of the ingenious meters invented by Ferranti, Aron, and others.

References.—The early literature of electric lighting consists mainly of papers published in scientific and technical journals, for the most part since 1878, among which may be mentioned: J. Hopkinson in *Inst. Civil Eng. Lectures* (1883) and *Proc. Royal Soc.* (1887), G. Kapp in *Proc. Society of Telegraph Engineers* (1888) and *Min. Proc. Inst. Civil Eng.* (1889), and G. Forbes in *Journal of Society of Arts* (1885, 1886, and 1889); Fleming, *Electric Lamps and Electric Lighting* (1899). Recent text-books on the subject are: Thomälen and Howe, *A Text-book of Electrical Engineering;* Gisbert Kapp, *The Principles of Electrical Engineering;* Meares and Neale, *Electrical Engineering Practice;* Gisbert Kapp, *Transformers for Single and Multiphase Currents;* Maurice Solomon, *Electric Lamps;* Hutchinson, *High Efficiency Electrical Illuminants;* A.P. Trotter, *Illumination;* J. A. Fleming, *Mercury Arc Rectifiers;* Dick and Fernie, *Electric Mains and Distributing Systems;* C. C. Garrard, *Electric Switch and Control Gear;* Drysdale and Jolley, *Electrical Measuring Instruments.*

Electric Railway. The proposal that electricity should furnish motive-power on railways is nearly as old as the railway-system itself. In 1837, when it was still doubted whether steam locomotives would come into general use, an experiment in electric traction was made by Robert Davidson, who propelled a car on the Edinburgh and Glasgow Railway by an electro-magnetic engine, with a galvanic battery to supply the current. But the cost of producing electricity on a large scale by means of a battery is so great as to make such a method of locomotion impracticable, however perfectly the electric energy may afterwards be converted into mechanical work. And the electro-magnetic motor of those days was an extremely inefficient machine, which did not succeed in utilising more than a small fraction of the electric power supplied to it. The matter consequently fell into complete abeyance, and was not revived until engineers had at their command a much cheaper mode of producing electric energy, and a much more efficient mode of turning it to mechanical account. This came about with the introduction of the Dynamo-electric Machine (q.v.), which gave a cheap means of converting work done by a steam-engine or any other prime mover into the electrical form, and with the recognition that the operation of the dynamo was reversible—that it would serve as a motor, to do mechanical work by the agency of the electric current. Hence it became practicable to work a railway electrically, by having at one station a dynamo to produce the current, driven by a steam-engine, turbine, or any other source of power, and by using this current to drive another dynamo, as a motor, upon the train, electrical connection between the train and the source of supply being maintained by means of conductors with which the train should be kept in contact throughout its course.

This was first demonstrated on a practical scale at the Berlin Exhibition of 1879 by Werner Siemens, who made and worked with complete success a line 219 yards long, on which three carriages, carrying twenty people, ran at a speed of about 7 miles an hour, by means of the current from a fixed dynamo, which was driven by a steam-engine. The current reached the car through a special conducting rail placed between the wheel-rails, and insulated from the ground by blocks of wood. The motor on the car took the current from this rail by the rubbing contact of copper brushes, and the circuit was completed through the car wheels and the ordinary rails. In 1881 a permanent electric tramway, 1½ mile long, was established at Lichterfelde (Berlin), where a still simpler plan of conducting the current was employed: the two ordinary rails, insulated from the ground and from one another by wooden sleepers, formed the two conductors.

The first really successful electric railway was the Portrush line in Ireland, 6 miles long and 3-foot 6-inch gauge, opened in 1883; the first line in America was opened a year later, and from that time forward the growth of electric railways has been continuous. Among the more important developments in this country may be mentioned the City and South London tube railway, 1887; the Liverpool overhead railway, the whole length of the docks (6 miles, with fourteen stations), 1893; the Central London tube railway, 6½ miles long, from Shepherd's Bush to the Bank; the Mersey Railway and the District Railway from Ealing to South Harrow (5 miles), both electrified in 1903. The first application of electric traction in place of steam on the main railway systems of the country began in the following year (1904), when the Tynemouth branches of the North-eastern Railway and the Liverpool and Southport branches of the Lancashire and Yorkshire Railway were both electrified. Slowly but surely the other great railway companies are following suit by electrify-

ing portions of their systems over which the passenger traffic is sufficiently dense.

The plan of using the rails themselves as the only conductors is obviously impracticable, except on very short lines and in special circumstances, on account of the difficulty of maintaining good insulation. Of the various methods which have been employed for keeping the moving car or train in continuous electrical contact with the source of supply, three in particular deserve mention. In the first place there is the so-called 'overhead system,' in which a bare copper wire is carried on posts above the track, connection being made by a wheel mounted at the extremity of a trolley-pole which projects from the roof of the car. This is the system nearly always adopted for electric trams which have to run along public thoroughfares. A notable exception is the tramway system of the London County Council. In this case, instead of a single wire suspended overhead, two stiff conductors are carried on insulators in a conduit constructed between the rails, the collector or 'trailer' which makes the necessary sliding contact passing down through a narrow slot in the top of the conduit. The third and last system of which mention can be made is that commonly found on electric railways. A third stiff conducting rail is used, raised from the ground on insulating supports, sometimes between the running rails, but more often on one side and rather above the level of the other rails. A metal brush projecting from the side of the car leads in the current from the insulated 'live rail' to the motors. In common with the 'overhead system,' the return path for the current is through the wheels to the running rails. This is not the case, however, in the 'conduit system' of the London County Council. Here there are two separate insulated conductors in the conduit, with which continuous contact is maintained, one of which acts as the return, and no current flows into the tram-lines. As there is danger from electric shock to any one who may accidentally step on the live rail of an electric railway, this system can only be allowed when the line is private property and completely shut off from the general public; for instance, level crossings cannot be tolerated across a railway electrified on this system. Continuous current and alternating currents, both single and multiphase, have all been successfully applied for purposes of electric traction; but by far the greater number of electric trams and trains in this country are propelled by two or more direct current series wound motors. Generally gearing is introduced so that the motors rotate at a higher speed than the driving-wheel axles, but in some cases the armatures are fixed directly on the driving-axles.

To obtain the full benefit of electric traction it is essential that two or more separate motors should be employed in order to secure economical operation of the motors at a low speed as well as at full speed. This object is attained by connecting the motors in series when starting or travelling at slow speed, and altering the connections so that the motors are in parallel when full speed is acquired. Suitable resistances are also introduced at starting and in the transition stages between the series and parallel arrangements in order to check the large currents that would otherwise flow. The necessary changes in the connections are all made in proper sequence by simply turning the handle of a switching apparatus called the 'controller.' As currents of considerable magnitude have to be broken in switching over from one step to the next, destructive arcing is liable to occur at the controller contacts. For this reason it is usual to arrange a strong magnetic field, obtained by making the current taken from the line pass through the coil of an electro-magnet in such a way that the interreaction between this field and the current in the arc bridging the retreating contacts blows out the arc almost as soon as it is formed.

Besides the saving of electric-power effected by the so-called 'series-parallel control' just described, a further advantage of having at least two separate motors on every vehicle is that the driving effort can be spread over two or more axles, and consequently nearly all the dead-weight can be made available for securing a good adhesion between the driving-wheels and the rails.

The difficulty encountered in a system of electrification employing continuous current only is that the pressure at which the current is picked up from the track is usually limited in this country to 600 or 750 volts. It is true that in France and certain other Continental countries 1500 volts is being standardised for main-line electrification, while America provides an example in which the pressure of the direct current picked up by the moving train is as high as 3000 volts. Still, even at 3000 volts the limit of distance is soon reached at which it becomes uneconomical to transmit direct current from a single central station.

The usual way of overcoming this difficulty is to equip the central station with high-pressure three-phase alternating current generators, and to transmit the electric energy in this form to a series of sub-stations arranged at intervals along the railway. In these sub-stations the high-pressure three-phase current is converted into direct current at 600 to 3000 volts as the case may be, in which form it is applied to the various sections of the line.

Many alternative schemes have been worked out for utilising the high-pressure alternating current transmitted from the power station directly upon the moving trains, so avoiding the complication of the sub-stations for transforming into low-pressure continuous current. If three-phase current is employed, the train can be propelled satisfactorily by induction motors, and certain Continental electric railways are operated on this system; but the advantages obtained by the elimination of the sub-stations are considerably offset by the necessity of having an extra rubbing contact maintained between the train and a high-tension conductor.

On the whole, the best way of applying high-pressure alternating current directly to the train seems to be by means of single-phase current and compensated single-phase motors either of the series or repulsion type (see article on Dynamo-electric Machines). The first examples of English railways equipped on this system are the Heysham, Morecambe, and Lancaster section of the London Midland and Scottish Railway and the Brighton section of the Southern Railway. Both these lines have a single overhead conductor supplied with alternating current having a frequency of 25 and a pressure of about 6600 volts. Transformers on the train reduce this high pressure to a low pressure suitable for the motors. A drawback to the system is that the electrical equipment of the train is rather heavy, which results in more waste of energy every time the train has to be stopped and started again from rest.

All the arrangements for electric traction that have been referred to above are *conductor* systems. Energy is continuously passing to the car through the conductor which maintains connection between the distant dynamo and the motor on the car, and any break of continuity of the conductor, or any failure on the part of the car to make contact with it, deprives the car instantly of locomotive power. The introduction of storage batteries (see ELECTRIC LIGHT) has made an alternative method of electric traction practicable—viz. the *storage* system, in which each car or train is self-contained as regards

power. In this system there are no conductors along the line, but each locomotive is furnished with a set of storage cells, which are charged from time to time by means of a station dynamo, and carry enough energy to last during the trip. (For electric motor-cars specifically so called, see the article MOTOR-CARS, where they are described.) In some cases the plan is worked by placing the cells under the seats of the car, in others by using a separate locomotive car to carry them and the motor. Its chief drawbacks are the dead-weight of the batteries and the cost of renewing these when they are worn out or injured by the rather rough treatment they receive on the road.

See Dawson, *Electric Railways and Tramways* (1897); Hanchett, *Electric Railway Motors* (New York, 1900); Bell, *Power Distribution for Electric Railroads* (N.Y. 1900); Herrick, *Electric Railway Handbook* (N.Y. 1901); Rider, *Electric Traction* (1903). Recent text-books on the subject are: Wilson and Lydall, *Electric Traction*; F. W. Carter, *Railway Electric Traction*; A. T. Dover, *Electric Traction*.

Electric Telegraph. See TELEGRAPH.

Electric Waves. See the latter part of the article ELECTRICITY, also ETHER, LIGHT, MAGNETISM, REFRACTION, &c.; and for their practical application in wireless telegraphy, TELEGRAPH.

Electric Welding. See WELDING.

Electro-biology is a term used both of Animal Electricity, discussed at ELECTRIC FISHES, and of Mesmerism, or a phase of Animal Magnetism (q.v.).

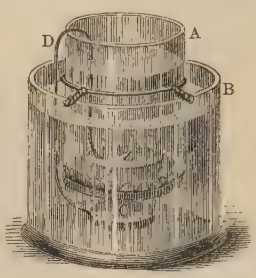
Electrocution, a mode of execution adopted in the state of New York in 1888, and afterwards in various other states of the Union, by passing a current of electricity through the body. The condemned man is seated in a chair, and one electrode applied to his head, the other to the calf of the leg. The word is irregularly formed in imitation of *execution*.

Electrolysis. See ELECTRICITY.

Electro-magnetism. See MAGNETISM.

Electro-metallurgy is the art of depositing, electro-chemically, a coating of metal on a surface prepared to receive it. It may be divided into two great divisions—electrotype and electroplating, gilding, &c., the former including all cases where the coating of metal has to be removed from the surface on which it is deposited, and the latter all cases where the coating remains permanently fixed. Gold, platinum, silver, copper, zinc, tin, lead, cobalt, nickel, can be deposited electrolytically.

Electrotype is the art of copying printing type, woodcuts, seals, medals, engraved plates, ornaments, &c. by means of the galvanic current in metal, more especially copper. Suppose we wish to copy a seal in copper; an impression of it is first taken in gutta-percha, sealing-wax, fusible metal, or other substance which takes, when heated, a sharp impression. While the impression —say, in gutta-percha—is still soft, we insert a wire into the side of it. As gutta-percha is not a conductor of electricity, it is necessary to make the side on which the impression is taken conducting; this is done by brushing it over with plumbago by a camel-hair brush. The wire is next attached to the zinc pole of a weakly charged Daniell's cell, and a copper plate is attached by a wire to the copper pole of the cell; or, as is now usual, the current required is supplied by Dynamo-electric Machines (q.v.). When the impression and the copper plate are dipped into a strong solution of the sulphate of copper, they act as the – and + electrodes. The copper of the solution begins to deposit itself on the impression, first at the black-leaded surface in the vicinity of the connecting wire, then it gradually creeps over the whole conducting surface. After a day or two on the old method—after a few hours when the magneto-electric is used—the impression is taken out; and the copper deposited on it, which has now formed a tolerably strong plate, can be easily removed by inserting the point of a knife between the impression and the edge of the plate. On the side of this plate, next the matrix, we have a perfect copy of the original seal. If a medal or coin is to be taken, we may proceed in the same way, or we may take the medal itself, and lay the copper on it. In the latter case, the first cast, so to speak, that we take of each face is negative, showing depressions where the medal shows relief; but this is taken as the matrix for a second copy, which exactly resembles the original. The adhesion between the two is slight, and they can be easily separated. The cell of a battery is not needed to excite the current. A galvanic pair can be made out of the object to be coated and a piece of zinc. The figure shows how this may be done. B is a glass vessel containing sulphate of copper; A is another, supported on B by a wire frame, and containing a weak solution of sulphuric acid. The glass vessel A is without a bottom, but is closed below by a bladder. A piece of zinc, Z, is put in the sulphuric acid, and a wire, D, coated with insulating varnish, establishes a connection between it and the impression, C, which is laid below the bladder. Electrotype is of the greatest importance in the arts; by means of it duplicates in copper of pages of type are obtained, as is done with this Encyclopædia; engraved copper plates may be multiplied indefinitely, so that proof-impressions need be no rarity; woodcuts can be converted into copper; bronzes can be copied; and similar applications are made of it too numerous to mention. By connecting a copper plate ready for corrosion with the + pole, and making it a + electrode, it can be etched with more certainty than with the simple acid, and without the acid fumes.



Electroplating.—This is the art of coating the baser metals with silver by the galvanic current. Theoretically simple, it requires experience and skill. Articles that are electroplated are generally made of brass, bronze, copper, or nickel silver. When Britannia metal, iron, zinc, or lead is electroplated, it must be first electro-coppered, as silver does not adhere to the bare surface of these metals. Articles to be electroplated are first boiled in caustic potash to remove any adhering grease; they are then immersed in dilute nitric acid to dissolve any rust or oxide that may be formed on the surface; and they are lastly scoured with fine sand. Before being put into the silvering bath, they are washed with nitrate of mercury, which leaves a thin film of mercury on them, and this acts as a cement between the article and the silver. The bath where the electroplating takes place is a large trough of earthenware or other non-conducting substance. It contains a weak solution of cyanide of silver in cyanide of potassium (water, 100 parts; cyanide of potassium, 10 parts; cyanide of silver, 1 part). A plate of silver forms the + electrode; and the articles to be plated, hung by pieces of wire to a metal rod lying across the trough, constitute the – electrode. When the plate is connected with the copper or + pole of a one or more celled galvanic battery, according to the strength required, or subjected to the magneto-electric current, and the rod is joined with the zinc or – pole, chemical decomposition

immediately ensues in the bath, the silver of the cyanide begins to deposit itself on the suspended objects, and the cyanogen, liberated at the plate, dissolves it, re-forming the cyanide of silver. According, then, as the solution is weakened by the loss of the metal going to form the electro-coating, it is strengthened by the cyanide of silver formed at the plate. The thickness of the plate depends on the time of its immersion. The electric current thus acts as the carrier of the metal of the plate to the objects immersed. In this way, silver becomes perfectly plastic in our hands. We can by this means, without mechanical exertion or the craft of the workman, convert a piece of silver of any shape, however irregular, into a uniform plate, which covers, but in no way defaces, objects of the most complicated and delicate forms. When the plated objects are taken from the bath, they appear dull and white; the dullness is first removed by a small circular brush of brass wire driven by a lathe, and the final polish is given by burnishing. The process of electro-gilding is almost identical with that of electroplating. Success in either is attained by proper attention to the strength of the battery, the strength of the solution, the temperature, and the size of the + electrode.

Electro-deposition of other metals is similar in principle to electroplating. Gold (see GILDING) is deposited by a current from solution in aqua regia; copper from copper sulphate; zinc (in 'electrogalvanising' iron) from zinc sulphate; nickel (in 'nickel-plating') from nickel ammonium sulphate.

In a wider sense electro-metallurgy includes all processes in which electric current is used for metallurgical purposes, whether by its heating effect, as in welding, or the Electric Furnace (q.v.); or by electrolysis (see ELECTRICITY), as in obtaining metals from ore or waste material; or by both combined, as when the current fuses and electrolyses the ores of aluminium.

Electrom'eter. See ELECTRICITY.

Electron. The name given by Dr Johnstone Stoney to the smallest charge of electricity carried by an atom of matter; the facts of Electrolysis (q.v.) —interpreted by Faraday and Maxwell—serving to show that this was an indivisible unit or atom of electricity. In the years 1897–99 Sir J. J. Thomson demonstrated the separate existence of negative electrons, or corpuscles, in rarefied gas when conveying an electric current; and the nature of the corpuscle was found to be independent of the nature of the gas. He showed that these particles had 'mass' (see MATTER), but of amount so small that a thousand of them would not equal that of an atom of hydrogen, the lightest known particle of ordinary matter. Whether electrons have 'weight'—i.e. whether they are gravitationally attracted by the earth like ordinary matter—is still unknown. There is good reason to maintain, on the strength of experiments by Kaufmann and others, that the mass or inertia of an electron is explicable electromagnetically—i.e. that it is explicable in terms of the magnetic field generated by any moving charge. This theory, when worked out, fixes the order of magnitude for the size of the nucleus or centre of force which constitutes an electron, which turns out to be about the hundred-thousandth part of an atom in diameter, thus being by far the smallest individual particle known or suspected. The size of the electron and its charge and mass have been ascertained, with great experimental accuracy, by Professor Millikan in America. Ordinary electrification is the result of an excess or defect of electrons.

The positive electron has not yet been certainly discovered, but the unit of positive charge is known to be a very small massive atomic nucleus, 1850 times as heavy as an electron, and therefore comparatively stationary, while electrons can revolve round it. Such a positive unit is called a proton. A single proton is a hydrogen nucleus; four constitute the nucleus of helium; and other combinations occur at the centre of other atoms. The properties of the proton have been chiefly elucidated by Sir Ernest Rutherford. The present view of the constitution of matter is that it is composed or built up of definite groupings of electrons and protons in equal numbers.

Electric conduction through metals—possibly thermal conduction also—is believed to be due to the locomotion of a crowd of electrons through atomic interstices, in a state almost free, or passing so easily from one atom to another as to be practically free. In electrolysis, they only travel by carrying the atoms with them; but in a vacuum tube they are flung from the negatively charged terminal or cathode with enormous velocity, against the positive terminal as a target, and produce the various effects of bombardment observed by all experimenters, and elucidated by Crookes in and about 1879.

When these projectiles are suddenly stopped in a sufficiently high vacuum, moreover, they not only heat or render luminous the target which they strike, but the stoppage of each is accompanied by a momentary pulse or shiver of ether, which travels out with the speed of light, penetrating many opaque bodies to a surprising depth, and producing the other effects discovered initially by Lenard, and more conspicuously by Röntgen (q.v.).

All radiation, on the classical theory, is believed to be due to the acceleration or change of motion of electrons, ordinary light being due either to their orbital rotation, or to perturbation of those orbits by what may be called 'chemical clash.' The theory of electronic radiation we owe to Sir Joseph Larmor, *Æther and Matter*. The atomic theory of Professor Bohr of Copenhagen has accounted in accurate detail for the bright line spectra of the chemical elements, by supposing that round the nucleus of an atom are a number of possible stable orbits, and that it is only in dropping from one of these orbits to another that light of definite wave-length is emitted. See ATOM. The number of electrons belonging to each atom of the chemical series of elements was counted by Moseley, and the numbers range from 1 for the lightest element, hydrogen, to 92 for the heaviest element, uranium. The heavier elements are liable to instability, and occasionally fling away electrons and protons, thereby degrading or stepping down, to become lower elements in the series. In this way radium ultimately becomes lead. The subject will be found treated in Sir J. J. Thomson's *Discharge of Electricity through Gases*, in Sir Oliver Lodge's book called *Electrons*, in Rutherford's *Radioactivity*, and also more recently in Professor Millikan's book *The Electron* (Univ. of Chicago Press). See ELECTRICITY.

Electroph'orus, an instrument for obtaining electricity by means of induction. A tin mould, kept in connection with the ground, is filled with shell-lac or resin, and has a movable metal cover with a glass handle. When the surface of the resin or shell-lac is smartly beaten with cats' fur, this electrifies the resin negatively. When the cover is brought near the lower part of the apparatus, it is charged positively on its under surface, negatively on its upper. If then it is touched, the negative escapes, and the cover is charged with + electricity; and if removed and applied to any conductor, it will give a positive charge to the conductor. This may be often re-

peated with but small diminution of the original charge in the lower part of the apparatus, save by connection or dampness. The earth connection may also be made by other means.

Electroplating. See ELECTRO-METALLURGY.

Ele'git, a writ by which a judgment creditor is put in possession of the land of the debtor; as contrasted with a writ of *Fieri Facias* (q.v.) to the sheriff to levy the debt.

Elegy (Gr. *elegeia*), properly a song of lamentation, came even amongst the Greeks to be used of any poem written in distichs. The alternation in elegiac verse of hexameter with pentameter helps to give to this species of poetry its character; but many poems have been written in this form which are not elegies proper. Few Greek have come down to us. Among the Romans, Catullus, Propertius, Tibullus, and Ovid were elegiac writers. Tibullus brought the erotic elegy to its highest perfection. In England the term elegy is applied to any serious piece where a tone of melancholy pervades the sentiments, as in Gray's famous *Elegy* (see GRAY). It includes also such splendid tributes to the dead as the *Lycidas* of Milton, the *Adonais* of Shelley, the *In Memoriam* of Tennyson, the *Thyrsis* of Matthew Arnold, the *Ave atque Vale* of Swinburne. There are collections of English elegies by W. F. M. Phillipps (1879) and J. C. Bailey (1899).

Elemental Spirits. See SYLPHS.

Elements, CHEMICAL, the simplest known constituents of all compound substances. Chemists regard as elementary substances or elements only those substances which have not been proved to be compound. It is not inconceivable that some of the substances at present designated elements (for list of known elements, see ATOMIC THEORY) may hereafter be proved to consist of more than one simple kind of matter, but in the meantime they are correctly called elements, as that term is applied above. The elements are somewhat arbitrarily divided into non-metals and metals, the latter forming by far the larger class. There is no sharp line of demarcation between the two classes, several elements occupying positions on the border line. The elements long classed as non-metals were: Hydrogen (in chemical relations behaving like a metal), chlorine, bromine, iodine, fluorine, oxygen, sulphur, selenium, boron, nitrogen, phosphorus, carbon, silicon. But the list was increased by the discovery of helium and argon (1895), and krypton, neon, and xenon (1898). Many hold that all the elements are composed of one fundamental elementary substance (see CHEMISTRY, PHYSICAL CHEMISTRY, METALS, RADIUM, ATOM, MATTER). For the time-honoured 'Four Elements' of the Greeks—air, fire, water, earth—see EMPEDOCLES. The 'Shoo-king,' a Chinese work older than Solomon, has five elements —water, fire, wood, metal, earth. The Indian Institutes of Manu have also five—subtle ether, air, fire, water, and earth.

Elemi, a fragrant resinous substance, is obtained from the pitch-tree, Arbol de la Brea, a native of Manila. Formerly many varieties of elemi, such as Mexican, Brazilian, and Mauritius elemi, were in the market, but these have now been supplanted in Great Britain by the original substance, that obtained from Canarium. Manila elemi, when pure and fresh, is colourless, and resembles in consistence old honey, but it is usually found mixed with impurities, hard, and of a yellow tint. It possesses an aromatic odour resembling that of a mixture of lemon, fennel, and turpentine, and when distilled, yields as much as 10 per cent. of essential oil. When treated with cold alcohol, it partly dissolves, leaving about 20 per cent. of a white resinous substance called Amyrine. Elemi is never used internally, and only seldom as a stimulating ointment to old wounds.

Elephant, a genus of mammals in the order Proboscidea, now represented only by two species. These two survivors of a once numerous and widely distributed order occupy a zoological position of peculiar isolation, but they are connected by the

Fig. 1.—African Elephant ('Jumbo').

extinct Mastodon and Dinotherium to Coryphodon and the Dinocerata, and further back still to a probable origin among primitive hoofed or ungulate animals. The modern elephants—African and Indian—are quite distinct from one another, and are sometimes referred to separate genera (fig. 2). Like other giant animals, they are becoming gradually restricted in distribution and numbers, a fact of course hastened by the demand for the ivory of their tusks.

Principal Characters.—In some of their structural features, especially in nose, skull, and teeth, the elephants are as highly differentiated as they are in general intelligence; while on the other hand the anatomy of their limbs and anterior venous system is simple and primitive. The huge size, thick skin, and scanty hairs; the enormous head with high rounded skull containing large air-spaces and with wide expanse for the insertion of muscles; the long, muscular nose or proboscis with the nostrils at the tip; the short stiff neck which makes the trunk such an advantage; the huge simple limbs and massive feet, are conspicuous features. The brain is not much larger than man's, but as one would expect from the elephant's cleverness, is richly convoluted; the hind portion or cerebellum is, however, uncovered like a rabbit's. The teeth consist (1) of a pair of enormous, ever-growing upper incisors or tusks, composed mainly of the precious dentine or ivory; and (2) of the large plaited molars, the final result of a long series of historical differentiations, six on each side above and below, but never represented by more than one in full use at a time. The upper parts of the stout limbs are very long, so that the knees especially are situated far down; the five toes are inclosed in a common hoof which is very massive, the circumference of the fore-foot measuring about half the height at the shoulder. More technical characters are the presence of two superior venæ cavæ, the simple stomach and large cæcum, the abdominal situation of the male organs, the two-horned uterus,

deciduate zonary placenta, and the position of the two teats upon the breast. The diet is vegetarian, and the animals are gregarious. An elephant may weigh 3 to 4 tons, and live 120 years, though the average seems to be about eighty.

The Two Species.—The Indian Elephant (*Elephas indicus*) is now restricted to the forest-lands of India and south-east Asia, including Ceylon and Sumatra. The African Elephant (*E.* or *Loxodon africanus*) inhabits the greater part of the African continent south of the Sahara. The contrast between the two species may be indicated as follows :

Indian.	African.
Ears of moderate size.	Ears 3½ feet long by 2½ feet broad.
Molar teeth with folds parallel.	Lozenge-shaped folds.
Trunk ends in finger-shaped upper lobe.	Lobes of trunk apex nearly equal.
Concave forehead.	Arched forehead.
Four or five nails on the hind-foot.	Three nails on the hind-foot.
Males about 10 feet at shoulder.	Males about a foot higher.

For extinct forms such as the Mammoth (*Elephas primigenius*), nearly allied to the Indian species, for the ancient British forms, for the Pigmy Elephant (*E. melitensis*), and for other Proboscidea, the reader is referred to the articles Mammoth and Mastodon.

Habits: Food.—The elephants use their trunks in gathering leaves, branches, and herbage, which they pass dexterously to the mouth. The Indian elephant eats the leaves of the palm, fig, and jak trees, &c. ; the African form is fond of the succulent mimosa. Most kinds of palatable vegetable food, from sugar-canes to coco-nuts, are acceptable. Those brought to Britain are largely fed on hay and carrots. They prefer forest and mountainous regions ; are ready to plunder rice and other crops, but seem to have a wholesome dread of fences.

Drinking.—Without bending head or limbs, the elephant dips the end of the trunk into the water, and fills it by a strong inspiration. The trunk is

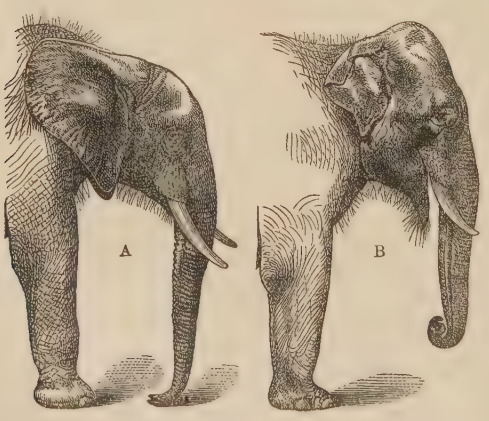


Fig. 2.—Heads of (A) African and (B) Indian Elephants.

then inserted into the mouth and forcibly emptied. In the same way water or even sand may be blown over the body for cleaning and cooling the skin.

Locomotion.—The general leisurely and heavy tread of the elephant can be changed into a very fast trot or peculiar shuffle, especially when the males furiously charge their rivals or enemies. Their slow but sure progress is found most serviceable in difficult mountain travelling. Though one would hardly expect it, they undoubtedly have considerable powers of swimming. 'A whole herd has been known to swim without touching bottom for six consecutive hours, rest a while, and then swim three more, with one rest.' When a herd with young ones is forced to take to the water, the mothers hold some up with their trunks, while others find a more comfortable position on their mothers' backs.

Fig. 3.—Tips of Trunks of (*a*) African and (*b*) Indian Elephants.

Herding.—Elephants are conspicuously social, a habit which has doubtless directly influenced their intellectual development. The herds are usually family parties ; the mothers and young go in front, the males bring up the rear. The positions are reversed in alarm and danger. Both family likeness and family sympathies are often strongly marked. The leader is obeyed and also protected with much *esprit de corps.*

Breeding.—The males of both species are rather larger than the females, and excel in strength, endurance, and in the greater development of the tusks. A male is on this last account valued at one-fifth more than a female. In some localities—e.g. Ceylon, the female incisors remain very small, and the disproportion is always more marked in the Indian species. The male elephant is polygamous, and usually rules alone in the herd, expelling or killing his rivals. By means of such habitual contests the tusks have doubtless been perfected in strength. Except at the breeding season, the adult males live much by themselves, probably for selfish reasons rather than from love of solitude. At pairing-time a gland opening on the side of the head, between eye and ear, becomes especially active in the adult males, which are then said to be in 'must,' and are then well known to be probably the most dangerous of animals. The gland secretes a substance of strong musk-like odour, and is one of the numerous secondary sexual characters exhibited by animals. The fragrance is probably attractive to the female sex, though this must be a subsequent advantage, and not in any way a cause of the development of such an organ. 'The elephant,' Darwin observed, 'is reckoned the slowest breeder of all known animals, and I have taken some pains to estimate its probable minimum rate of natural increase : it will be under the mark to assume that it begins breeding when thirty years old, and goes on breeding till ninety years old, bringing forth three pair of young in this interval ; if this be so, at the end of the fifth century there would be alive fifteen million elephants, descended from the first pair.' It is obvious enough that mortality and enemies, especially man nowadays, obviate any approximation to even such slow, natural increase of numbers. The elephant is one of the best examples of Spencer's law of the inverse ratio of individuation and rate of reproduction. Endless stories are told of the savageness of 'rogue' elephants, which seem chiefly to be males who have been expelled from the herd, and have in part the savageness of Ishmaelites, and in part the madness of enforced celibacy. The mothers manifest much maternal affection and care. One young elephant is born at a time, though occasionally twins may occur. There is a long (20½ months) period of gestation. The elephant sometimes breeds in captivity. Even after twenty years of menagerie life, birth is said to have occurred. In Siam and other parts of the East, breeding studs are kept up, but recruiting by fresh captives is always necessary. One of the baby Asiatic elephants born in America weighed 245 lb. at birth, and was about the size of a sheep.

It took milk for six months, and afterwards began to eat tender grass. The sucking is done as usual with the mouth, not with the trunk.

While the tusks of the male are much used in the customary contests with rivals, they serve other purposes. Thus Darwin notes: 'The elephant uses his tusks in attacking the tiger; according to Bruce, he scores the trunks of trees until they can be thrown down easily, and he likewise thus extracts the farinaceous cores of palms; in Africa he often uses one tusk, always the same, to probe the ground, and thus ascertain whether it will bear his weight.' The tusks are also used in ploughing the ground in search of bulbs. According to the position and curvature of the tusks, he either 'flings the tiger to a great distance—it is said to even 30 feet, or endeavours suddenly to pin him to the ground'—an action dangerous to the rider, if there be one, who is apt to be jerked off the howdah.

The trunk can be used in endless ways, to pull down a tree or snip a bunch of grass, to lift an immense weight or a pin from the ground, to fight or to fondle. Through it they make a loud shrill sound described by Aristotle as resembling the hoarse noise of a trumpet.

Intelligence.—Though the eyes are very small, they are quick to discern, and the other senses are highly developed. The elephants are also social animals. These two conditions, always favourable to intellectual development, are certainly here associated with a high degree of intelligence. Their memory both for friends and foes is strong, and has been more than once remarkably illustrated by tamed elephants, which, having escaped and been recaptured, returned with all their old obedience to their keeper. In higher mental qualities elephants are only excelled, according to Romanes, by dog and monkey. By dexterous blowing, an elephant made a potato, which had fallen out of reach, rebound against the opposite wall so as to return to an accessible place. Darwin observed similar experiments in the Zoo. Their dexterity in assisting human labour, their quiet submission to operations, the gusto with which decoys practise deceit, the manner in which they thatch their backs in summer to keep off sun and flies, their selection, shaping, and dexterous use of pieces of wood (implements) for leech-scrapers, fans, &c., their discriminating way of lifting and handling different materials according to their hardness, sharpness, (abstract ideas), &c., are all remarkable. To pile up materials round the base of a tree, so as to make a platform from which to reach an otherwise inaccessible enemy, shows decided power of rational device. An elephant has been known to feign death, and the working tamed forms are said to have an accurate sense of time. Of their capacity for learning tricks little need be said; to take tea at a table and ring for the waiter, to uncork bottles and drink the contents, or even to salute princes, puts more strain upon the elephant's patience than upon his intellect.

Emotions.—The elephant may be extremely gentle and affectionate, or when injured, both passionate and vindictive. They readily form friendships with their keepers, with children, or with fellow-animals, and sometimes manifest quite human tenderness. The partnership between the wild elephants and the birds which pick insects from their skin and rise screaming when alarm threatens, is obviously not disinterested. The better emotions, such as sympathy, appear undoubtedly to predominate, but there is no doubt as to their proverbial vindictiveness. The classic story of the tailor and the elephant has been repeatedly verified, in some cases with tragic results. As peculiarities of emotional temperament, Romanes notes the following: 'If a wild elephant be separated from its young for two or three days, though giving suck, it never after recognises or acknowledges it. The members of a herd are exclusive, a strayed stranger is driven off, and may thus become a "rogue" or "goondah." Such an Ishmaelite undergoes a transformation of disposition, becoming savage, cruel, and morose. He is possessed not by sudden bursts of fury, but by a deliberate brooding resolve to wage war on everything, and lies patiently in wait for travellers.' Elephants are also subject to sudden death from what the natives call a 'broken heart,' and which seems in some cases at least referable to psychical or cerebral conditions.

White Elephants.—Albinos occur among elephants as in other animals. In these the colouring matter of the skin is deficient; but the adjective white can hardly be used to describe the result. Their rarity has made them valuable, and they are revered as incarnations of Buddha. Holder notes that in the 16th century Pegu and Siam fought over one for many years, till five successive kings and thousands of men were killed, while Barnum in 1883 bought one in Siam which cost him $200,000 by the time it reached America. Elephants vary slightly in the amount of hair on their characteristically naked hides. Those on high cool regions in India are said to have rather more hair, thus approaching the woolly extinct species of long past Arctic climates.

Hunting.—The elephant is hunted either for captivity, work, and pageantry, or for the sake of its ivory. The Indian forms are often captured alive in numbers by organised parties of four hundred or so natives, and the process is both tedious and costly. The herd is surrounded, and the circle narrowed by fires and watching. A strong fence and moat are made to form the so-called 'kheddah' into which the elephants are driven. There they are separated and hobbled by riders on tame elephants, whom the captives, curiously enough, do not touch. Single elephants are also noosed or decoyed by tame females; the pitfall method is too frequently fatal to be profitably employed if the elephants are wished alive. They are of course also hunted and killed both for sport and ivory. Sometimes, too, their ravages on cultivated ground have necessitated check. The shots are said to kill only on the forehead, temple, and behind the ear. The African elephant is followed either on horseback or foot, and some of the Arabs are said to be daring enough to face it with only sword and shield.

Uses.—The Indian elephant has been, and still is, much used as a beast of burden. In its half-domesticated state it becomes a patient and effective worker. They are of great service in lifting and carrying heavy burdens, which they hedge on to their tusks with the trunk. An ordinary elephant can carry half a ton continuously on a level road. In their natural state they often march for 20 miles to their feeding-ground or water-supply. In captivity they require a great deal of care and as much food. 'A large tusker needs 800 lb. of green fodder in 18 hours.' Their expensiveness, delicacy, and infertility are obstacles to domestication. The African elephant, anciently trained for war and pageantry, seems, contrary to the prevailing belief, to be still tamed and worked in the upper Congo basin. Some of the Duke of Mecklenburg's expedition (*From the Congo to the Nile and the Niger*, 1913) saw a herd of thirty, some of them at work, and photographed one ploughing.

Alexander encountered elephants in his campaigns; Semiramis is said to have made sham ones. In the Carthaginian wars, the Romans were at first disastrously affrighted by them, but with

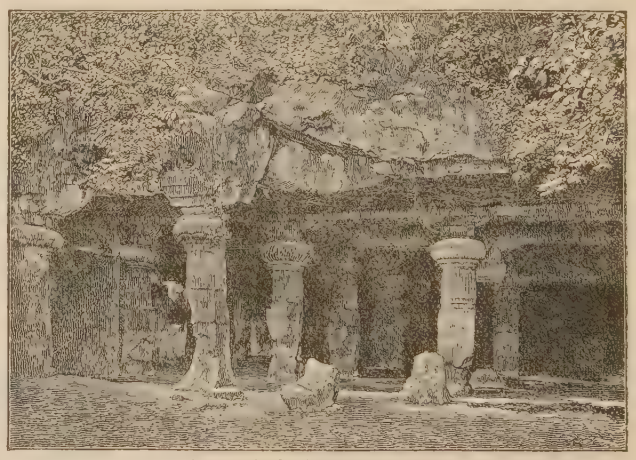
familiarity learned to terrify them with torches. They captured several from Pyrrhus in 276 B.C. The Carthaginians are said to have used 140 elephants at the siege of Palermo; Hannibal took 37 over the Alps, where, according to Philemon Holland's quaint translation of Livy, they had 'much ado not to topple on their noses in the slabby snow-broth;' and the Romans themselves learned to use them. Even in modern times, in the East, they have continued to be so used, and in the Burmese war, though not actively engaged, elephants were found of great use both for transport and for clearing passages in the jungles.

Elephants have been almost equally used in pageantry and games. Cæsar held elephant tournaments and employed them to draw chariots, while Nero characteristically matched an elephant against a single fencer. So too they have for many centuries held their place in the Juggernaut processions, and were remarkably displayed in honour of the visit of Edward VII. (as Prince of Wales) to India.

Ivory.—The tusks of an elephant may weigh 150–300 lb., and 'a famous tusk exhibited by Grote & Co., New York, measures 8 feet 11 inches on outside curve, has a diameter at the base of 6½ inches, and weighs 184 lb.' They have small 'milk' predecessors, but these fall out when the animal is very young. The true tusks are what are called rootless teeth, growing from persistent pulp, and owe their value to the large mass, elastic nature, and somewhat peculiar texture of the dentine portion (see TEETH). The enamel is very slightly developed, and only at the apex. See IVORY.

Proboscidean Fictions.—Under this title, Holder, in his interesting account of the 'Ivory King,' collects a number of the oddities erroneously recorded in regard to elephants. Thus it was long believed that they shed their tusks every ten years, but buyers of ivory can no longer have such comfortable assurance. Writers of the 14th century allude to the belief that they have two hearts, such extremes of temperament do they exhibit! From the low position of the knee-joint, the idea arose that the elephant's legs bend in opposite directions to those of other animals; while a different view is expressed by Ulysses in *Troilus and Cressida:* 'The elephant hath joints, but none for courtesy, his legs are for necessity, not for flexure.' Choicest by far, however, is the expression to a common belief exposed by Sir Thomas Browne in *Pseudodoxia Epidemica*—the elephant 'hath no joynts, and being unable to lye down, it lieth against a tree, which the hunters observing do saw almost asunder, whereon the beast relying by the fall of the tree falls also downe itselfe, and is able to rise no more.'

Elephanta (native *Gharápuri*), an island over 4 miles in circuit, in the harbour of Bombay, 6 miles E. of the city, and 4 miles from the mainland. It owed its European name to a large figure of an elephant which stood near its former landing-place, but which, after 1814, gradually sank into a shapeless mass. Of the island's far-famed Brahmanic rock-caves, four are complete, or nearly so; the most important is the Great Temple, still used by the Hindus on Sivaite festivals. It is entirely hewn out of a hard trap-rock, and measures 130 feet from north to south, and the same distance from east to west; the body of the cave forms a square of about 91 feet, originally supported by twenty-six columns, and sixteen half-columns, of from 15 to 17 feet, many of which have been injured or destroyed. The most striking of its many sculptures is a three-headed bust of Siva, nearly 18 feet high and 23 feet round the eyes. This unique bust, like most of the other figures here, has been much defaced, and policemen are now employed to protect the cave. The caves most probably date from the 9th century.



Caves of Elephanta—Entrance.

Elephanti'asis Arabum (also called *Cochin* or *Barbados Leg*, or *Pachydermia*) is a disease chiefly of tropical climates, and specially frequent in India. It consists in an overgrowth of the skin and connective tissue of the parts affected, with occasional attacks of inflammation resembling erysipelas. The disease (so called because the skin becomes like elephant's hide) is associated with, or caused by, obstruction of the lymphatic vessels of the affected part. In many cases a parasitic worm (*Filaria sanguinis hominis*) is found in the patient's blood, and is believed to cause the obstruction; but the disease may occur from other causes. The lower limbs and genital organs are the parts usually affected, and may attain an enormous size; the scrotum has been known to weigh over 100 lb. In the early stages it can sometimes be reduced or kept in check by firm bandaging, with careful avoidance of all causes of irritation—e.g. over-fatigue, great changes of temperature. But in severe cases, amputation of the part affected is often necessary to allow the patient to move about at all. For the wholly distinct disease, *Elephantiasis Græcorum*, see LEPROSY.

Elephantiné (Arab. *Gezîrat Aswân*, or *Gezîrat-ez-Zahr*, 'isle of flowers'), a small island of the Nile, 'a mosaic of vivid green, golden sand, and black syenite,' lying opposite to Assuan (q.v.), the ancient Syene, on the confines of Egypt and Nubia, in 24° 5′ N. lat., and 32° 34′ E. long. The ruins of the ancient city are traced in a large mound near the modern villages. From this island the Greek mercenaries were sent into Ethiopia by Psammetichus I. to recall the Egyptian deserters, and it was garrisoned in the times of the Pharaohs, Persians, and Romans. The island was anciently called *Ab*, or the 'ivory island,' from its having been the entrepôt of the trade in that precious material. The most important ruins, preserved till 1822, when they were mainly demolished to build a vandal governor's palace, were a late granite gateway of the time of Alexander III.; and a small temple dedicated to Khnum, the god of the country, and Sati, the goddess of the inundation, which was

built by Thothmes III. and his successors down to Amenhotep III. Another remarkable edifice (also destroyed in 1822) was the Roman Nilometer, mentioned by Strabo, which appears to have been built in the time of the Cæsars; several inscriptions still preserved record the heights of inundation from the time of Augustus to Severus. The island had the honour of giving a dynasty (the 5th) to Egypt, and was the capital of the first nome of the Southern Kingdom; the inscriptions on the rocks attest the adoration paid by Seti I., Psammetichus II., and other monarchs, to the local deities. Other interesting monuments have been found on this island; amongst which may be cited part of a calendar recording an important chronological datum—the date of the rising of the star Sothis, marking the beginning of the Egyptian year, in the reign of Thothmes III. (1445 B.C.); a Roman quay; and numerous inscribed potsherds—principally receipts in the Greek language—given by the farmers of the taxes in the reign of the Antonines. The population of the island is at present exclusively Nubian. There is a museum.

Elephant Island, an uninhabited island of the South Shetlands (q.v.), nearly completely covered with ice and snow, and almost entirely destitute of plant life, was discovered along with the other islands of the South Shetlands by a British trader in 1819. A landing there was first effected on 15th April 1916 by Shackleton's Antarctic expedition of 1914–16, after their great drift, first on the ice-bound *Endurance*, then on a detached ice-floe, and latterly in open boats. From here Shackleton with five men later made South Georgia in an open craft, and returned, after three abortive attempts, to the successful rescue of the hard-pressed members of his expedition, 30th August 1916.

Elephant-seal, or SEA-ELEPHANT (*Macrorhinus proboscideus* or *leoninus*), the largest of the seals, the male measuring about 20 feet in length. It occurs in the southern oceans off Patagonia, Juan Fernández, Kerguelen, &c. The colour is grayish, the teeth relatively very small, the hind-feet without nails. The males are much larger than the

Elephant-seal (*Macrorhinus proboscideus*).

females, and have a tubular prolongation of the snout, dilatable in excitement. They live in families and societies, and feed on fish and molluscs, especially cuttle-fishes. The skin furnishes leather; the oil is valuable for burning; the tongue alone is palatable. Some distinguish a second, almost exterminated, species (*M. augustirostris*), found off the coasts of California and Western Mexico. See SEAL.

Elephant's-foot. See HOTTENTOT'S BREAD.

Elephant-shrew, a name applied to a number of long-nosed, long-legged Insectivora, forming the family Macroscelidæ. They are natives of Africa, and are notable for their agile jumping over loose sand. They use their hind-legs somewhat in kangaroo fashion. There are three genera, Macroscelides, Rhynchocyon, and Petrodromus.

Elettaria. See CARDAMOMS.

Eletz. See JELETZ.

Eleusiné, a genus of Grasses, of which several species are of importance as cultivated cereals, notably *E. coracana* and *E. indica* in India, and *E. Tocusso* in Abyssinia. *E. indica* is now common in the United States.

Eleusis, next to Athens the most important town of ancient Attica, on the Bay of Eleusis, opposite Salamis, was connected with the capital by the Sacred Road. It was famous as the chief seat of the worship of Demeter, whose mystic rites were here performed with great pomp and solemnity from the earliest authentic times till the era of Alaric, by whom the second and famous temple of the goddess, designed by Ictinus, one of the architects of the Parthenon, was destroyed. For the Eleusinian mysteries, see MYSTERIES. The site of the old Eleusis is now occupied by the little village of Lefsina, 16½ miles WNW. of Athens by rail. Excavations carried on by the Greek Archæological Society since 1882 have laid bare the whole of the sacred buildings, and the history of the great hall of mysteries can be traced. See Percy Gardner, *New Chapters in Greek History* (1892); J. G. Frazer's translation of *Pausanias* (1898); and *Eleusis*, by Phillios (trans. by Gatcliff, 1906).

Eleu'thera, one of the Bahamas (q.v.). For Eleuthera Bark, see CASCARILLA, CROTON.

Elevation, in Geology. See UPHEAVAL, VOLCANO.—In Astronomy and Geography, elevation means the height above the horizon of an object on the sphere, measured by the arc of a vertical circle through it and the zenith. Thus, the elevation of the equator is the arc of a meridian intercepted between the equator and the horizon of the place. The elevation of the pole is the complement of that of the equator, and is always equal to the latitude of the place. The elevation of a star, or any other point, is similarly its height above the horizon, and is a maximum when the star is on the meridian.

Elevation of the Host. See HOST.

Elevators (GRAIN) is the name given, especially in the United States, to erections for the transhipment of grain, and in which it is often stored for months, being weighed both when received and when sent out. Some of the largest are erected at Chicago and Buffalo. The grain on being received at the elevator is examined and graded, all of the same quality being kept together. The farmer or merchant who brings it receives an acknowledgment for so much grain of such a quality; and the grain which is delivered from the elevator on his account is grain of that quality, and not the same as he brought. In New York, floating elevators are frequently employed to transfer the grain from barges to sea-going vessels direct. Fixed elevators are generally built so as to be approachable by vessels on one or two sides, and have tramways running in on the level of the street; the chain of buckets which raises the grain moves, as the case may be, in an inclined plane passing through the wall to a vessel outside, or in a vertical plane into pits into which the grain has been shot from railway-trucks. The chain receives its motion from an endless band passing over one or two horizontal shafts in the upper part of the structure, the engine and boiler being located in a building outside the elevator itself.—Elevators in hotels, &c. are in Britain generally called Lifts (q.v.).

Elf. See FAIRIES.

Elf-bolts, flint arrow-heads (see FLINT IMPLEMENTS), long believed to be shot by elves, and therefore used as amulets.

Elgar, SIR EDWARD, O.M. (1911), was born 2d June 1857, at Broadheath, near Worcester. He played in orchestras, was bandmaster at the county lunatic asylum in 1879–84, and in 1885 succeeded his father as organist in the Roman Catholic Church, Worcester. An *Intermezzo* by him was produced at Birmingham in 1883. After a discouraging residence in London (1889–91) he returned to the west of England, and taught and composed at Malvern and at Hereford. He attracted a certain amount of notice by his *Froissart* overture, played at the Worcester Festival in 1890, by *Scenes from the Saga of King Olaf* (1896), *Caractacus* (1898), his cycle *Sea Pictures* (1899), and other works; but it was only in 1900, by his oratorio *The Dream of Gerontius*, that he gained world-wide recognition as one of the leading musicians of his time. In 1904 he was knighted. In 1905–8 he was professor of music in Birmingham University. Having made a new thing of oratorio in *Gerontius* and *The Apostles* (1903), he afterwards did the same for the violin concerto (1910) and for the symphony (1908 and 1911). During the Great War he produced many notable compositions, including the *Spirit of England* and *Carillons*.

Elgin, the county town of Elginshire, 5 miles by rail SSW. of its seaport, Lossiemouth, 37 ENE. of Inverness, and 178 N. of Edinburgh. It lies on the Lossie in the 'garden of Scotland;' and while it retains a few quaint old houses, two crosses, and its cathedral, bishop's palace, and other ruins, it brightened up much during the 19th century. The Elgin Institution was erected in 1832 as an almshouse and school, out of £70,000 bequeathed by Andrew Anderson (1746–1822), who from private had risen to be major-general in the service of the East India Company. Other edifices are Gray's Hospital (1819) and the adjoining asylum (1834–65), the county buildings (1866), the court-house (1841), the market buildings (1850), the academy (1800), and the parish church (1828), with a tower 112 feet high. The once glorious Gothic cathedral (1224–1538) was a cruciform structure, 289 feet long by 120 across the transept, with two western towers, and a loftier central spire (198 feet). It was partially burned in 1270, and again in 1390 by the 'Wolf of Badenoch;' was dismantled in 1568; and in 1711 was finally reduced to ruins by the fall of the great tower. The chapter-house, with its 'prentice pillar,' is noteworthy. The town itself has suffered much from fire, its partial destruction in 1452 at the hands of the Earl of Huntly giving rise to the proverb 'Half done, as Elgin was burnt.' Little remains of the royal castle, which in 1296 lodged Edward I. of England; its ruins are surmounted by a monument (1839–55) to the last Duke of Gordon. A royal burgh since the reign of David I. (1124–53), Elgin till 1918 united with Banff, Macduff, Peterhead, Inverurie, Cullen, and Kintore to return one member to parliament. Pop. (1831) 4493; (1921) 7776. See Mackintosh, *Elgin, Past and Present* (1914).

Elgin, a city of Illinois, on the Fox River, 36 miles WNW. of Chicago by rail, with good water power, large watchworks, and many other manufactures; pop. (1880) 8787; (1920) 27,454.

Elgin and Kincardine, EARL OF, Governor-general of India. James Bruce, eighth Earl of Elgin, and first Baron Elgin in the peerage of the United Kingdom (1849), was born in London, 20th July 1811. He was son of the seventh Earl of Elgin (1766–1841) who brought from Athens the collection of sculptures known as the 'Elgin Marbles.' As governor of Jamaica (1842–46), and as governor-general of Canada (1847–54), he displayed administrative abilities of the highest order. While on his way to China in 1857, as plenipotentiary extraordinary, he learned at Singapore the outbreak of the Indian mutiny, and promptly diverted the Chinese expedition to the aid of Lord Canning. The mission to China was delayed, but ultimately, after some military operations and diplomacy, issued in the treaty of Tientsin (1858). He also negotiated a treaty with Japan. In 1860 again a combined English and French force penetrated to the capital, and enabled Lord Elgin and Baron Gros to dictate a peace under the walls of Peking. In 1861 Elgin became viceroy of India, but died 20th November 1863. See his Letters and Journal (1872); and books on parts of his life by Laurence Oliphant (1859), Bourinot (1905), and Wrong (1905).—His son, the ninth earl (1849–1917), born near Montreal, and educated at Eton and Balliol, was an active Liberal politician, and held numerous offices, including those of Treasurer of the Household, First Commissioner of Public Works, viceroy of India (1892–98), chairman of the commission on the churches question in Scotland (1905), and colonial minister in the Campbell-Bannerman cabinet (1905–8).

Elgin Marbles, ancient sculptures brought from Greece by the seventh Earl of Elgin, then ambassador to the Porte, and acquired for the British Museum in 1816 for £35,000. Elgin obtained a firman to examine, measure, and remove certain stones with inscriptions from the Acropolis of Athens, then a Turkish fortress. His agents, on the strength of this firman, removed the so-called Elgin Marbles, packed before Elgin's recall in 1803, but not finally conveyed to England till 1812. They are said to have cost the ambassador upwards of £74,000; and

Part of the Frieze of the Parthenon—Elgin Marbles.

both before the purchase by the government and afterwards, there was fierce controversy as to the artistic value of the statues, and Elgin's right to remove them from Athens. Lord Byron's view as to the unjustifiableness of the removal was shared by

many, who nevertheless believed not merely that the marbles were thus saved from great risks, but that they were now made vastly more accessible to students than they could have been in Athens during the troublous times that followed.

These sculptures adorned certain buildings on the Acropolis of Athens. The chief portions, which are from the Parthenon or Temple of Minerva, were designed by Phidias, and executed by him, or under his superintendence. They consist mainly of statues from the pediments, metopes, and a large part of the frieze of the cella (see ATHENS); a figure from the Erechtheum, and a statue of Dionysus, and part of the frieze of the Temple of Winged Victory. See the various publications of the British Museum.

Elginshire, or MORAY, a Scottish county extending 30 miles along the low shore of the Moray Firth. It is 34 miles long, and 488 sq. m. in area, a former detached portion having in 1870 been annexed to Inverness-shire, whilst a corresponding portion was transferred from that county to Elginshire. The surface has a general southward ascent, and attains a maximum altitude of 2328 feet. Rivers are the Spey, Lossie, and Findhorn; and of several small lakes much the largest is Lochindorb (2 miles by 5 furlongs). West of the Findhorn's mouth are the sand-dunes of Culbin, due to drifting chiefly in 1694, and some of them rising 118 feet (see DRIFT). The predominant rocks are crystalline in the south; next Old Red Sandstone, with fish remains; and then reptiliferous sandstone of (probably) Triassic age (see DICYNODON). Agriculture is highly advanced over all the flat fertile lower tract; still, only about one-third of the entire area is in cultivation. Burghead and Lossiemouth are fishing-villages; and whisky is distilled in the higher districts. Moray and Nairn shires return one member to parliament. Pop. (1801) 27,760; (1841) 35,012; (1921) 41,561. The ancient province of Moray included the counties of Elgin and Nairn, with parts of Banff and Inverness shires. Scandinavians early gained a footing; and it did not become an integral part of the Scottish kingdom till the later half of the 12th century. Antiquities are the Roman remains of Burghead, Elgin cathedral, Sueno's Stone (Forres), Kinloss Abbey (1150), Pluscarden Priory (1230), a Romanesque church at Birnie, and the castles of Duffus, Lochindorb, and Spynie, the last with memories of Bothwell. See histories by Shaw (1775) and Rampini (1897), and C. Matheson, *Moray and Nairn* (1915).

Elgon, a volcanic mountain mass, 40 miles square, on the Kenya-Uganda boundary, 50 miles NNE. of the Victoria Nyanza, first visited by Joseph Thomson in 1883; highest point of the crater's rim, 14,140 feet above the sea. The southern slopes show a series of vast caves, partly artificial.

El Hasa. See ARABIA.

Elias Levita. See LEVITA.

Elie, a pretty little watering-place of Fife, 23 miles NE. of Edinburgh (by rail 44). The so-called Elie rubies, found on the beach, are garnets. Pop. 1500, or, with the adjoining burgh of Earlsferry, 2200 (one-half visitors).

Elie de Beaumont. See BEAUMONT.

Elijah, one of the greatest of the prophets of Israel, flourished during the reigns of Ahab and Ahaziah (*circa* 870–840 B.C.). The story of his career is told in 1 Kings, xvii.–xix., xxi.; 2 Kings, i., ii.; 2 Chron. xxi. 12–15. His main effort was directed to save Israel from lapsing into heathenism, and especially to thwart the efforts of Ahab and Jezebel to establish Baal-worship. The narrative of his life is full of human interest. His victory over the prophets of Baal on Mount Carmel is one of the most dramatic scenes in the Old Testament, and the record of his despair and flight to Horeb, where he receives a revelation from God in a 'still small voice,' one of the most pathetic. The great figure of Elijah so impressed itself upon the Jewish imagination that a belief grew up that he would return to earth to herald the advent of the Messiah, and Jesus himself said of John the Baptist, 'This is Elijah that is to come' (Matt. xi. 14). See Milligan, *Elijah, his Life and Times* (1887); and Cheyne, *The Hallowing of Criticism* (1888).

Elimination, in Algebra, is the operation which consists in getting rid of a quantity or letter which is common, say, to two equations, by forming out of the two a new equation, in such a way as to make the quantity in question disappear. In complicated equations, elimination becomes difficult, and often impossible. Elimination is an important process in other sorts of reasoning besides the mathematical; in this larger acceptation, it means the setting aside of all extraneous considerations —of everything not essential to the result. In astronomical observations, the elimination of errors of observation is often effected by repeating the observations several times in such a way as to cause the errors to be of opposite kinds, then adding the observed values, and taking their average.—The word to 'eliminate' is often erroneously used in the sense of to 'elicit,' or bring to light.

Eliot, CHARLES WILLIAM, president of Harvard University, was born in Boston in 1834, and was educated at Harvard, where he filled some minor posts, and was president from 1869 to 1909. Under his rule the university was doubled in strength, and the old prescribed curriculum was finally abandoned for an optional system of studies. President Eliot is LL.D. of Williams, Princeton, and Yale, and has published, with Professor Storer, two manuals of chemistry.

Eliot, GEORGE. This is the *nom de guerre* of the great English novelist, who is perhaps best known as the author of *Adam Bede.* She was born on 22d November (St Cecilia's Day) 1819, and died on 22d December 1880. Her baptismal name was Mary Ann Evans, but she usually signed herself Marian Evans. She was the youngest daughter of the second family of Mr Robert Evans, a land-agent in Warwickshire, on the property of Mr Francis Newdigate. Mr Evans was at the time of the child's birth living at Arbury Farm, on the Newdigate property. Four months later he removed to Griff on the same property, 'a charming red-brick, ivy-covered house,' and here the afterwards celebrated authoress lived during the first twenty-one years of her life. Robert Evans was a man of strongly-marked and strenuous character, many of the leading traits of which were transferred by his daughter to the characters of Adam Bede in the novel of the same name, and of Caleb Garth in *Middlemarch.* But as Mr Evans died in 1849, and George Eliot's first work of fiction was produced in January 1857, the father was never made aware of the character of the daughter's genius. Of the life at Griff, many of the features are given in the sketch of Maggie Tulliver's and Tom's childhood in the *Mill on the Floss;* and especially her relation to her own brother Isaac, who was her senior by three years, is there powerfully painted. Her first school was at Miss Lathom's of Attleboro, where she remained between the ages of five and nine. Then she went to Miss Wallington's at Nuneaton, where the principal governess was Miss Lewis, with whom she formed a close friendship, and with whom she corresponded during those earlier years of expanding mind and receding faith, which intervened between her father's removal to Coventry in 1841 and his death in 1849. Between the ages of thirteen and

sixteen, she went to school at Miss Franklin's at Coventry, where she became for a time a fervent evangelical. She lost her mother, whom she loved devotedly, in 1836, when she was only sixteen; and early in 1837 her elder sister Christiana, who was five years her senior, and whose character and relation to herself are said to have been in some degree reflected in the Celia of *Middlemarch*, and in the relation between Celia and Dorothea in that tale, married Mr Edward Clarke, a surgeon, practising at Meriden in Warwickshire. From this time Mary Ann Evans took entire charge of her father's house. A master came over from Coventry to give her lessons in German and Italian, and another came to teach her music, of which she was passionately fond throughout life. But besides her studies in language and music, she was an immense reader on all sorts of subjects which interested her.

In the spring of 1841, when Mary Ann Evans, or Marian Evans, as she now called herself, was just of age, her brother Isaac married and took the house at Griff, her father removing to Foleshill Road, in the outskirts of Coventry. Here she became acquainted with Mr Charles Bray, the author of several works setting forth the philosophy of necessity from the phrenological point of view, and formed a close friendship with his wife (*née* Caroline Hennell), as well as with her sister Sarah, and with her brother Charles Hennell, who had published in 1838 *An Inquiry concerning the Origin of Christianity*, from the rationalistic point of view. On 2d November 1841, Marian Evans announces to Miss Lewis, her evangelical friend, that she is about, as she hopes, 'to effect a breach in the thick wall of indifference, behind which the denizens of Coventry seem inclined to intrench themselves,' and her biographer, Mr John Cross (to whom she was married in 1880), says that 'this probably refers to the first visit paid by Miss Evans to Mr and Mrs Bray at their house in Coventry.' We understand it as anticipating some success in bringing her new friends to a more religious state of mind. If so, the result was just the opposite of her expectations. Before a fortnight had passed—i.e. on the 11th November, she writes to the same friend anticipating that Miss Lewis may feel estranged from her as a consequence of some revolution which was taking place in her own mind, and that the visit which Miss Lewis was to have paid to Miss Evans at Christmas may no longer be one which she would wish to pay; and before the end of the year she had so greatly offended her father by refusing to go to church that he actually formed some intention, though he did not carry it out, of breaking up his household and going to live with his married daughter. Subsequently Marian Evans withdrew her objection to going to church, though she did not modify her views, and the breach between father and daughter was avoided.

At the opening of 1844, the work of translating Strauss's *Leben Jesu*, which had been at first undertaken by Mrs Charles Hennell, was transferred to Marian Evans, and at this she worked most laboriously till its publication in 1846. It was done in very scholarlike fashion. Indeed, the accuracy of George Eliot's work, whenever scholarship was needed, was all, the more remarkable for her great imaginative power. There was nothing loose or slipshod about her. She may occasionally be fairly accused of pedantry, never of slovenliness, never of carelessness concerning facts, or of trusting to her imagination for what she had the means of verifying. She was painstaking by temperament as well as by self-discipline, though it would be difficult to find a case in which that very bad definition of genius, as 'an infinite capacity for taking pains,' would be more wholly inapplicable. George Eliot had a vast capacity for taking pains, and she had also a great genius; but her capacity for taking pains was as distinct from her genius, and showed itself in intellectual achievements as different as *Silas Marner* from her translation of Strauss's *Leben Jesu*. She translated later Spinoza's *Tractatus Theologico-Politicus*, and in after-years his *Ethics*, though we are not aware whether either translation was ever published, certainly not with her name. On the last day of May in 1849 her father died, and on the 11th June Marian Evans went abroad with Mr and Mrs Bray, ultimately to Geneva, where she remained for some months, the Brays returning home without her. Towards the close of March 1850 she returned to England, crossing the Jura on a sledge, and reaching London on 23d March. She now began to write for the *Westminster Review*, and in September 1851, in the year of the Great Exhibition, she became its assistant editor, lodging at its headquarters in the Strand, and becoming the centre of the literary circle of which Mr Herbert Spencer and Mr G. H. Lewes were two of the most influential members. It was at this time that she translated Feuerbach's *Essence of Christianity*, the only book to which she appended her real name. The drift of this book was to show that God is only a 'virtual' image of man, the magnified form of his hopes and desires.

Gradually her intimacy with Mr Lewes grew, and in 1854 she formed a connection with him which lasted till his death in 1878, a connection which was the great false step of her life. In July 1854 she went abroad with him, staying three months at Weimar, where he was preparing for his *Life of Goethe*. After a somewhat longer stay at Berlin, George Eliot and Mr Lewes returned to England, and took up their abode first at Dover, then at East Sheen, and then at Richmond. In November 1856, when she was just thirty-seven, she attempted her first story, *The Sad Fortunes of the Rev. Amos Barton*, the commencement of the *Scenes of Clerical Life*. The first part of it was published in *Blackwood's Magazine* in January 1857, and almost all who read it recognised at once that a new English author of great power had arisen. This story was quickly followed by *Mr Gilfil's Love Story* and *Janet's Repentance*. In 1858 she wrote *Adam Bede*, partly at home, partly abroad at Munich and Dresden, completing it at Richmond in November. After the publication of this brilliant story, which had the most marvellous success, George Eliot found to her amazement and annoyance that a Mr Liggins, who had lived in the same country as herself in the Midlands, claimed to be himself the author. There was a sharp controversy in the *Times* on the subject, and it was not till the publisher, Mr Blackwood, had intervened, that Mr Liggins's authorship was generally discredited. After the publication of *Adam Bede*, *The Mill on the Floss*, *Silas Marner*, *Romola*, and *Felix Holt* appeared in succession, but not rapid succession, for George Eliot always took her time, the last story coming out in 1866. Her first poem, *The Spanish Gypsy*, was published in 1868, followed in the next year by *Agatha*, *The Legend of Jubal*, and *Armgart;* and in 1871 appeared the first part of what proved to be, we think, in every sense her greatest work, *Middlemarch*. After that *Daniel Deronda*, published in 1876, showed a marked falling off in power, though many of the scenes are sufficiently rich in pathos, humour, and insight. Of the *Impressions of Theophrastus Such*, a volume of somewhat miscellaneous essays not unlike Thackeray's *Roundabout Papers* in their rather

vague structure, no good critic, we think, formed any very high estimate.

After the death of Mr Lewes, on 28th November 1878, George Eliot, who was always exceedingly dependent on some one person for affection and support, fell into a very melancholy state, from which she was roused by the solicitous kindness and attention of Mr John Cross (1840–1924), an old friend of her own and of Mr Lewes's, and to him she was married on 6th May 1880. Their married life lasted but a few months. George Eliot died in Cheyne Walk, Chelsea, on 22d December of the same year, and is buried in Highgate Cemetery, in the grave next to that of Mr Lewes.

As a novelist, George Eliot will probably always stand among the greatest of the English school; above Richardson, whom she greatly admired, and with whose painstaking and elaborate style of portraiture she had something in common, though in her preference for studies taken from simple rural life, from commonplace subjects so delineated as to bring out the humorous side of human shortcomings and the overmastering power of pitiable passions, she approached nearer to the still greater genius of Fielding. But her mind had not the movement and vivacity of Fielding's. If it had had that movement, that elasticity, that freedom of life in it, her genius would probably have shown itself much earlier than it did, and not waited till she was close upon forty before it betrayed even its existence. In early life she seems to have given her whole mind to the higher problems of life, and to have declared them virtually insoluble before she took refuge in portraying, with the wonderful power she actually displayed, the disappointments, the breakdowns, the narrow discontents, as well as the generous hopes and unsatisfied ideals of other human beings. She did not give the first-fruits of her intellectual energy to fiction. She exhausted, to her own thinking, the province of theology first, and having accepted with her usual too great docility the negative view of those who held that we have no trustworthy evidence that Christ's life was a revelation of divine power at all, and who held that Christianity is a mere dream dreamt in the idealising mood of eager human aspiration, she passed on sadly to a pitying study of man in the frame of mind of one who is determined to make the best of a bad business. And she extracted, perhaps, from our human lot all the good that it is possible for any one to extract from it who has once come deliberately to the conclusion that, though something may be done to elevate, and a good deal to alleviate it, and though not a little amusement may be extracted from it, yet that no power can really transfigure it, and that the more modest the aim, the less serious will be the inevitable disappointment. This subdued tone of regret that the highest human endeavour is destined to be baffled runs through all her tales, and it can hardly be doubted that their pervading melancholy is at least in some degree due to the false step which she herself, under the influence of a negative school of religious thought, had deliberately taken, when she sacrificed her own life to the ends of a connection out of which most of the joy, and almost all the sacredness, were taken by the unnatural and morally humiliating circumstances under which she entered upon it. It was greatly to her credit that, in spite of these circumstances, she steadily refused to lower the moral ideal at which she aimed, though she pursued it with scanty hope, and without the assistance of the faintest trust in the help of any higher power. She told her friend Miss Hennell in 1857, when the success of her *Scenes of Clerical Life* was already assured: 'If I live five years longer, the positive result of my existence on the side of truth and goodness will outweigh the small negative good that would have consisted in my not doing anything to shock others, and I can conceive no consequences that will make me repent the past' (*Life and Letters*, vol. i. p. 461). She lived twenty-three years more; but the good of living up to one's own ideal is neither small nor negative, and the Life appears to show that the shock of having herself contributed to the world an example of a mode of life of which in her literary work she was constantly struggling to 'outweigh' the influence, was far greater and more enduring than she had at this time realised.

George Eliot's mind was one of extraordinary reflective power, but deficient in vivid personal instincts. She notices in *Silas Marner* how slowly impressions grow up within us, and how little we are sometimes aware of the origin of even those impressions which are destined to produce the greatest effects upon our character and external life. 'Our consciousness,' she says, 'rarely registers the beginning of a growth within us any more than without us. There have been many circulations of the sap before we detect the smallest sign of the bud.' In most men and women, such obliviousness of the first appearance of a germ of evil would hardly apply to a violation of wholesome instincts of that peculiar and marked kind by which she set her actual life at variance with her moral ideal. But perhaps it was so in her case. Her *Life and Letters* appear to show that the suave and long-drawn melancholy and somewhat artificial condition of self-repression in which she lived grew upon her more and more as 'the sap circulated' and fed her ideal of the true relation of husband and wife. In story after story she attempted to impress upon others the absolute sacredness of the relations to which her own action had apparently shown her to be indifferent. Her most impressive stories, *Adam Bede*, *Silas Marner*, *Romola*, *Felix Holt*, *Middlemarch*, and *Daniel Deronda*, were all penetrated with the desire to show how selfish and desecrating what is called love may be without marriage, and how equally selfish and desecrating marriage may be without love; yet at every return to that subject there seems to be less of hopefulness, less of awe, less of testimony to the sharp remorse which follows wrong-doing, less of vivid instinct, more of the tone of tragic warning, more of a tendency to acquiescence in inevitable misery, in her treatment of the theme.

Her pictures of the English farmers and tradesmen and the lower middle class generally of the Midland counties are hardly surpassed in English literature, and may be put on a level with Sir Walter Scott's similar pictures of the Scotch peasantry. Jeanie and Effie Deans in the *Heart of Midlothian* are hardly more impressive than Dinah and Hetty in *Adam Bede*, and many might plausibly contend that they are less so. George Eliot's drawing had finer touches, and was more from within; Sir Walter Scott's was more rapid and vigorous, and excited a deeper interest in the outward careers of his *dramatis personæ*. Then again, George Eliot's farmers and millers, and farriers and auctioneers, and parish-clerks, are painted not with more humour perhaps, but with humour of a rarer and finer kind, though it is less popular and effective than Sir Walter Scott's bailies and drovers, and dominies and gypsies. What George Eliot is too frequently deficient in is action; what Sir Walter lacks is depth of insight. But on the whole George Eliot's stories give us at least as good a picture of the life of the Midland counties, as masterly and full-length portraits of the slow-moving, beef-consuming, habit-ridden population of those counties in the earlier part of the 19th

century, as Sir Walter Scott has given us of the Border counties during the whole of the 18th century, with their wilder and more adventurous people. Of course there is a great difference in method between the two novelists, corresponding pretty closely to the difference between their favourite subjects. Sir Walter loved to show his favourites embarked in perilous adventures, Rob Roy gaining access to the Glasgow Tolbooth, and endangering his own neck to help a friend, or again, persuading the soldier to whom he was buckled to let him loose himself and dive for his life as they crossed the Forth. George Eliot on the other hand is seldom so successful as when she patiently develops her characters in rather slow but humorous dialogue—such dialogue as Shakespeare loved to interpolate in his plays when he chose to show us how the 'Goodman Dull' of the Midlands talked away in his stupid but comfortable self-satisfaction. Perhaps now and then George Eliot a little overdoes this microscopic view of inarticulate natures. In that curious short story of hers, *The Lifted Veil*, she gives a picture of a man with a quite preternatural insight into the vagrant and frivolous background of the minds of those amongst whom he lives, who is made to complain of 'the obtrusion on my mind of the mental process going forward in first one person and then another, with whom I happened to be in contact; the vagrant, frivolous ideas and emotions of some uninteresting acquaintance . . . would force themselves on my consciousness like an importunate, ill-played musical instrument, or the loud activity of an imprisoned insect.' Had not George Eliot herself some curious gift of the same kind?—as for instance in the very long analysis she gives of the way in which the gossips of Raveloe constructed, out of their own consciousness, the dress and personal appearance of the pedlar who is supposed by them to have stolen Silas Marner's gold? She seems sometimes to have had the buzz of dull but excited gossip almost revealed to her by a kind of disagreeable intuition, and to have written it down at too great length in order to rid herself of its leaden predominance over her imagination.

But if in delineating character George Eliot is often more than the equal of Sir Walter Scott, because she goes deeper and has a more penetrating insight, she is greatly his inferior in play and richness of pictorial imagination, in rapidity of movement, and in warmth of colour. *Romola*, her one historical romance, though it is full of subtlety of conception, contains some very striking figures, and is painted with a surprising minuteness of realistic detail, is a doubtful success. Sir Walter Scott never failed in making the chief historical figure of his historical romances the most interesting figure in his group. His studies of Mary Stuart in the *Abbot*, of Elizabeth in *Kenilworth*, of James I. in the *Fortunes of Nigel*, and of Louis XI. in *Quentin Durward* are studies which will live in the imaginations of men as long as the most vivid of historical portraits. George Eliot did not thus succeed in painting Savonarola. It was in Tito and Tessa that she achieved her great successes. As regards the historical background of *Romola*, one can hardly say that it holds its place at all as compared with even the least successful historical romance of Sir Walter Scott, say, *Anne of Geierstein* or the *Fair Maid of Perth*. George Eliot's imagination was not buoyant enough to travel back into these far regions of history, and create them anew for us. Nor does her story move rapidly enough to make up for the difficulty of transporting our sympathies to so distant a region. We miss the vividness and we miss the action which are needful for the art of historical romance.

And again in her poetry George Eliot falls far short of Sir Walter Scott; she is sombre, stately, even Miltonic after a fashion of her own, but Miltonic without Milton's felicity and charm. She is as grandiose as Milton without being as grand. Sometimes she attains true grandeur, as in her delineation of the selfishness that remained at the heart even of the inspired musician Jubal:

> This little pulse of self that living glowed
> Through thrice three centuries, and divinely strowed
> The light of music through the vague of sound,
> Ached smallness, still in good that had no bound.

The last line is grand, but not with Milton's sweet and winning grandeur. And usually George Eliot falls quite short of true grandeur in her poetry, and seems to be impressive without actually impressing the reader. The rhythm is laboured, the thought is laboured, the feeling is laboured, and the effect is more artificial than artistic.

Perhaps the most curious feature of George Eliot's genius is that she wrote so very much better and with so much more ease when she was writing dramatically than she did when she was writing her own thoughts in her own name. There is hardly a good letter—considered as a letter—in the whole three volumes, made up chiefly out of her letters, which Mr Cross gave to the world. There is on the contrary hardly an ineffective speech put into the mouth of any of the characters whom she delineated in her novels. Sir Walter Scott has given us a far larger *proportion* of ineffectively painted characters, though also a greater number of effectively painted characters, than George Eliot. There is hardly a country squire, or dairymaid, or poacher, or innkeeper, or country lad or lass to whom George Eliot does not give a thoroughly individual voice; but when she comes to speak for herself, her voice is measured, artificial, monotonous, and a little over-sweet. Her letters read as if they were turned out by machinery, though machinery invented by some gently intellectual and laborious mind. Scott's letters are delightful reading; Miss Brontë's are full of interest; even Miss Austen's, though they disappointed everybody, give the impression of a lively and observant mind. But George Eliot's have no freedom or personal stamp upon them, unless the absence of personal feeling be itself a personal stamp. It almost seems as if her mind had been intended more as an instrument for interpreting the minds of others, more as a phonograph through the agency of which the natures of all the various interlocutors with whom she met could be delicately registered and made to report themselves to the world, than as a distinct organ of her own taste and purpose. George Eliot is in the highest degree original in her power of interpreting others, but she gives an effect of faded second-hand suavity when she comes to interpret herself. Nevertheless she will be named in the same category with Sir Walter Scott, Thackeray, and Dickens.

See the Life, edited by J. W. Cross (3 vols. 1885–86), and works by Mathilde Blind (1883), O. Browning (1890), and C. S. Olcot (1911); also F. W. H. Myers, *Essays: Modern* (1883); R. H. Hutton's *Essays* (1871) and his *Modern Guides of English Thought* (1887); Sir Leslie Stephen's *George Eliot* ('Men of Letters,' 1902); G. Gardiner's *The Inner Life of George Eliot* (1912); and M. H. Deakin's *Early Life* (1913).

Eliot, Sir John (1839–1908), meteorologist, born at Lamesley in Durham, was second wrangler at Cambridge, and became professor of mathematics at Rurki and Allahabad and of physical science at Calcutta. He played an important part in organising meteorological work in India and elsewhere.

Eliot, John, 'the Indian Apostle,' was born probably at Widford in Hertfordshire in 1604, the son of a yeoman, graduated at Cambridge in 1622, and, after taking orders in the Church of England,

quitted his native country for conscience' sake, and landed at Boston in New England in 1631. For some months he 'exercised' in the church there, but being fore-engaged to friends who had settled at Roxbury, he repaired thither in the summer of 1632. In 1646, after two years' study of the language, he delivered a long sermon in the native dialect at Nonantum, about five miles from Roxbury; and other meetings soon followed. He shortly after began to establish his converts in regular settlements, his work meeting with approval both in the colony and at home; in England a corporation was founded in 1649 'for the promoting and propagating the Gospel among the Indians of New England,' which defrayed the expenses of the preachers and the cost of printing translations. At one time there were over a dozen townships of 'praying Indians' within the bounds of Massachusetts, and many more outside these limits, with numbers estimated in 1674 at 3600; but, although the organisation survived until the death of the last native pastor in 1716, the decay of the 'praying towns' was rapid after the war with a native king, Philip (1675), in which the converts suffered equal cruelties at the hands of their countrymen and of the English, whom they are nevertheless believed to have saved from extinction. Eliot died at Roxbury, 21st May 1690; there are monuments to his memory in the Indian burying-ground at South Natick, and at Newton, near the scene of his first Indian sermon. A man of earnest piety and devotion to evangelisation, warm-hearted, and of a singularly attractive manner, he has left a memory that is honoured among the first in the history of New England. Along with his colleague Thomas Weld, and Richard Mather, Eliot prepared an English metrical version of the Psalms, the 'Bay Psalm-book' (Camb. 1640), which was the first book printed in New England. He was also the author, among other works, of *The Christian Commonwealth* (Lond. 1659; suppressed by the general court, and now extremely rare), of *The Communion of Churches* (Camb. 1665; the first book privately printed in America), of several tracts, and of translations into the Indian tongue of Baxter's *Call*, Bayly's *Practice of Piety* (abridged), and Shepard's *Sincere Convert*. But the great work and the noblest monument of his devoted life was the translation of the Bible into the tongue of the Indians of Massachusetts (Algonquin), of which the New Testament appeared in 1661, and the whole work, with a version of the Psalms in metre, and a page of 'catechism,' in 1663. His *Indian Grammar Begun* was printed in 1666, his *Indian Primer* in 1669; a reprint of the only copy of the latter which can be localised, now in the library of Edinburgh University, was issued in 1880, along with a reprint of one of the only two extant copies (not alike) of *A Christian Covenanting Confession*. The finest collection of unique and scarce copies of Eliot's works is in the Lenox Library, New York; many of them have been reprinted.

The best Life of Eliot is that by C. Francis in vol. v. of the first series of *Sparks's American Biography* (1836), the earliest that by Cotton Mather (1691); see also two careful articles in the *Cyclopædia of Amer. Biog.* (vol. ii. 1887) and the *Dict. of Nat. Biog.* (vol. xvii. 1889).

Eliot, Sir John, English statesman, the earnest champion of the supremacy of parliament in the government of the nation, was the son of a country gentleman of Cornwall, in which county, at Port Eliot on the Tamar, he was born, 20th April 1592. He studied for three years at Exeter College, Oxford. During the course of his continental travels he became acquainted with Villiers, afterwards Duke of Buckingham, an acquaintanceship which had a most important influence upon his subsequent parliamentary career. He entered the parliament of 1624 as an adherent of Buckingham, whom he heartily supported in his warlike policy against Spain. But during the course of the next parliament (1625) his eyes seem to have become opened to the true character and designs of the favourite; he finally broke with him that same year, owing to an arrogant refusal on Buckingham's part to acknowledge the House of Commons as the real ruling power in the nation, and swung over to an extreme of fierce and implacable hostility. Accordingly, in the next parliament, in which, from the force of circumstances, Eliot was the leading spirit, his policy was in the main one of antagonism to the king, and finally culminated in the impeachment of Buckingham. For this Eliot was sent to the Tower on 11th May, and not released until the 19th. In the parliament of 1628 Eliot raised his voice against arbitrary taxation, and was instrumental in forcing from Charles the celebrated Petition of Right. For having again protested formally against the king's proceedings in matters of taxation and religion Eliot was, on 4th March 1629, sent, along with eight other members, to the Tower; and steadfastly refusing to acknowledge himself to have been in error, was kept in confinement until his death, on 27th November 1632. During his incarceration, Eliot composed an account of Charles's first parliament, *Negotium Posterorum* (first printed in 1881); a philosophico-political treatise, *The Monarchy of Man* (1879); and *An Apology for Socrates* (1881), a vindication of his own public conduct. He also left *De Jure Majestatis, a Political Treatise of Government*, and the *Letter-book of Sir John Eliot*, both published in 1882. See Life by John Forster (2d ed. 1871).

Eliot, Samuel (1821–98), United States author, born in Boston, graduated at Harvard, and was professor of History and Political Science in Trinity College, Hartford, in 1856–64, being also its president in 1860–64. Between 1864 and 1874 he lectured there and at Harvard, and he afterwards filled important posts in the Boston schools. The first two parts of a *History of Liberty* appeared in 1847–49–53. He also published a *Manual of United States History* (1856; revised ed. 1873).

Eliot, Sir Thomas. See Elyot.

Eliot, Thomas Stearns, poet and critic, was born at St Louis, Missouri, in 1888. Having graduated from Harvard, and studied at the Sorbonne and at Merton College, Oxford, he became a teacher and lecturer in London, where he has lived since 1913. *The Love Song of J. Alfred Prufrock*, his best poem, appeared in 1917; other longer poems are *Portrait of a Lady*, *Gerontion*, and *The Waste Land*. Eliot's verse, for the most part ironic and satiric, while brilliant in execution, is lacking in invention and poetic fire. *The Sacred Wood* (1920) is a work of literary criticism.

Eliott, General. See Heathfield (Lord).

Elis, one of the ancient divisions of the Peloponnesus, bounded N. by Achaia, E. by Arcadia, and W. by the Ionian Sea. The northern and more fertile region, watered by the Penēus and numerous smaller streams, was famed for the excellence of its horses; the southern and more rugged district is drained by the Alphēus, which rises in the mountains of Arcadia. On its banks were the grove and temple of Olympic Zeus, and the plain in which the great Olympic games were celebrated. For long the sacred character of Elis, as the seat of the greatest of the national festivals, protected the country from invasion, but during the Peloponnesian war, the Athenians, and afterwards the Spartans, disregarded the privileges of the Eleans. See Olympia, for excavations.

Élisabethville, capital of the province of Katanga, in the SE. corner of Belgian Congo, near the Rhodesian frontier, is some 2300 miles from Capetown by rail. The district is rich in radium and copper.

Elisavetgrad, a fortified town of Ukraine, 130 miles N. of Kherson, is an important military depot, with a strong citadel. Flour-mills, soap, tallow, and candle factories are the principal works. Elisavetgrad was founded in 1754, and named after the Empress Elizabeth. Pop. 77,000.

Elisavetpol, or ELIZAVETPOL, or YELISAVETPOL, a town of the republic of Azerbaijan, on a tributary of the Kur, at an altitude of 1450 feet. The place is mean, but it has several mosques and churches, the mosque of Shah Abbas being particularly fine. Elisavetpol is not a healthy town; its inhabitants, about 60,000 in number, are compelled to retire to the hills in summer. The town and its vicinity are famous for their fruit-trees; and horticulture, the breeding of silkworms, and agriculture are the chief industries of the place. Elisavetpol (Gandzha or Kanga) formerly belonged to the Turks. The modern town was founded by Shah Abbas of Persia, but fell into the hands of the Russians in 1804. On 25th September 1826 the Persians were defeated here by the Russians under Paskevitch. The name Gandzha has been restored.

Elisha, a Jewish prophet and the successor of Elijah. His work extended over a period of fifty-five years during the reigns of Jehoram, Jehu, Jehoahaz, and Jehoash (*circa* 850–795 B.C.). The story of his life is told in 1 Kings, xix. 19; 2 Kings, ii.–ix.; xiii. 14–21. Elisha lacked the originality of Elijah, and his career is far less dramatic, but his influence upon the political and religious life of the nation was far-reaching in its effects. The incidents recorded reveal him as a man of great sympathy and compassion, always eager to place himself at the disposal of the suffering and the needy.

Elixir (Arab. *el iksir*, 'the philosopher's stone;' see ALCHEMY), a term in pharmacy which has come down from the days of Alchemy (q.v.). By the alchemists the term was applied to various solutions employed in the attempt to transmute metals. But the most notable elixir, sought after by many, was the *elixir vitæ*, 'the elixir of life,' that sublime, potent, perfect, invaluable preparation which, if discovered, would confer immortality or at least extreme length of life on him who drank it. The name has recently been appropriated to a class of American pharmaceutical preparations. These are very different from the old-fashioned elixirs, which corresponded in the main to our modern tinctures; for in the American elixirs the first object sought is to present the medicine under an agreeable form, even if frequently with a loss of potency. These newer elixirs are often highly alcoholic, and are sweetened and flavoured with great skill. In British pharmacy, *Elixir of Vitriol* is almost the only representative of the old class, and is prepared by mixing together sulphuric acid, alcohol, tincture of ginger, and spirit of cinnamon. This preparation, also known as aromatic sulphuric acid, is useful for quenching thirst, sharpening the appetite, checking profuse perspiration, and often reducing the action of the pulse. The dose may range from ten to forty drops, administered in syrup or water.

Elizabeth, the capital of Union county, New Jersey, formerly capital of the state, lies 5 miles SSW. of Newark by rail, with one quarter (generally called Elizabethport) on Staten Island Sound. It contains a court-house, city-hall, and several good schools, and is the seat of a large Singer sewing-machine factory, and of a number of manufactories of saws, chemicals, hardware, &c. Elizabethport ships large quantities of anthracite coal; it also has several foundries. A great drawbridge over Staten Island Sound, 800 feet in length, with a draw-span 500 feet long, connects New Jersey here with the Staten Island shore. Pop. (1880) 28,229; (1890) 37,764; (1920) 95,783.

Elizabeth, Queen of England and Ireland, was the daughter of Henry VIII. by his second wife, Anne Boleyn, and was born in Greenwich Palace, 7th September 1533. From her father she inherited physical strength, resolution, energy, hauteur, a fiery temper, an inclination both to cruelty and to coarseness, and a passion for splendour; to her mother may be attributed such physical attractions as can be claimed for her, whatever of feminine piquancy flashed fitfully across her essentially masculine life, and probably also her insincerity, her jealousy, and her love of artifice. The marriage of her parents was a secret one, and when, in 1536, her mother was beheaded, and her father married Jane Seymour, she, as well as her half-sister Mary, the daughter of Catharine of Aragon, was declared illegitimate. Her early years were in consequence passed under a cloud, though profitably so far as intellectual discipline was concerned. The governesses and teachers, in whose society she spent most of her time till the death of her sister Mary, and of whom the chief were Lady Bryan, Lady Tyrwhitt, Sir John Cheke, William Grindal, and Roger Ascham, were almost all devotees to the New Learning, while some were adherents of those Reformation principles which her father partially accepted and established in England. Her accomplishments, like her charms, the ardour of her Protestantism, and even her patriotism and political foresight, were exaggerated by the historians-in-waiting of her reign. But it is beyond question that she learned to read Cicero, Sophocles, and even one or two of the Fathers in the original, to speak German and French with fluency, and to acquire a mastery over the then limited *technique* of music.

During the life of Elizabeth's father, two of her stepmothers, Anne of Cleves and Catharine Parr, looked upon her with a friendly eye, and the latter, but for her father's temper or dislike, would have had her much at court during the closing years of his reign. But till, on the death of Mary, she ascended the throne, she did not play an important part in English politics. During the reign of Edward VI. she, then a girl of sixteen, was subjected to the dubious attentions of Lord Seymour, High Admiral of England, and responded so far to them that her conduct was made the subject of a public inquiry. On her brother's death she took the side of her sister against Lady Jane Grey and the Duke of Northumberland, but her identification with Protestantism aroused the suspicion of Mary and her counsellors, and led to her being implicated in Wyatt's rebellion in 1554, and thrown into the Tower. Subsequently she was strictly guarded in Woodstock, and her adroit and seemingly not altogether insincere conformity to the Catholic ritual was probably the sole cause of her not sharing the fate of the leading Protestants of the time, and being sent to the block.

On the death of Mary, 17th November 1558, Elizabeth, then twenty-five years of age, was summoned to the throne amid the acclamation alike of Protestants, who saw in her advent a cessation to the persecutions of the preceding five years, and of Catholics, who had more than a suspicion of her indifferentism in ecclesiastical and theological matters. Although to the end of her life she retained a liking for the splendour of Catholic ceremonial, and had no sympathy with the doctrines of Geneva, her political sagacity enabled her at once to perceive that her part in Europe must be that of a Protestant sovereign, while her courage led her

to act promptly. Having presumably taken the advice of Sir William Cecil (afterwards Lord Burghley), whom three days after her accession to the throne she appointed Chief Secretary, she issued a proclamation to the effect that the church service be read in English, and the elevation of the host be discontinued. That she ordered the English ambassador at Rome to notify her accession to the reigning pontiff, Paul IV., is denied. Paul IV. maintained that Elizabeth, being illegitimate, must resign all pretensions to the crown of England, which he claimed a right to dispose of, that country being a fief of the holy see. The only result of this assumption was to make Protestantism and patriotism in England synonymous. The Anglican Church, with its Thirty-nine Articles, its Book of Common Prayer, and its acknowledgment of the headship of the sovereign, was there and then virtually established in its present form. The change that was effected was in no sense a revolution. Of the prelates who were in office when Elizabeth began her reign, only one, Kitchin, Bishop of Llandaff, agreed to the innovations contained in her proclamation, but of 9000 clergy, fewer than 200 resigned their livings.

To an exceptional extent, even for a sovereign with such strong absolutist instincts as Elizabeth, her life was bound up with the history of England (q.v.). Here, therefore, it will be necessary only to point out how her personal prejudices and opinions, and still more, her likes and dislikes, affected the policy of her country. The great blots upon her reign were the persecution of the Catholics, and the execution of Mary, Queen of Scots. As to the last, it is impossible now to say how much feminine jealousy on Elizabeth's part of a woman with greater personal attractions than herself had to do with the tragedy, but it is unquestionable that such jealousy existed. The discovery of designs against her life, such as the Ridolfi plot, had probably also not a little to do with her final determination, and certainly led to the execution of the Duke of Norfolk. The great glory of Elizabeth's reign, on the other hand, was the destruction of the Spanish Armada in 1588; but for this great national deliverance but slight credit is due to Elizabeth. It is true that, when an army assembled at Tilbury to resist invasion, she showed the courage of her race, and addressed her troops in language which has the genuine ring of patriotism. But it is also true that she at first declined to admit the national danger, although it was apparent to all her advisers, that she hesitated lamentably as to the steps to be taken to meet it, and that her parsimony in such matters as the naval commissariat led to the risk of disaster, and prevented the victory which was actually won from being so complete as otherwise it would have been. The triumph of England over Spain is to be attributed to the wisdom and energy of Elizabeth's advisers, to the skill and courage of the great English captains of the time, and to the generous patriotism of English, and especially of London, merchants.

It would be difficult to say whether the romantic side of Elizabeth's life is more notable for its prominence or for its farcicality, if not unreality. From her sixteenth year to her fifty-sixth, one matrimonial scheme or violent passion, not always remarkable for delicacy, succeeded another. Before she ascended the throne, her name was mentioned in connection either with marriage or with love, not only with Admiral Lord Seymour, as already mentioned, but with Edward Courtenay, son of the Earl of Devonshire; the Earl of Arran; Philip of Spain, who married Mary; and Philibert of Savoy. After she became Queen of England, Philip renewed his courtship, while her hand was also solicited by or for Eric, king of Sweden, Henry III. of France, his successor Henry of Navarre, the Archduke Charles of Austria, and the Duke of Alençon. Letters preserved in Hatfield show that she cherished an attachment for the last until he died, worn out with debauchery, in 1584; although at the time they first met she was thirty-eight and he nineteen, and a dwarf with a face horribly disfigured by smallpox. But her heart was most profoundly touched by Robert Dudley, Earl of Leicester (q.v.), master of the horse, an accomplished courtier, and a handsome and clever, though dissolute and essentially shallow man. She indicated her partiality for him even before the death of his wife, the ill-fated Amy Robsart. The despatches of the Bishop of Aquila, ambassador of Philip II. in London, represent her indeed as accessory to the 'murder' of Amy, and as being willing to become a Roman Catholic, provided Philip consented to her marriage with Leicester. But the bishop violently disliked Elizabeth, and there is every reason to believe that he was befooled by her, while it is by no means certain that the death of Leicester's wife was the result of foul play. But it is unquestionable that Elizabeth would have married Dudley but for the remonstrances of her chief adviser, the elder Cecil. After Leicester's death, Robert Devereux, second Earl of Essex (q.v.), succeeded to his position as favourite. But Elizabeth's relations towards Essex, as indicated by outbursts of temper as well as of affection, were essentially those of a mother towards a spoiled child. When Essex was beheaded for rebellion in 1601 she does not seem to have exhibited much grief. The eccentricity of Elizabeth was shown even more in her passion for adulation and extravagance in dress than in her coquetries. Raleigh felt constrained to compare her in a breath to Alexander, Diana, Venus, Orpheus, an angel, and a nymph. She is Shakespeare's 'fair vestal throned by the west,' and Spenser's Gloriana. Paul Hentzner, a German, who saw her going to chapel when she was in her sixty-fifth year, says that at that time she 'had pearls with rich drops in her ears, wore false red hair, had a small crown on her head, her bosom uncovered, her dress white silk, bordered with pearls of the size of beans, a collar of gold and jewels.' So long as she retained any activity she attended theatrical and other pageants; and the more splendid these were, the more they were to her taste. The vigorous style of her dancing was commented on sarcastically by her enemies. The variety and number of her dresses have passed into a proverb. When every allowance has been made for the manner in which Elizabeth's charms were enhanced by her own artifices, and by the flattery of her courtiers, she must still be believed to have had some personal attractions. When young she was noted for her abundance of auburn hair and mobile though regular features, while Hentzner found her 'stately and majestic,' and remarked 'a special beauty in her delicate white hands.'

Patriotic as Elizabeth was after her own peculiar fashion, she was outside of and had no sympathy with either the intellectual or the religious movements of her time. Protestantism in the form of Puritanism she abhorred; she was indifferent to the genius of Shakespeare, though his plays were performed before her. She never advanced beyond the essentially classical studies of her girlhood; yet, in virtue mainly of translations from Greek, Latin, and French, she has been included by Horace Walpole in his *Catalogue of Royal and Noble Authors.*

A personal interest attaches to the last years of Elizabeth's reign, owing to her great loneliness. This was due in large measure to the fact that her leading advisers and friends, including Burghley, Walsingham, Hatton, Bacon, and Warwick, prede-

ceased her. Their places were taken by other men of ability, Sir Robert Cecil, Burghley's second son, being in particular both a skilful diplomatist and an accommodating courtier. But she never was on exactly the same terms with them as she had been with their predecessors. She also felt lonely in a political sense. She had inherited Tudor views as to the absolute supremacy of the crown over parliament. During the last thirteen years of her reign parliament assembled three times, in 1592, 1597, and 1601, and although, partly owing to her tact and partly to its timidity, no actual collision occurred between them, it protested against monopolies, and sought to curtail Elizabeth's expenditure. With such manifestations of public spirit Elizabeth could have no sympathy, and indeed she felt somewhat of a stranger in her own country, and among a people whose intellectual, religious, and even political ideas were widely different from, and in some cases diametrically opposed to her own. Nevertheless, her indomitable spirit enabled her to retain her zest for the pleasures of life; to the last, too, she retained her indifference to the sufferings of others. As late as the year 1601 she was able to give receptions, to visit at the country-houses of wealthy subjects, and even to comport herself after the fashion of a hoydenish school-girl. Within a few weeks of her death a seminary priest of the name of Richardson was hanged and disembowelled at Tyburn. In the beginning of 1602 those immediately about her noticed a decline in her health. She revived temporarily, however, and was able to ride, hunt, and even dance once more. In the second week of 1603 she caught cold, and never recovered. In February she was seized with sickness, which was aggravated by melancholy. She would take no medicine and little food, refused to go to bed, and rested in silence day and night on cushions. She continued in this condition till March 24, when she died in the presence of her council. She had previously made a sign with her hands in answer to a question by Cecil, which was interpreted as indicating her wish to be succeeded by James VI. of Scotland.

'The golden days of good Queen Bess' are more than ever regarded as one of those periods of English history of which we have as a nation much reason to be proud. It is emphatically the period in which England took up her position as a 'world power,' and it is impossible to believe that Elizabeth had no personal part in making it what it was. The 'Virgin Queen,' it is true, stands revealed by history as cruel, capricious, insincere, at once unpleasantly masculine and weakly feminine, but she was highly popular with her subjects, and this popularity cannot be quite explained away by circumstances outside of herself. She had unquestionably the invaluable faculty—in her case it amounted almost to genius—of selecting as her advisers the most capable of the men around her.

See the Lives by A. Strickland (new ed. 1864) and Bishop Creighton (sumptuously illustrated, 1896; smaller reprint, 1899). M. Wiesener (Paris, 1878; trans. 1879) deals with her youth, and F. Chamberlin (1921) with her private character. The most reliable authorities on the public events of her reign are the calendars of the state papers, especially the calendar of the MSS. at Hatfield, and the calendar (1509–1603) of the state papers relating to Scotland. Among historical works dealing with this period, Froude's, in spite of the doubts which have been thrown on his accuracy by able critics, is still the best and most exhaustive. Hallam, Lingard, Birch's *Reign of Queen Elizabeth* (1754), Wright's *Queen Elizabeth* (1838), Beesly's *Queen Elizabeth* (1892), Motley's *Dutch Republic* and *United Netherlands*, and A. F. Pollard, *Political History of England*, vol. v. (1910) should also be consulted. Essays on Elizabeth are innumerable; that of Dr Jessopp (1889), contributed to *The Dictionary of National Biography*, will be found exceptionally bright and comprehensive. See also the articles MARY, QUEEN OF SCOTS; BURGHLEY, ARMADA, LEICESTER, ESSEX, DRAKE, RALEIGH; and for the Elizabethan Literature, see ENGLAND (LITERATURE OF), and DRAMA.

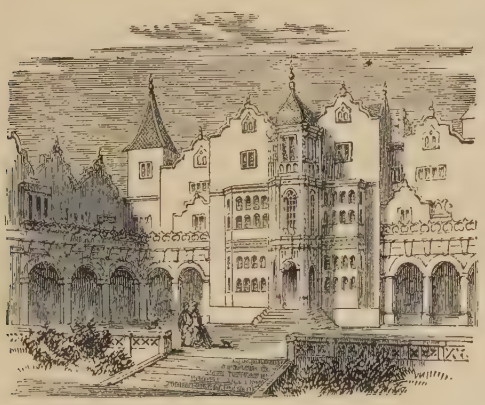
Elizabeth, Queen of Bohemia, forms the connecting link between the ancient royal families of England and Scotland and the present reigning dynasty. Daughter of James VI. of Scotland and I. of England, she was born in the palace of Falkland, 19th August 1596, educated in England, and in 1613 married to Frederick V. (q.v.), Elector Palatine, who in 1619 was chosen by the Bohemian estates to fill the throne of Bohemia. The following year the army of the 'Winter King' was routed by the forces of the Catholic League, and the royal family took refuge in Holland, where they had to endure sore poverty. Of the thirteen children of Elizabeth, mention may be made of Charles Louis, who was restored to the hereditary electorate at the close of the Thirty Years' War in 1648; Rupert, the 'mad cavalier;' Maurice, who also fought in England during the Civil War; and Sophia, who was married to Ernest Augustus of the House of Brunswick, afterwards Elector of Hanover. After the Restoration Elizabeth went to England, where she died February 13, 1662. When in 1701 the question of succession to the crown of Great Britain was debated, it was found that all the descendants of James I. were either dead or were Roman Catholics, except Sophia, Electress of Hanover, and her family. By act of parliament the crown was accordingly secured to her and her descendants, 'being Protestants;' and in virtue of this Act of Settlement, on the death of Queen Anne Sophia would have ascended the throne, but she predeceased the queen three months, and her son became king of Great Britain as George I., August 12, 1714. In this extraordinary and unforeseen manner did the unfortunate queen of Bohemia originate the dynasty of the reigning monarch. In her prosperity fond of luxury and magnificence, in adversity a devoted wife and mother, she was always resolute and vivacious, and exercised a singular charm over her contemporaries. See her Life in Mrs Everett Green's *Lives of the Princesses of England* (1851); Gardiner's *History of England;* and R. S. Rait's *Five Stuart Princesses* (1902).

Elizabeth, MADAME (1764–94), a French princess, sister of Louis XVI. (q.v.).

Elizabeth, ST, daughter of Andreas II., king of Hungary, was born at Presburg in 1207. At the age of four she was affianced to the Landgraf of Thuringia, Louis IV., and brought to his court in the Wartburg near Eisenach to be educated under the eyes of the parents of her future husband. She early displayed a passion for the severities of the Christian life. She despised pomp, and ambition, cultivated humility, and exhibited the most self-denying benevolence; her conduct even as a girl astonished the Thuringian court. The marriage took place when Elizabeth was only fourteen. Louis himself, far from blaming the devout girl whom he had made his wife for her long prayers and ceaseless almsgiving, was himself partially attracted to a similar mode of life. A boy and two girls were the fruit of their union. Louis died as a crusader at Otranto in 1227. Great misfortunes soon befell the saintly landgravine. She was deprived of her regency by the brother of her deceased husband, and driven out of her dominions on the plea that she wasted the treasures of the state by her charities. At last she found refuge in a church, where her first care was to thank God that he had judged her worthy to suffer. Subsequently, after other severe privations, such as being forced to take up her

abode in the stable of a hostelry, she was received into the monastery of Kitzingen by the abbess, who was her aunt. When the warriors who had attended her husband in the crusade returned from the East, she gathered them round her, and recounted her sufferings. Steps were taken to restore to the unfortunate princess her sovereign rights. She declined the regency, however, and would only accept the revenues which accrued to her as landgravine. The representations of other potentates soon induced her brother-in-law to allow her to return to Marburg, and to draw a yearly revenue of 500 marks. She now devoted herself wholly to a life of asceticism, put on nun's raiment, and took up her residence in a cottage at the foot of the hill on which stood her castle of Marburg. The remainder of her days were devoted to incessant devotions, almsgivings, and mortifications. All her revenues were given to the poor, and what she required she earned with her own hands. She died 19th November 1231, and was canonised four years after by Pope Gregory I. Miracles surrounded her even during her lifetime; thus a basket conveying provisions to the poor, when opened by a suspicious person, was found to contain nothing but roses. Above her grave at Marburg the beautiful Elisabeth-kirche was founded in 1236. See Montalembert's *Histoire de Sainte Élisabeth de Hongrie* (1836; 17th ed. 1880). Kingsley's *Saint's Tragedy* (1848) is based on the story of Elizabeth's life.

Elizabethan Architecture, a term applied to the mixed style which sprang up on the decline of Gothic architecture. It is chiefly exemplified by mansions erected for the nobility in the reigns of Elizabeth and James I., and originated in the first attempt to revive classic architecture. This tendency came from abroad, and was influenced, no doubt, by Holbein, who was patronised by



Holland House.

Henry VIII., and furnished several designs in this manner. John of Padua succeeded him, and built in the mixed style a palace for the Protector Somerset (for which purpose the cloisters of St Paul's were taken down), and the mansion of Longleat for his secretary, Sir John Thynne. At first the classic forms were applied to the details only, and the old English design was preserved, both as regards the plan and general aspect of the exterior; but by degrees the classic taste pervaded the whole design. Thus the bow-windows and turrets of the Tudor style are preserved, but their decoration is treated with classic cornices and pilasters instead of Gothic enrichments. The vast dimensions of the apartments, the extreme length of the galleries, and enormous square windows are leading characteristics of this manner of building. The ornaments both within and without were cumbrous but picturesque, while the plaster ceilings wrought into compartments are amongst the most original and striking features. In short, the architecture was in keeping with the dress of the period, rich and gorgeous, rather than elegant and graceful; but the domestic arrangements and general planning of the houses were carried to a degree of completeness and comfort which has scarcely been exceeded since. The following examples of mansions of the 17th century may be still seen near London: Holland House, Campden House, Charlton, the Marquis of Salisbury's at Hatfield, and Knole, the property of Lord Sackville. The most eminent architects of those times were John Thorpe, Gerard Christmas, Rodolph Symonds, and Thomas Holt.

Elizabeth Petrovna, Empress of Russia, daughter of Peter the Great and Catharine I., was born in the year 1709. Of doubtful legitimacy, and apparently indifferent to everything but the gratification of her passions, she did not oppose the accession of the boy Peter II. in 1727, of Anna, Duchess of Courland, in 1730, and of the infant Ivan VI. in 1740. In 1741 the infant emperor was deposed, and Elizabeth raised to the throne, partly by the agency of Lestocq, a surgeon, and the Marquis de la Chétardie, the French ambassador. In the following year Elizabeth proclaimed as her successor Peter, the son of her sister the Duchess of Holstein-Gottorp. During this reign a war with Sweden was brought to a successful conclusion by the peace of Åbo. The anti-Prussian policy of her advisers and her personal animosity towards Frederick II. led her to take part in the war of the Austrian Succession and in the Seven Years' War, before the close of which she died in January 1762. Though profligate in conduct, she was strict in the observance of the public ordinances of religion. Averse to business, she was guided by favourites, while corruption prevailed in every department of the state. She founded the university of Moscow and the Academy of Art at St Petersburg.

Elizavetpol. See ELISAVETPOL.

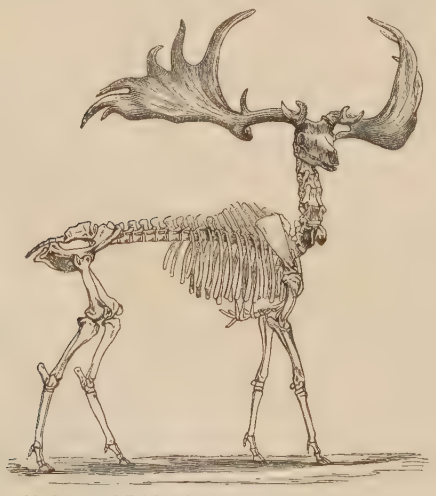
Elk, or MOOSE (*Alces machlis*, or *palmatus*), the largest living deer, a magnificent animal of circumpolar distribution, in Europe, Asia, and especially in America. It is the only species of its genus or sub-genus, but is nearly allied to Cervus (see DEER). It must be distinguished from the Wapiti (*Cervus canadensis*), with which it is often, verbally at least, confused. The adult elk usually stands about six feet high at the shoulders, and may exceed even this noble stature. The male bears very broad (palmate) divergent antlers, with which it has been known to kill a wolf at a single blow. The general colour is dark reddish-brown, but becomes slightly lighter and grayer in winter. The limbs, especially the fore-legs, are very long, and as the neck is short, the elk browses more upon bushes and the like than upon the ground herbage, which it is but little adapted to reach. The tail is very small. More detailed characters are the broad

Head of Elk (*Alces machlis*).

hairy nostrils, the overhanging upper lip, the small eyes and tear-pits, the long and broad ears, the low stiff mane on the back of the neck, the loose mane on the lower side of the neck and on the breast, the long brittle hair, &c. The antlers form between them a sort of basin, for each broadens out in a great shovel-shaped expansion, with marginal prongs or snags, increasing as usual with the years of life. The entire 'head'—i.e. the pair of antlers—sometimes weighs 40 lb., while adult animals are said to weigh in all about 10 cwt. The young male elks do not begin to acquire antlers till they are nine months old, and growth seems to go on for fourteen years. The younger elks are also marked by a large goitre-like swelling under the throat.

Elks are for the most part solitary in their habits, except at the breeding season. They delight in marshy places and in forests. The widely separating halves of the hoof enable them to find firmer foothold in soft ground or among snow. In the forest, their magnificent antlers, as Darwin notes, must sometimes be rather in the way than otherwise. When walking leisurely, they carry themselves so well that entanglement is avoided, but it is easy to see how the case is altered when, with head thrown back, they flee before the wolves. The usual gait is a shambling trot, but the elk can also gallop rapidly. Only when the deep snow impedes it are the hunters, aided with snow-shoes, able to run it down. The usual method of hunting is to steal upon the elk as it rests, but as its senses are extremely acute and the trails often confused, successful capture is regarded as a feat. Naturally timid and inoffensive, the disposition changes in the breeding season. The male elks fight with one another, and are at that season sometimes decoyed to the hunter, who imitates the sounds of a rival. As the elk is then furious, this device demands strong nerve and sure aim.

The European and Asiatic distribution of the elk is now much restricted. In Germany, for instance, they were abundant in the time of Cæsar, but are now all but extinct. In the Baltic states, in



Skeleton of Irish Elk (*Megaceros hibernicus*): Height to summit of antlers, 10 feet 4 inches.

Northern Russia, in Norway and Sweden, they still occur, but not in the abundance which is still exhibited in North America. Domestication has been tried with success, and the animal trained to the sledge. The flesh is esteemed a good kind of venison; the fat is remarkably soft; the nose and tongue are reckoned delicacies. The skin is used for a variety of purposes. As the elk feeds largely on leaves, buds, and bark, it does considerable damage to forest trees.

Elk, Irish (*Megaceros giganteus* or *hibernicus*), a giant deer now extinct, known from the remains found in the Pleistocene diluvium of Middle Europe, Britain, and especially Ireland. It must have been a magnificent animal, standing about 6 feet high at the shoulders, and probably very like a fallow-deer. The antlers formed the most striking feature. They have their own peculiarities, but recall in part those of the quite distinct modern elk, and also those of the fallow-deer. Antlers have been found 5 feet in length, while a straight line drawn between the extreme tips in one specimen measured 10 feet 10 inches. In a specimen where the skull alone weighed 5¼ lb. the antlers weighed 81 lb. Associated with such an enormous head-growth we naturally find large and strong neck vertebræ and fore-limbs. The skeletons are to be seen in most museums. See Deer.

Elkesaites. See Ebionites.

El-khargeh. See Oases.

Elkhart, a city of Indiana, at the junction of the St Joseph and Elkhart rivers, 101 miles E. by S. of Chicago by rail, with flour-mills, planing-mills, machine-shops, and railway workshops and manufactures of musical instruments, paper, and starch. Pop. (1890) 11,360; (1910) 19,282; (1920) 24,277.

Ell (allied to *el*bow, Ger. *ellen*bogen, Lat. *ulna*, 'the forearm'), a measure originally taken in some vague way from the arm, and which has been used to denote very different lengths. The English ell, as a measure of cloth, is equal to 1¼ yard (q.v.), the Flemish to ¾ yard, and the French to 1½ yard.

Elland, a town in the West Riding of Yorkshire, on the river Calder, 3 miles SE. of Halifax by rail. It has some cloth-mills, and there are valuable stone-quarries in the vicinity. Pop. 10,500.

Ellenborough, Earl of. Edward Law, first Earl of Ellenborough, was eldest son of the first Baron Ellenborough (1750–1818), Chief-justice from 1802 of the King's Bench. Born 8th September 1790, he entered parliament in 1813, held office under several administrations, and in 1841 was appointed Governor-general of India. He received the thanks of parliament in 1843 for his 'ability and judgment' in supporting the military operations in Afghanistan, but his treatment of the civil servants of the Company, and his policy of conciliating the natives by oriental display and proclamations which appeared to sanction idolatry, led to his recall in 1844. Supported by the ministry, he was created Viscount Southam and Earl of Ellenborough, and in 1846 was First Lord of the Admiralty under Peel. In the Derby administration of 1858 he was Minister for India, but the publication of a despatch in which he severely rebuked Viscount Canning forced him to resign in order to avert the overthrow of the government. He afterwards took a frequent and influential part in the debates of the Upper House. In 1863 he expressed strongly his sympathies on behalf of Poland, and in 1864 advocated British intervention in favour of Denmark. Ellenborough died without issue, December 2, 1871, when the barony devolved on a nephew, but the earldom and viscounty became extinct. See *History of the Indian Administration of Lord Ellenborough*, by Lord Colchester (1874), who also edited his *Political Diary, 1828–30* (1881).

Ellery, William (1727–1820), born in Newport, Rhode Island, sat in the congress of 1776, and was one of the signers of the Declaration of Independence. From 1790 till his death he retained the office of collector in his native place.

Ellesmere, a town of Shropshire, near a beautiful lake or mere of 120 acres, 19 miles NNW.

of Shrewsbury. Pop. 1800. The Ellesmere Canal, connecting the Severn and the Mersey, passes here. It is carried across the Dee and the Vale of Llangollen by Telford's Ellesmere Aqueduct (1805), 1007 feet long and 127 high. Ellesmere Port, in Cheshire, is at its junction with the Manchester Ship Canal; pop. with Whitby, 13,000.

Ellesmere, Francis Egerton, first Earl of, was second son of the first Duke of Sutherland, and was born in London, 1st January 1800. Educated at Eton and Christ Church, Oxford, he sat for Bletchingley, Sutherland, and South Lancashire, and successively (1828–30) held the offices of Irish Secretary and Secretary for War. In 1833, on succeeding to his father's Bridgewater estates, he assumed the name of Egerton, in lieu of his patronymic Leveson-Gower, and in 1846 became Earl of Ellesmere and Viscount Brackley. He translated *Faust*, published poems, histories, and sketches of travel, and was a patron of the arts. He died 18th February 1857.

Ellesmere Land, an Arctic region west of Smith Sound.

Ellice Islands, N. of Fiji, extend 360 miles from NW. to SE. between 5½° and 11° S. lat. and 176° and 180° E. long. They consist of nine groups of atolls or coral islands, one of which groups was discovered in March 1819 by the American Captain Peyster. Another of the atolls had previously been discovered in 1781. The population of the whole archipelago is about 3500, mostly Christianised Polynesians. Like the people of Samoa and Tonga they have a fine physique, and are peaceable in disposition. The islands grow little but coconut trees, copra being the main export. A little guano also is exported. A British protectorate since 1892, they are now part of the Gilbert and Ellice Islands Colony (1915), and are subject to the jurisdiction of the High Commissioner for the Western Pacific.

Ellichpur, chief town of a former district of the same name (since 1905 part of Amraoti) in the north of Berar, was at one time capital of the Deccan, and is said to have contained 40,000 houses. Its buildings include an extensive palace (fast falling to ruin), a detached fort, the burial shrine of Dalla Ráhman, and several handsome tombs of the nawábs. The military cantonment of Paratwada is 2 miles distant. Pop. (1881) 26,728; (1921) 26,800.

Ellicott, Charles John, Bishop of Gloucester and Bristol, was born 25th April 1819, at Whitwell, near Stamford, of which parish his father was rector. He was educated at Oakham and Stamford schools, and at the university of Cambridge, where he graduated in 1841, and was elected fellow of St John's College. He became rector of Pilton, Rutlandshire, in 1848, professor of Divinity at King's College, London, in 1858, Hulsean lecturer at Cambridge in 1859, and Hulsean professor of Divinity the year after. Dean of Exeter from 1861, he was Bishop of Gloucester and Bristol from 1863 till the sees were separated in 1897, and Bishop of Gloucester till his resignation in 1905. His episcopate was distinguished by the most vigorous and catholic-spirited activity in educational, missionary, and church extension work. Chairman for eleven years of the New Testament Revision Committee, he is best known as a commentator, eminent for the thoroughness of his expository method, having published critical and grammatical commentaries on Galatians (1854), Ephesians (1855), Philippians, Colossians, Thessalonians, Philemon, and the Pastoral Epistles (1861); works on the Sabbath, on Scripture and its Interpretation, and on Modern Scepticism. A useful work which he edited was *A New Testament Commentary for English Readers* (3 vols.), with another on the *Old Testament* (5 vols.). He died 16th October 1905.

Elliot, Jean, the author of 'The Flowers of the Forest,' a touching lyric on the disaster of Flodden, was the daughter of Sir Gilbert Elliot of Minto House, Teviotdale, where she was born in 1727. The greater part of her life was spent in Edinburgh (1756–1804). She died at the family seat or at Monteviot, on 29th March 1805. Her eldest brother, Sir Gilbert Elliot (1722–77), was himself a song-writer; whilst John, the third brother, who died in 1808, was a distinguished admiral. See Minto.

Elliotson, John, an English physician, was born in London in 1791. After leaving Jesus College, Cambridge, he studied medicine at Edinburgh and London, and was for five years assistant physician at Guy's Hospital. In 1831 he became professor of the practice of medicine in the university of London, and took an active share in the establishment of University College Hospital. He was at this time one of the foremost physicians of London, and a successful lecturer. In 1837 he became a convert to mesmerism, which cost him his professorship in 1838, but did not apparently much diminish his private practice. He died in London on 29th July 1868. Besides being one of the first to use the stethoscope, Elliotson conducted numerous useful experiments as to the action of drugs, and did much to encourage the practice of clinical study. He was the founder of the Phrenological Society. His name will live securely from its connection with Thackeray's *Pendennis*.

Elliott, Ebenezer, the Corn-law Rhymer, was born of mixed moss-trooper and yeoman ancestry at the New Foundry, Masbro', in Rotherham parish, Yorkshire, on 17th March 1781. A shy and morbid boy, who proved a dull pupil at four different schools, he worked in his father's foundry from his sixteenth to his twenty-third year, and threatened to become a 'sad drunken dog,' till the picture of a primrose in Sowerby's *Botany* 'led him into the fields, and poetry followed.' His *Vernal Walk*, written at sixteen, was published in 1801; to it succeeded *Night* (1818), *The Village Patriarch* (1829), *Corn-law Rhymes and the Ranter* (3d ed. 1831), and other volumes—collected in 1840 (new ed. 2 vols. 1876). He had married early, and sunk all his wife's fortune in his father's business; but in 1821, with a borrowed capital of £100, he started on his own account as a bar-iron merchant at Sheffield, and throve exceedingly, 'making £20 a day sometimes without stirring from his counting-house, or ever seeing the goods he disposed of.' Though in 1837 he lost fully one-third of his savings, still in 1841 he was able to retire with good £300 a year to a house of his own building at Great Houghton, near Barnsley. Here he died 1st December 1849.

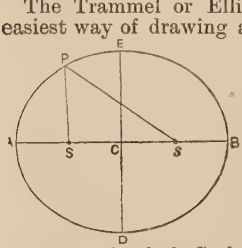
Elliott the poet is well-nigh forgotten. His poems are nowadays little more read than in his lifetime was his tragedy *Tauraassdes*. It had three readers, Elliott one of them. But Elliott the Corn-law Rhymer is still remembered as the Tyrtæus of that mighty conflict whose triumph he lived to witness, as the typical maker of ballads, not needing to care who should make the laws of the nation. This Corn-law Rhymer had been bred a 'Berean' and Jacobin; yet he hated Communists, Socialists, and physical-force Chartists; he lies buried in Darfield churchyard; he left two sons Established clergymen. His whole life long he looked on the Corn-laws as the 'cause of all the crime that is committed;' agriculturists, he maintained, 'ought not to live by robbing and murdering the manufacturers.' On the other hand, 'Capital has a

right to rule the world,' and 'competition is the great social law of God.'

There are two poor memoirs of Elliott, by his son-in-law, John Watkins (1850), and by 'January Searle'—i.e. George S. Phillips (1850). See also Carlyle's essay from the *Edinburgh* for July 1832, and Professor Dowden in Ward's *English Poets* (2d ed. 1883).

Ellipse, a section of a cone by a plane less inclined to the base than is a generator, is intermediate to the circle and parabola (see DIRECTRIX). It is of great importance in Astronomy, being the shape of the orbit described by a planet under the action of gravitation. Mathematically, the ellipse is a closed curve, every point of which has the sum of its distances from two fixed points always the same. These two fixed points are called the foci; and the diameter drawn through them is the major axis; the minor axis bisects the major at right angles. The distance of a point on the curve from the focus is less than that from the directrix. The ratio (*eccentricity*) is fixed. The less the eccentricity the nearer the figure approaches to a circle. When the foci coincide the ellipse becomes a circle, and when they are infinitely apart it becomes a parabola. The tangent at any point of the curve is always equally inclined to the two focal distances; and any diameter bisects all the chords which are parallel to the tangents at its extremities.

The Trammel or Elliptic Compass affords the easiest way of drawing an ellipse. It depends on the principle that when a line of fixed length moves so that its extremities are always on two fixed perpendicular lines, any point in it must describe an ellipse. A simple practical method is by passing a loop of thread over two pins stuck in the foci, S*s* in the diagram, the length of the loop being equal to SB. If the point of a pencil be put into the loop P, and moved round so as to keep it stretched, the pencil will trace an ellipse AEBD. There are also various ways of approximating to the figure by the use of circular arcs.



The equation to an ellipse (see GEOMETRY, ANALYTICAL), referred to its centre as origin, and to its major and minor axes as rectangular axes, is $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, where a and b are the semi-major and semi-minor axes respectively. From this equation it may be shown, by the integral calculus, that the area of an ellipse is equal to πab; or is got by multiplying the product of the semi-major and semi-minor axes by 3·1416. It may also be shown that the length of the circumference of an ellipse is got by multiplying the major axis by the quantity $\pi\left\{1-\left(\frac{1}{2}\right)^2\frac{e^2}{1}-\left(\frac{1.3}{2.4}\right)^2\frac{e^4}{3}-\left(\frac{1.3.5}{2.4.6}\right)^2\frac{e^6}{5}-\&c.,\right\}$ to which there is an excellent practical approximation when e is not too large, viz. $\frac{\pi}{2}\left(a+b+\sqrt{2\,(a^2+b^2)}\right)$. The eccentricity, e, is $=\sqrt{1-\frac{b^2}{a^2}}$ and the *ellipticity* is the ratio $a-b$ to a. Another approximation, as good or better, under the same limitation, is $\pi\left(\frac{3}{2}(a+b)-\sqrt{ab}\right)$. The latter is due to Mr Hope-Jones.

Ellipsoids are of two kinds, the simpler being those of revolution, produced by an ellipse turning round the major or the minor axis. The surfaces so generated are known as prolate and oblate spheroids respectively, and that of our globe is an instance of the latter. The ellipsoid proper has three rectangular axes of different lengths, and its section in any direction is an *ellipse*, whereas the spheroids must give a circular section if cut at right angles to the axis of revolution.

Ellis, or (till 1825) SHARPE, ALEXANDER JOHN (1814–90), philologist, was born at Hoxton, and educated at Shrewsbury, Eton, and Trinity College, Cambridge, where he graduated sixth wrangler in 1837. He wrote numberless papers of great learning on mathematical, musical, and philological questions, and did more than any other scholar to advance the scientific study of phonetics, of early English pronunciation, and of existing English dialects. Of his many and valuable books the most important are *Essentials of Phonetics* (1848); *Universal Writing and Printing* (1856); *Early English Pronunciation, with especial reference to Chaucer and Shakespeare* (5 parts, 1869–89); *Practical Hints on the Quantitative Pronunciation of Latin* (1874); and a translation of Helmholtz's *Sensations of Tone* (1875; 2d ed. 1885).

Ellis, GEORGE (1753–1815), English author, was born in London and educated at Westminster school and Trinity College, Cambridge. A contributor to the *Rolliad* (q.v.), he later changed sides and became one of the founders of the *Anti-Jacobin* (q.v.). Apart from his work in political satire, Ellis was one of the first to arouse interest in Early English literature, and he edited *Specimens of the Early English Poets* (1790), and *Specimens of Early English Metrical Romances* (1805). He also, in 1796, edited Way's translation of select *Fabliaux*. He was an intimate friend of Sir Walter Scott.

Ellis, SIR HENRY (1777–1869), antiquary, born in London, was educated at Merchant Taylors' School, and at St John's College, Oxford, of which he became a Fellow. From the staff of the Bodleian he received, in 1800, an appointment at the British Museum, and became principal librarian (1827–56). His *Introduction to Domesday Book* was published in 1833; his *Original Letters illustrative of English History*, issued in three series, in the years 1824–46; and his invaluable edition of Brand's *Antiquities*, in 1813. He also wrote a *History of the Parish of St Leonard, Shoreditch*, and works on the Townley and Elgin Marbles, and was the chief editor and writer of the English portion of the edition of Dugdale's *Monasticon* (1817–30). His works exhibit much learning and research.

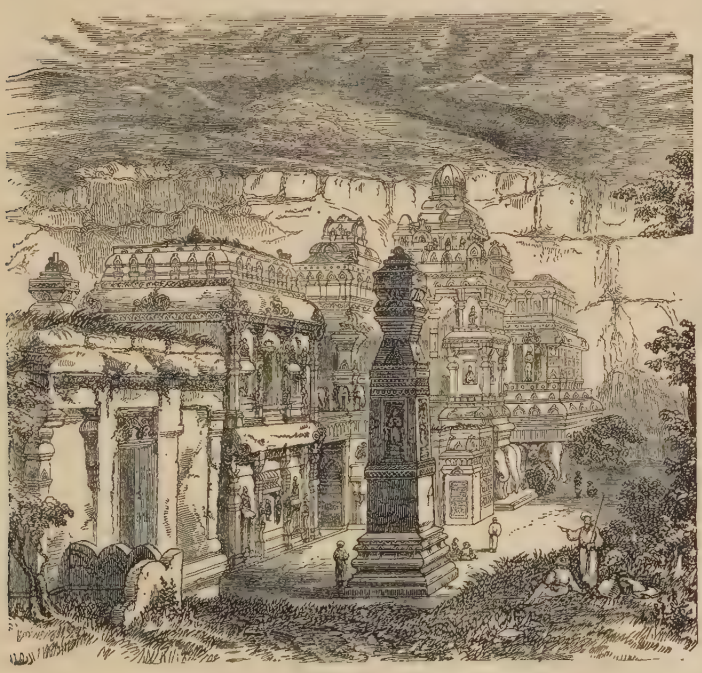
Ellis, HENRY HAVELOCK, was born at Croydon, 2d February 1859. Before completing his medical education at St Thomas's Hospital, London, he went to Australia and taught in New South Wales from 1875 to 1879. Returning to England in 1880 he qualified in medicine, but devoted himself mainly to literary and scientific work. His many writings include *The Criminal* (1890, 4th ed. 1910), and several volumes of *Studies on the Psychology of Sex* (1899, &c.). His *Impressions and Comments* appeared in 1914 (2d series, 1921).

Ellis, WILLIAM, an eminent English missionary, was born in London, 29th August 1794. He was brought up as a gardener, but having offered himself to the London Missionary Society, was trained and despatched in 1816 to the Pacific Islands, where he laboured for nearly ten years, first at Eimeo, next at Oahu. The illness of his wife obliged him to return to England in 1825, and he became foreign secretary to his Society (1832–41). Meantime his *Tour through Hawaii* (1826) and his *Polynesian Researches* (1839) extended his fame as a missionary. His wife died in 1835, and two years later he married Sarah Stickney, in her day a well-known teacher, and author of *The*

Women of England (1838), *The Daughters of England* (1842), *The Wives of England* (1843), *Hearts and Homes* (1848-49), and *The Mothers of Great Men* (1859). From 1847 to 1853 Ellis ministered to a small congregational church at Hoddesdon, Hertfordshire. In 1838 he had published a history of Madagascar, and in 1853 he was sent on missionary work to that island. He made four different visits, the last extending over four years (1861–65), and by his tact and sagacity did much to settle the external relations of the Christians on a safe basis. His books on Madagascar, besides their personal and religious interest, became standard works. Ellis died 9th June 1872; his wife but a week later. See the Life by his son (1873).

Ellis Island, a small island in the north of upper New York Bay, owned by the United States government, and used by it since 1892 as an immigration station, the administration of which has from time to time been the subject of criticism.

Elliston, Robert William, actor, was born in London, the son of a watchmaker, in 1774, and was educated at St Paul's school. In 1791 he ran away from home, and made his first appearance on the stage at Bath, where his Romeo in 1793 lifted him into public favour. In 1796 he appeared at the Haymarket and Covent Garden; and after 1803 he made London his headquarters, though still making occasional essays as a provincial manager. He was a member of the Drury Lane company in 1804–9 and 1812–15; in 1819 he became lessee and manager of the theatre, from which, in 1826, he retired a bankrupt. He afterwards played in the Surrey theatre; but dissipation hastened his death, 8th July 1831. Elliston was the first comedian and one of the first tragedians of his day, and in Leigh Hunt's estimation the 'best lover on the stage both in tragedy and comedy;' Lamb's eulogy is well known. See the Life by Raymond (2 vols. 1845).



The Kailás Temple at Ellora. (From Fergusson.)

Ellora, a village in the Nizam's dominions, 13 miles NW. of Aurungabad. It is celebrated for its wonderful rock-cut temples. Of these there are 34 of a large size, Buddhist, Brahmanical, and Jain. Some are cave-temples proper—i.e. chambers cut out in the interior of the rock—but others are vast buildings hewn out of the solid granite of the hills, having an exterior as well as an interior architecture, and being, in fact, magnificent monoliths. In executing the latter, the process was first to sink a great quadrangular trench or pit, leaving the central mass standing, and then to hew and excavate this mass into a temple. The most beautiful of these objects is the Hindu temple, called the Kailás, dedicated to Siva. At its entrance the traveller passes into a large antechamber adorned by numerous rows of pillars. Thence he ascends a few steps into a great rectangular court, averaging 276 feet in length and 154 in width, in the centre of which stands the temple itself, a vast mass of rock richly hewn and carved. It is supported by four rows of pilasters, with colossal elephants and other animals beneath, and seems suspended in the air. The interior is about 103 feet long, 56 broad, and 17 high, but the entire exterior forms a pyramid 164 feet long, 109 wide, and 100 high, and is overlaid with sculpture. In the great court are numerous ponds, obelisks, colonnades, sphinxes, and on the walls thousands of mythological figures of all kinds, from 10 to 12 feet in height. The interior, and certainly some parts of the exterior, have been plastered over and painted. It is now generally believed that the caves date from the 7th century.

Ellore (*Elúr*), a town in the Kistna district, Madras, on the Jammaler River, 255 miles N. of Madras, with manufactures of woollen carpets and saltpetre. The heat is very oppressive, reaching 110° F. in the shade. Pop. 30,000.

Ellsworth, a city and port of entry in Maine, on the river Union, 28 miles SE. of Bangor, with a very large lumber trade; pop. 3000.

Ellwangen, an industrial town of Württemberg, on the Jagst River, 55 miles N. of Ulm by rail; pop. 5300. The old castle of Hohen-Ellwangen, close to the town, has been used as an agricultural school since 1843.

Ellwood, Thomas, whose name will never be forgotten from its connection with Milton's, was born at Crowell in Oxfordshire in 1639. At twenty the influence of his friends the Penningtons converted him to Quakerism, from which neither his father's blows, nor confinement within his house, nor frequent imprisonments could cure him. In 1662 he made Milton's acquaintance, and soon visited him 'every day in the afternoon, excepting on the first day of the week, and sitting by [the poet] in his dining-room, read to him in such books in the Latin tongue as he pleased to hear me read.' Milton taught him to read Latin in the foreign manner. The readings were interrupted six weeks later by Ellwood's illness; but again, in 1665, we find him hiring a cottage at Chalfont St Giles, where Milton might escape the plague then raging in London. One day Milton

gave him the manuscript of *Paradise Lost* to read, and when returning it Ellwood said, 'Thou hast said much of "Paradise Lost," but what hast thou to say of "Paradise Found?"' When Milton handed him *Paradise Regained* in London, he added, 'This is owing to you, for you put it into my head by the question you put to me at Chalfont, which before I had not thought of.' Ellwood married in 1669, was busy in controversy, and seems to have had more than his share of the persecutions that fell upon the Quakers almost till his death in 1714. Of his many tracts, treatises, epistles, and even poems, only his Autobiography is now interesting, and that not for his own sake, but because he crossed the orbit of almost our greatest poet. There are editions by Professor Henry Morley in his 'Universal Library' (1885), and by C. G. Crump (1900).

Elm, a village of Switzerland, at the head of a mountain-girt valley in the canton of Glarus, with 1000 inhabitants when, in 1881, the whole of the northern side of Tschingel Peak (10,230 feet) crashed down upon it, destroying a large part of it, and filling the narrow valley with the debris of the landslip.

Elm (*Ulmus*), a genus of trees of the natural order Ulmaceæ, natives of temperate climates, with serrated leaves unequal at the base, and small flowers growing in clusters appearing before the leaves, and containing 4–12 stamens and one germen. The fruit is a samara, or compressed one-seeded little nut, winged all around. Elm is a remarkably variable genus, so much so that botanists are greatly divided in opinion as to which are species and which varieties among the numerous forms comprised in it. There are two well-marked types common to Britain, and having a wide distribution in Europe and Western Asia and Northern Africa. These are the English Elm (*U. campestris*), which is the most common in English woods and pleasure-grounds; and the Scotch or Wych Elm (*U. montana*), which, though more common in Scotland and in Ireland, is more sparingly distributed also in England and on the Continent.

Common English Elm (*Ulmus campestris*): *a*, flower; *b*, fruit.

The English elm often attains a height of from 70 to 90 feet, with a diameter of from 5 to 6 feet, before it is one hundred years old—an age that the elm-tree rarely much outlasts; it may even exceed 100 feet in height. Both species have been productive of many varieties, some of which are so distinct as to be by some considered species and by others as merely well-marked sub-species or varieties. The fact that no reliance can be placed on the progeny of any of these forms, when reared from seed, having the features and attributes of the parent appears to corroborate the latter view. In consequence of this peculiarity in elm it is necessary, if we wish to perpetuate any specially desirable or meritorious kind, to propagate it by budding, grafting, or layering. Varieties of the English elm are numerous. All are not alike valuable as timber-trees. For forest planting, seedlings of the type and other well-marked kinds are selected. Besides the typical form, varieties known to nurserymen as the Broad-leaved English Elm (*U. c. latifolia*), the Red English Elm (*U. c. stricta*), and the White English Elm (*U. c. alba*) are preferred to any others as the seed parents, their progeny proving almost invariably valuable timber producers. Of this species there are some interesting and beautiful varieties, much esteemed for their effect in ornamental grounds and garden scenery. The most distinct are the typical form with silver variegated leaves, and also with yellow variegated leaves, and *U. c. viminalis*, of which there is also a silver-leaved form, both of them being remarkable for the small, twiggy character of their shoots, and their light, elegant appearance. The Twisted Elm (*U. c. tortuosa*) is a very singular variety of French origin. Its trunk marked with alternate protuberances and hollows gives it a very remarkable appearance in old trees. Its timber is preferred in France above all others by wheelwrights, particularly for spokes, its fibre being exceedingly tough, twisted, and interlaced together. The Dutch Cork-barked Elm (*U. c. major*) is a well-marked variety or sub-species of the English elm, which was introduced by William III. when the Dutch style of gardening was fashionable. Its rapid growth and adaptability to being clipped into the stiff, formal shapes essential to that style of gardening led to its being much used while the fashion prevailed; but when Dutch gardening disappeared, the cultivation of this variety of elm almost ceased, as its timber is comparatively worthless. The bark of the younger branches is rough and cork-like. The Cork-barked English Elm (*U. c. suberosa*) is a very handsome and well-marked sub-species, growing with greater vigour and to a larger size than the type, having also larger leaves and the bark of the branches distinctly lined with corky wings.

Common English Elm (*Ulmus campestris*).

The wood of the English elm is highly valued for its great strength, toughness, and closeness of texture. It is less liable to split than almost any other timber, and powerfully resists the decomposing action of water; it is therefore much in request for keels of ships and boats, naves and spokes of wheels, foundation piles, and wet-planking. The large bosses or knots with which the trunk is frequently covered are much prized in cabinet work and in turnery for their beautiful appearance when cut up

and polished. The bark is used in dyeing and in sugar-refining, and in times of scarcity has been used in Norway for grinding into meal and mixing in bread. The inner bark is used medicinally in cutaneous diseases; it is mucilaginous, and has a bitter astringent taste. In Persia, Italy, and the south of France galls are frequently produced on the leaves, often of large size, containing a clear fluid called *eau d'orme*, which is sweet and viscid, and is used to wash wounds. Towards autumn these galls dry up, leaving a residue of a yellow or blackish balsam called *beaume d'orme*, which was formerly in great repute for diseases of the chest. The seeds of the elm are eagerly eaten by pigeons and common poultry. A peculiar vegetable principle called *ulmin*, or *ulmic acid*, was first discovered in the substance which often spontaneously exudes from the bark of the English elm. It is a dark-brown substance, without smell or taste, insoluble in cold, sparingly soluble in boiling water, which it colours yellowish-brown, and soluble in alcohol and in alkaline solutions.

The typical form of Scotch elm is easily distinguished from the English by its less upright trunk, more spreading branches, and larger, broader leaves. The tree is generally considered more picturesque in style than the English elm. Its timber, though more liable to crack, is quite as much esteemed for its durability and toughness, and is used for nearly every purpose for which that of the English elm is in demand. The enormous bosses which frequently occur on the trunk are highly valued in cabinet-making. The varieties of this species are numerous, and some of them are important both as timber and as ornamental trees. The Smooth-leaved Wych Elm (*U. m. glabra*) is so distinct in its upright growth, smaller and smooth leaves, and other even more important characters, from the typical Wych Elm, that some are disposed to regard it as a species. It is certainly well marked, and from it have sprung the Huntingdon Elm, the Chichester Elm, and the Scampston Elm, all of which have a strong resemblance to each other, and are remarkable for their great rapidity of growth and their value as timber-trees. Of ornamental and curious varieties, the Wych Elm is the parent of several, the more remarkable of which are the Weeping Wych Elm (*U. m. pendula*), the Exeter Wych Elm (*U. m. fastigiata*), and the Variegated Wych Elm (*U. m. variegata*), the leaves of which are silvery striped. *U. effusa* is a continental species with a large spreading head and smooth bark, distinguished also by the long stalks of its flowers and its ciliated fruit.

The American or White Elm (*U. americana*), which abounds in the Mississippi basin, and attains its loftiest stature between 42° and 46° N. lat., is a magnificent tree, sometimes 100 feet in height, the trunk reaching 60 or 70 feet before it separates into branches, and the widely diffused pendulous branches floating gracefully in the air; but the timber is not much esteemed. Slippery Elm (*U. fulva*) is also common in the basin of the Mississippi as far south as 31° N. lat., and in the western parts of Canada. It attains a height of 50 or 60 feet. The wood is more valuable than that of the last species, but much inferior to the English elm. The leaves and bark yield an abundant mucilage, which is bland and demulcent, and esteemed a valuable remedy in catarrh, dysentery, and other complaints. The Wahoo or Winged Elm (*U. alata*) is a small tree, found from 37° N. lat. to Florida, Louisiana, and Arkansas, remarkable for the branches being furnished on two opposite sides with wings of cork. The wood is fine-grained, compact, and heavy. Both the English elm and the Wych elm have been introduced into the United States. *U. chinensis* is a Chinese species of elm, the leaves of which bear galls used in tanning and dyeing.

The name Spanish Elm is given in the West Indies to a valuable timber-tree also called Bois de Chypre, *Cordia Gerascanthus*, of the natural order Cordiaceæ; also to *Hamelia ventricosa*, of the natural order Rubiaceæ, the timber of which is known to cabinetmakers as Prince-wood.

Elmali, a town of Asia Minor, on the Lycian tableland, 45 miles W. of Adalia. It has manufactures of red leather, dye-works, and a general trade. It is inhabited by direct descendants of the ancient Lycians. Pop. 4000.

Elmina, a British settlement and fortified seaport on the Gold Coast, a few miles W. of Cape Coast Castle. It was first settled by merchants of Dieppe, came into the hands of the Portuguese in 1471, and of the Dutch in 1637, and in 1872 was ceded to the British, who destroyed the native town during the Ashanti war. Pop. 6000.

Elmira, capital of Chemung county, New York, on the Chemung River, 149 miles ESE. of Buffalo by rail. It contains a court-house, a famous state reformatory prison (see PRISONS), and the Elmira Female College, and has extensive manufactures of valves, iron bridges, automobile parts, iron rails, railway and other carriages, &c. Pop. (1870) 15,863; (1910) 37,176; (1920) 45,393.

Elmo's Fire, ST, is the popular name of an electric appearance sometimes seen, especially in southern climates during thunder-storms, of a brush or star of light at the tops of masts, spires, or other pointed objects. It is also observed at the tops of trees, on the manes of horses, and occasionally about human heads. It is similar in kind to the luminous glow seen at the point when a lightning-rod is working imperfectly, or when there is any very rapid production of electricity (see ELECTRICITY). In the four years 1884–87 eleven cases of St Elmo's fire were recorded at the Ben Nevis observatory. The phenomenon, as seen at sea, was woven by the Greeks into the myth of Castor and Pollux, and was regarded as of friendly omen. The name of *Elmo* is by many thought to be a corruption of that of Helena, the sister of Castor and Pollux. Others take it to be a corruption of St Erasmus, a Syrian bishop and martyr of the 3d century (Italianised, *Ermo*, *Elmo*). The phenomenon has also been called the fire of St Elias, of St Clara, of St Nicolas, and of Helena, as well as *composite* or *composant* (i.e. *corpus sanctum*) on the Suffolk seaboard.

Elmshorn, a town in the Prussian province of Sleswick-Holstein, is situated on a navigable feeder of the Elbe, 20 miles NW. of Hamburg. It has considerable manufactures, especially of boots and shoes, an active trade in grain, a boat-building yard, and some breweries and tanneries. Pop. 15,000.

Elmsley, PETER, classical scholar, was born in 1773, and educated at Westminster and Christ Church, Oxford, where he graduated B.A. in 1794. He next took orders, and was presented in 1798 to the living of Little Horkesley in Essex, which he held till his death. He lived at various periods of his life at Edinburgh, at St Mary Cray in Kent, and at Oxford, where he was in 1823 appointed principal of St Alban Hall, and Camden professor of Ancient History. Here he died, 8th March 1825. Elmsley contributed to the *Edinburgh* and *Quarterly* reviews, but is now remembered only by his valuable critical work on Sophocles and Euripides. See *Elmsleiana Critica* (1833).

El Obeid. See OBEID (EL).

Elocution (Lat., 'speaking out'), the art of effective speaking, more especially of public speaking. It regards solely the utterance or delivery; while the wider art of oratory takes account also

of the matter spoken. The art of elocution held a prominent place in ancient education.

Elodea. See ANACHARIS.

Éloge. When a member of the French Academy dies, it is customary for his successor to deliver an oration, setting forth his merits and services. This is called an *éloge* (Lat. *elogium*, 'a short saying,' confused with Gr. *eulogia*, 'praise'), and a considerable branch of French literature goes by the name. Interesting and valuable collections are the éloges of Fontenelle (2 vols. 1731), and of Cuvier (1819).

Elohim, Heb., plural of *Eloah* (only used in poetry; cf. Arab. *Ilâh*, Chald. *Elâh*, Syr. *Alôh*), might, power; in plur., great beings, kings, angels, gods, *Deity*. As a *pluralis excellentiæ* or *majestatis*, and joined to the singular verb, it denotes, with very rare exceptions, *the One*, true God. Joined to the plural verb, however, it usually means gods in general, whether including the One or not. It is mostly used (in the singular sense) for or together with Jehovah; but some portions of the Scriptures employ exclusively either the one term or the other. This circumstance has given rise to endless discussions, and suggested the opinion that Genesis is by different authors (see BIBLE, JEHOVAH). It was very probably Peter Lombard who first tried to prove the Trinity out of this plural form—an attempt which, although unanimously and scornfully rejected by almost all scholars, from Calvin, Calixtus, the younger Buxtorf, &c., to our times, was revived by Rudolf Stier.

Eloi, or ELIGIUS, ST, Bishop of Noyon and apostle of Flanders (588–658), was originally a goldsmith, and as such became patron of goldsmiths and hammermen.

Elopement. See MARRIAGE, ABDUCTION, GRETNA GREEN.

Elopura. See BORNEO.

El Paso, capital of El Paso county, Texas, on the left bank of the Rio Grande (which forms the boundary between Mexico and the United States), at the junction of the Southern Pacific with the Mexican railways. There is much transit trade, with some silver-smelting and meat-packing. Pop. (1880) 736; (1890) 10,338; (1900) 15,906; (1910) 39,279; (1920) 77,560. Opposite is the Mexican town of Ciudad Juárez (q.v.), formerly called El Paso del Norte.

Elphege, or ALPHEGE, ST (954-1012), called in his own time ÆLFHEAH, or GODWINE, was a monk of Deerhurst, an anchorite, afterwards abbot, at Bath; in 984 was made bishop of Winchester by Dunstan's influence, and in 1006 archbishop of Canterbury. He went as Æthelred's ambassador to Olaf Tryggvessön, and confirmed (or possibly converted) him at Andover in 994. When Canterbury was sacked by the Danes in 1011 he was taken prisoner, and refusing to pay ransom, was murdered seven months later.

Elphin, a bishop's see in Roscommon, Ireland, united to Kilmore in 1833.

Elphinstone, ADMIRAL. See KEITH (VISCOUNT).

Elphinstone, MOUNTSTUART, fourth son of the eleventh Lord Elphinstone, was born in 1779, entered the Bengal civil service in 1795, and was posted to Benares, where he laid the foundation of that love of literature which distinguished him through life. During the operations of 1803 he was attached to Wellesley's staff, and his conspicuous services earned from his general the compliment that he had 'mistaken his profession, and ought to have been a soldier,' from his superiors the appointment to the post of resident at Nagpur. In 1808 he was selected as envoy to Shah Shuja (see AFGHANISTAN), of which the only fruit that remains is his *Account of Caubul* (1815); and in 1810 he became resident at Poona, where, in the Mahratta war of 1817, his military qualifications gained for him the honour of bringing the campaign to an end, and organising the newly-acquired territory. During his governorship of Bombay (1819–27) he founded the present system of administration, and greatly advanced public education. He returned to England in 1829, and declining the governor-generalship of India, lived in comparative retirement until his death, 20th November 1859. Elphinstone ranks next to Wellesley among those most instrumental in raising the fabric of British rule in India after the downfall of the Mahratta power. His well-known *History of India* appeared in 1841 (7th ed. 1889). See his Life (1884) by Sir E. Colebrooke, who also edited his *Rise of British Power in the East* (1887); and his *Official Writings*, with Memoir by Forrest (1884).

Elphinstone, WILLIAM, a celebrated Scottish prelate, and founder of King's College, Aberdeen, was born in 1431. He was the son of William Elphinstone, a canon of Glasgow, and archdeacon of Teviotdale—a natural son, for the marriage of ecclesiastics was then prohibited. Elphinstone studied at the university of Glasgow, where he took his degree of M.A. in 1452, some time later receiving priest's orders. He spent some years on the Continent, and so highly distinguished himself in the study of law that he was appointed professor in the university of Paris, and afterwards at Orleans. He returned to Scotland, and was made successively official-general of the diocese of Glasgow (1471–72), rector of the university (1474), and official of Lothian in 1478, 'then probably,' says Mr Cosmo Innes (*Sketches of Early Scottish History*, Edin. 1861), 'the second judicial office in the kingdom.' He was made Bishop of Ross in 1481, and of Aberdeen in 1483; was several times engaged in embassies, and for a few months before the death of James III. held the office of chancellor of the kingdom. Under James IV. he was employed on a mission to the Continent, and seems to have been keeper of the Privy Seal from 1492 till his death. He applied himself to the faithful discharge of his episcopal functions, endeavouring to reform the clergy, the service, and the ritual of the church. It appears to have been chiefly through his influence that the first printing-press—that of Chepman and Millar—was established in Scotland. The college of Aberdeen was founded in 1500, and dedicated to St Mary, a name afterwards changed to King's College. Additions to the cathedral and a stone bridge over the Dee were also due to his energy and liberality. The fatal battle of Flodden, 9th September 1513, broke the spirit of Elphinstone, who was never seen to smile after. He died in Edinburgh, 25th October 1514, and was buried before the high altar of the chapel of King's College which he had founded. His *Breviarium Aberdonense*, printed in 1509–10, was reprinted in two volumes quarto at London in 1853.

Elsass-Lothringen. See ALSACE-LORRAINE.

Elsinore (Dan. *Helsingör*), a town and seaport of Denmark, on the island of Zealand, is situated on the western shore of the Sound, and at its narrowest part, 2½ miles nearly due west of Helsingborg in Sweden, and 37 by rail N. of Copenhagen. The town, which has been in recent times considerably improved, consists of one principal street, with several lateral branches. The harbour (enlarged in 1883–84) has 22 to 26 feet of water, and the roadstead outside affords excellent anchorage. Elsinore has considerable trade, and some shipbuilding. Pop. 17,000. The Sound dues were collected here until their abolition in 1857.

Saxo Grammaticus, a famous writer of the 12th century, was born at Elsinore, and here too Shakespeare lays the scene of *Hamlet*. Elsinore was raised to the rank of a town in 1416; it was several times destroyed by the Hanseatic League, and in 1658 was taken by the Swedes, but restored to Denmark two years later. A short distance east of the town is the fortified castle of Kronborg, built in the Dutch Renaissance style by Frederick II. in 1580, while to the north-west of Elsinore stands the royal castle of Marienlyst, now much visited as a seaside resort; it commands an extensive view of the Sound and its islands, its shores, and the towns on them.

Elssler, the name of two celebrated dancers, sisters, and natives of Vienna—Therese (1808–78) and Fanny (1810–84). Their first great triumph was at Berlin in 1830; in 1841, after a tour through the capitals of Europe, the two sisters went to America, where they excited unwonted enthusiasm. They retired from the stage in 1851, in which year Therese became the wife of Prince Adalbert of Prussia, and was ennobled by the king of Prussia as Frau von Barnim.

Elster, the name of two rivers of Germany, the White and the Black Elster. The White Elster rises at the foot of the Elster Mountains, on the north-western boundary of Bohemia, flows in a northerly direction, and falls into the Saale, above the town of Halle, in Prussian Saxony. Total length, 122 miles. The Black Elster rises in Saxony, south of Elstra, flows north-west, and joins the Elbe 9 miles SE. of Wittenberg, after a course of 112 miles.

Elster, a Spa of Saxony, on the Bohemian frontier, 20 miles S. of Plauen; resident pop. 2000.

Elstracke, RENOLD, long classed as one of the earliest native English engravers, was born probably in Belgium towards the end of the 16th century, and flourished in England in the early part of the following century. He worked chiefly for the booksellers, and his engravings, including portraits of the kings of England, of Mary, Queen of Scots, and Darnley, of Whittington, and numerous other notabilities, are much sought after, chiefly from their rarity.

Elswick, a district in the western outskirts of Newcastle. Here are located the works of the firm of Sir W. G. Armstrong, Whitworth, & Co. (see ARMSTRONG, LORD), which are among the largest of the kind in Europe. The engineering section of these works dates from 1847; the ordnance-works were founded in 1857. Elswick Park, including Elswick Hall, was opened as a recreation-ground in 1878. Elswick forms three wards of the county borough of Newcastle-on-Tyne.

El Teb. See TEB (EL).

Eltham, the seat formerly of a royal palace in the west of Kent, now part of the metropolitan borough of Woolwich (q.v.).

Elton, or YELTON, a shallow salt lake of Russia, with an area of 62 sq. m., is near the north-east frontier of the government of Astrakhan. In spring the lake has a layer of almost pure salt-crystals, from 2 to 4½ inches thick. The yield forms a large proportion of the total salt production of Russia.

Elton, CHARLES ISAAC (1839–1900), of Whitestaunton, Somerset, an eminent jurist and ethnologist, was maternal grandson of Sir Charles Abraham Elton (1778–1853), of Clevedon Court, Somerset, poet and translator of Hesiod. He had his education at Cheltenham and Balliol College, Oxford, became fellow of Queen's College in 1862, was called to the bar at Lincoln's Inn in 1865, and afterwards became Q.C. He was Conservative member of parliament for West Somerset in 1884–85, and in 1886–92. He had already made a reputation as a jurist by his books, *The Tenures of Kent* (1867), *A Treatise on Commons and Waste Lands* (1868), *A Treatise on Copyholds and Customary Tenures of Land* (1874), and *Custom and Tenant Right* (1882), when he placed himself in the front rank of English ethnologists by his *Origins of English History* (1882). Not the least merit of this learned and ably reasoned work is its vindication of the Celtic element in the English race, which had been unduly belittled by the predominant Teutonic school of English history. The dissertation on *Borough English* (q.v.) is a masterpiece of learning and lucidity. *William Shakespeare, his Family and Friends*, appeared in 1904.

Elutriation is the term applied to the process of separating, by means of water, the finer particles of earths and pigments from the heavier portions. The apparatus generally used is a large vat, in which grinding wheels revolve; and the substance to be reduced to powder being placed in the vat along with water, the wheels in revolving not only pulverise the material, but from their motion being communicated to the water the latter is enabled to retain in mechanical suspension the finer particles of the clay, &c. By allowing a stream of water to flow in and out of the vat, the finer particles can be constantly floated away, and the liquid being run into settling vats, the fine powder settles to the bottom, when the water can be run off from the surface. This process is much employed in the manufacture of the materials used in pottery, and in the preparation of pigments.

Elvan, or ELVANITE, is the miner's name in the south-west of England for a granular crystalline rock, composed of quartz and orthoclase, which forms veins associated with granite. It occurs as veins not only proceeding from the granite and traversing other rocks, but in the body of the granite itself. It is included by geologists under Quartz-porphyry.

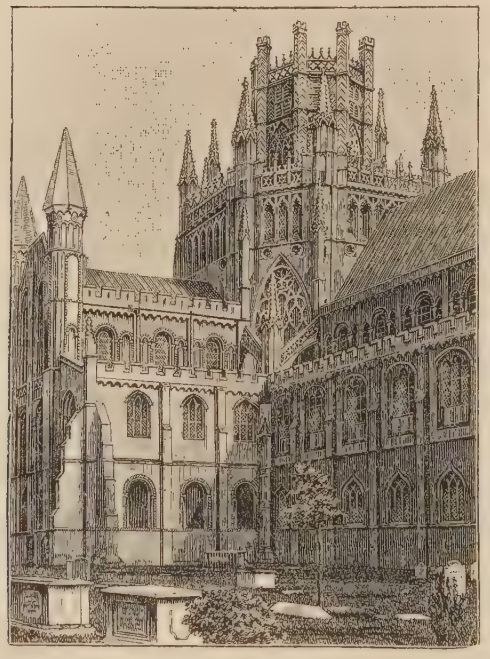
Elvas, the strongest fortified city of Portugal, in the province of Alemtejo, near the Spanish frontier, and 10 miles W. of Badajoz by rail. Standing upon a hill, it is defended by seven large bastions and two isolated forts, and has an arsenal and cannon-foundry. It is a gloomy town and a dirty, yet is supplied with water by a fine aqueduct, carried on three rows of superimposed arches. Its inhabitants (12,000) carry on an active contraband trade with Spain, principally in British manufactured wares, also in wool and wine. The district, which is very fertile, yields oil, wine, fruits, and vegetables. Elvas was made a bishop's see in 1570. In 1580 it was taken by the Spaniards, but they suffered a severe reverse before the town in 1659, and laid siege to it in vain in 1711. It was captured again in 1808 by the French.

Elves. See FAIRIES.

Elwes, JOHN, M.P., a famous miser, born in 1714, was the son of a successful brewer in Southwark named Meggot. With some good qualities of mind, he was so overcome by the passion of avarice that he would walk miles in the rain to save the hire of a conveyance, would sit for hours in wet clothes to save the expense of a fire, or risk his life to save paying a penny at a turnpike. His only indulgence seems to have been hunting. He died at Marcham, Berkshire, 26th November 1789, leaving property worth half a million.

Ely, a city of Cambridgeshire, crowns a low eminence on the left bank of the Ouse, amid the fen-land, 16 miles NNE. of Cambridge, and 30 SE. of Peterborough. Here, in 673, St Etheldreda (q.v.) founded a mixed monastery, which, burned in 870 by the Danes, was refounded in 970 as a Bene-

dictine abbey by Ethelwold, Bishop of Winchester. That abbey a century later became Hereward's 'camp of refuge,' until, in 1071, after a long and obstinate defence, Abbot Thurstan had to surrender to the Conqueror. In 1083 the first Norman abbot laid the foundation of the present church, which was made a cathedral in 1109, and which, as we see it to-day, is one of the most glorious shrines in Christendom. A cruciform structure, 537 feet long by 179 feet across the great transepts, it offers examples of all styles of Gothic, from early Norman to late Perpendicular, and is a growth of more than four centuries. There is the Early English 'galilee' or western porch (*circa* 1200); the western tower, 225 feet high, Transition Norman and Decorated (1174–1382); the south-west transept, now the baptistery; the late Norman nave (1150–89), 208 by 78 feet, with modern painted ceiling; the great transepts (1083–1170), Norman, with Perpendicular insertions; the richly sculptured choir (1234–1533), Early English, Decorated, and Perpendicular; the Decorated north-eastern Lady Chapel (1321–49); and at the crossing, the exquisite Decorated 'octagon' and lantern (1322–42), built by Alan de Walsingham on the fall of the great central tower. This, 'the only Gothic dome in existence,' rises to a height of 170 feet. Since 1845 the whole pile has been ably restored, mainly under the supervision of the late Sir G. G. Scott.



Ely Cathedral—Octagon.

It wants the north-west transept, the cloisters, and the chapter-house; but the 13th century Guesten Hall is now the deanery, and the 'Ely Porta,' or great gateway (1380), houses a grammar-school founded by Henry VIII. in 1541. The Bishop's Palace is a fine brick Tudor building. Among the bishops, nearly sixty in number, have been Langham, Bourchier, and Morton (archbishops of Canterbury), Arundel (archbishop of York), and Andrewes, Wren, Patrick, and Harold Browne. Of great laymen also, Ely has its memories, from Canute to Cromwell, who lived here 1636–40. There is a weekly market; and oil, earthenware, and clay-pipes are manufactured. Pop. 8000.—The 'Isle' of Ely, for which see the articles CAMBRIDGESHIRE and BEDFORD LEVEL, contains also March and Wisbeach, and is 372 sq. m. in area, with 74,000 inhabitants. Till 1837 a county palatine, it is still a parliamentary and administrative county.

See Bentham's *History of Ely Cathedral* (2d ed. 1812); J. H. Clement's *History of Ely* (1868); Canon D. J. Stewart's *Architectural History of Ely Cathedral* (1868); Dean Merivale's *Bissexcentenary Festival of St Etheldreda* (1874); and Murray's *Eastern Cathedrals*.

Elyot, SIR THOMAS, author of *The Governour*, seems to have been born not later than 1490, in Wiltshire (not Suffolk), and not to have studied at either Oxford or Cambridge. In 1511 he became clerk of assize on the western circuit, in 1523 clerk of the king's council. In a letter addressed to Cromwell he complains that he performed the duties of this clerkship by the space of six years and a half 'withoute fee, withoute reward more than the ordinare, and that which more grevith me, withoute thank of the king.' Later letters reveal him to us much impoverished by lawsuits, and begging for a share in the confiscated property of the monasteries. In 1531–32, as ambassador to Charles V., he visited the Low Countries and Germany, having orders to procure, if possible, the arrest of Tyndale. In 1535 he went on a second embassy to the emperor, whom he seems to have followed from Barcelona to Tunis and Naples. Member for Cambridge in 1542, he died at Carlton, Cambridgeshire, 20th March 1546. His chief work, *The Boke named the Gouernour, deuised by Sir Thomas Elyot, Knight*, was published in 1531. It may be described as the earliest treatise on moral philosophy in the English language, the author's principal object being 'to instruct men in such vertues as shall be expedient for them which shall have authoritie in a weale publike.' An elaborate tenth edition appeared in two vols. in 1880, with an excellent life, notes, and glossary by Mr H. H. S. Croft. Elyot's twelve other works include *Of the Knowledge which maketh a Wise Man* (1533); *Pasquil the Playne* (1533); Isocrates' *Doctrinal of Princes* (1534); Picus de Mirandola's *Rules of a Christian Lyfe* (1534); *The Castel of Helth* (1534); *The Bankette of Sapience* (1534); *Bibliotheca* (1538), the first Latin-English dictionary; *The Image of Governance* (1540); *Defence of Good Women* (1545); and *Preservative against Deth* (1545). These books went through edition after edition in their author's lifetime, and they have now become among the rarest treasures of the bibliomaniac.

Elysium (Gr. *elysion*), a place in the infernal regions of the ancient classical mythology, where the souls of the good dwell after death. In the *Odyssey*, Homer describes it as a place where the souls of the departed lived in ease and abundance among innocent pleasures, enjoying a mild and wholesome air. In the *Iliad*, however, he gives a sombre view of the state of the departed souls. Achilles, though in Elysium, is made to envy the life of the meanest hind on earth. By succeeding poets the bliss of Elysium is drawn in much brighter colours. Besides the amenity and various delights of the place, diverse employments are found for the inhabitants, according to the ruling passion of each while on earth. The Elysian plains were supposed by some writers to be in mid-air, by others in the sun, by others in the centre of the earth, next to Tartarus, and by others in the Islands of the Blest. See HADES.

Elytra, or WING-COVERS, a term applied to the fore-wings of beetles (Coleoptera), which are modified to form more or less tough and hard coverings for the hind pair. The term Hemielytra is applied to the short, firm fore-wings of Earwigs (q.v.) (Dermaptera). See INSECTS, BEETLES.

Elze, FRIEDRICH KARL, Shakespearian scholar, was born at Dessau, May 22, 1821, studied at Leipzig and Berlin, devoting especial attention to English literature, and afterwards continued his studies in England and Scotland. In 1875 he was appointed to the newly-established chair of English Language and Literature at Halle, and here he died January 21, 1889. His early publications include a collection of English songs, and *Atlantis* (1853–54), a journal dealing with England and America. In editions of *Hamlet*, Chapman's *Alphonsus*, and Rowley's *When you see me, you know me*—the last two edited for the first time—he endeavoured to apply the strict method of classical philology to a modern language. An English translation of his biography of Byron appeared in 1872, and of his *Essays on Shakespeare* in 1874; these last are selected from the *Shakespeare-Jahrbuch*, which he edited for the German Shakespeare Society from 1868 to 1879. Other works are his *William Shakespeare* (Halle, 1876; Eng. trans. 1888), his *Notes on Elizabethan Dramatists* (Halle, 2 vols. 1880–84), and his *Grundriss der englischen Philologie* (1887). Elze was a laborious student and sagacious critic rather than a mere antiquary or collector.

El'zevir, or ELSEVIER, a celebrated family of printers at Amsterdam, Leyden, and other places in Holland, whose beautiful editions were chiefly published between the years 1592 and 1681. During this period, covering scarcely a century, M. Willems has catalogued no fewer than 1600 works, all such as were doubtful having been rigorously excluded. The difficulty of determining what are genuine Elzevirs depends partly on there having been a good number of printers who bore the name, and on their having had three or four principal places of business. But above all, they were booksellers as well as printers, hence many works were attributed to them which were hardly published, and certainly not printed, by them; while imitations were constantly being made, and they themselves issued many books under pseudonyms, or other printers' or publishers' names. Louis, the first to make the name famous, is said to have been born at Louvain about the year 1540, and, driven by the religious commotions of the time, to have settled as a bookbinder and bookseller in Leyden, where he died about 1617. The first work issued by him bears the title *Drusii Ebraicorum Quæstionum ac Responsionum Libri Duo*, and the date 1583. The first work, however, really published by him at his own risk, was a Eutropius by P. Merula (1592). From this time till his death he published over a hundred books, his typographical mark (first used in 1595) being the arms of the United Provinces—an eagle on a column, holding in its talons a sheaf of seven arrows, with the inscription *Concordia res parvæ crescunt.*

Five out of Louis's seven sons continued to carry on their father's business. Their names were Matthias, Louis, Ægidius (Giles), Jodocus (Joost), and Bonaventura. The last, in conjunction with his nephew Abraham Elzevir (a son of Matthias), prepared the smaller editions of the Latin classics, in 12mo and 16mo, which are still valued for their beauty and correctness. Among the finest examples of these are the Livy, Tacitus, Pliny, and Cæsar (1634–36). Equally celebrated were their 24mo editions of French historical and political authors under the name of the *Petites Republiques*, and their 12mo French and Italian classics. The handiness and cheapness of these duodecimos, of which a volume of no less than 500 pages was sold for but one florin, found approbation from all but a few pedants who believed there could be no scholarship save in folios. The printing was long supervised by Abraham, while Bonaventura managed the publication and sale; the learned David Heinsius wrote the Latin introductions and dedications to many of the books. In 1625 they acquired the printing business established at Leyden by Isaac, the second son of Matthias, who had become printer to the university there. His typographical mark was an elm surrounded by a vine-branch bearing clusters of fruit, below which stands a solitary figure, with the motto *Non solus.* M. Willems has proved that the Elzevir type designs were due to Cornelius van Dyck. The two heads of the house died near each other in 1652, and their successors were Joannes Elzevir, Abraham's son, and Daniel, Bonaventura's son, who nobly maintained the traditions of the press. Their finest works were an *Imitatio* without date, and a psalter of 1653. In 1654 Daniel settled at Amsterdam, where he united with Louis, eldest son of Joost, who had already settled there in 1638, and distinguished himself by his editions of the works of Cartesius. The masterpieces of the new partnership were the *Corpus Juris* in folio (1663) and the French Bible (1669). Their typographical mark was a Minerva with the ægis, an owl, and olive-branch, and the motto *Ne extra oleas.* The last representatives of the house were Peter, grandson of Joost, who flourished at Utrecht from 1670 to 1672, and Abraham, son of the first Abraham, who was university printer at Leyden from 1681 to 1712. The Elzevirs were clever men of business, and were none too liberal to many of the scholars on whose labours they rose to wealth.

Emanation, in Theology and Philosophy, is an important word in various systems which considered all things as *emanating* or flowing from a Supreme Principle. According to these, the origin of things is only an overflowing of the divine fullness—an outstreaming of the light from the necessity of its nature, and not any conscious exercise of will on the part of God. What is thus given off as a copy from original perfection departs more and more from its source, and gradually degenerates, which was thought to account for the origin of evil. This doctrine pervades ancient Egyptian and Indian mythology, Neoplatonism (q.v.), and Christian Gnosticism (q.v.). See also RADIUM.

Emancipation, in the Roman law, was the act by which the *Patria Potestas*, or paternal authority, was dissolved in the lifetime of the father. It took place in the form of a sale (*mancipatio*) by the father of the son to a third party, who manumitted him. The Twelve Tables required that this ceremony should be gone through three times, and it was only after the third sale that the son became *sui juris*, under his own law. In general, the son was at last resold to the father, who manumitted him, and thus acquired the rights of a Patron (q.v.), which would otherwise have belonged to the alien purchaser who finally manumitted him. In the case of daughters and grandchildren one sale was sufficient. In the law of Scotland, emancipation is called Forisfamiliation. See also FAMILY, SLAVERY, CATHOLIC EMANCIPATION.

Emanuel I., king of Portugal, styled THE GREAT, or THE FORTUNATE, was born 31st May 1469, and succeeded John II. in 1495. His reign has been termed the golden age of Portugal. He prepared the code of laws which bears his name, and made his court a centre of chivalry, of art, and of science. Vasco da Gama's voyage round the Cape of Good Hope, Cabral's discovery of Brazil, and the expeditions under Albuquerque and others that extended the Portuguese possessions as far as the Moluccas, were all commissioned and encouraged by Emanuel. Through his exertions Portugal became the first naval power of Europe

and the centre of the commerce of the world. He died 13th December 1521.

Emarginate. See LEAF.

Emba, or YEMBA, a river in the Kirghiz territory (or republic), rises at the western base of the Mugadshar Mountains, and flowing south-west, enters the north-east corner of the Caspian Sea after a course of about 450 miles.

Embalming (so named from the balm or balsam often employed), the art of preserving the body after death. In Egypt bodies so preserved are known by the name of mummies, and are called in the hieroglyphs *sahu*, and by St Augustine *gabbaroe*. The custom is to be found in many parts of the world, but in all the nature of the technique employed emphasises an Egyptian origin. From Egypt, it is held by Professor Elliot Smith and his school, the practice spread to the Mediterranean littoral, Europe, and the Canary Islands; to East Africa, Upper Congo, Southern Nigeria; to the Persian Gulf, India, Ceylon, Burma, the Malay Archipelago, New Guinea, the islands of the Torres Straits, and thence to Australia, emigrants from the Malay Archipelago carrying it to Tonga, New Zealand, Tahiti, and eventually to the Peruvian coast. The art of embalming seems to have derived its origin from the idea that the preservation of the body was necessary for the return of the soul to the human form after it had completed its cycle of existence of three or ten thousand years. Sanitary reasons may also have influenced the ancient Egyptians; and the legend of Osiris, whose body, destroyed by Typhon, was found by Isis, and embalmed by his son Anubis, gave a religious sanction to the rite. The beginning of the art is at least as old as the 2d dynasty. The bodies of Cheops, Mycerinus, and others of the age of the 4th dynasty were embalmed. One of the earliest

Egyptian Mummy.

embalmments recorded in literature is that of the patriarch Jacob; and the body of Joseph was thus prepared, and transported out of Egypt. The process has been described by Herodotus and Diodorus; but their accounts are only partially confirmed by an examination of the mummies. A scribe marked with a reed-pen a line on the left side beneath the ribs, down which line the *paraschistes*, or ripper of the district (an officer of low class), made a deep incision with a rude knife of stone; he was then pelted with stones, and pursued with curses. The *taricheutes*, or salter, next proceeded to remove the entrails and lungs, with the exception of the heart and kidneys, while a colleague extracted the brain through the nose. The body was ready for the salts and spices necessary for its preservation, the quality of which depended upon the sum to be expended. When Herodotus visited Egypt, three methods prevailed: the first, accessible only to the wealthy, consisted in passing peculiar drugs through the nostrils into the cavities of the skull, rinsing the belly in palm-wine, and filling it with myrrh, cassia, and other substances, and stitching up the incision in the left flank. The mummy was then pickled in natron for seventy days, and then washed and elaborately bandaged up in rolls of linen, cemented by gums, and set upright in a wooden coffin against the walls of the house or tomb. This process cost a silver talent, perhaps equal to £725 of our money. A cheaper process, by means of an injection of cedar-oil, cost a *mina*, relatively worth about £243. The poorer classes washed the corpse in myrrh, and salted it for seventy days. When thus prepared, and covered with a pictorial representation of the deceased, attired as a labourer in the world to come, and duly labelled as a 'justified Osiris,' the mummy was placed in a costly coffin (see SARCOPHAGUS) ready for sepulture, but was frequently kept some time before being buried—often at home—and even produced at festive entertainments, to recall to the guests the transient lot of humanity. All classes were embalmed, even malefactors; but various methods were employed besides those mentioned by Herodotus. Some mummies are found merely dried in the sand; others salted by natron, or soaked in bitumen (Jew's pitch) with or without the flank incision, having the brains removed through the eyes or base of the cranium, with the viscera returned into the body, placed upon it, or deposited in jars in shapes of the genii of the dead, the skin partially gilded, the flank incision covered with a tin plate, the fingers cased in silver, the eyes removed and replaced. So effectual were some of these processes that after 2000 or 3000 years the soles of the feet are still elastic and soft to the touch. The sacred animals were also mummied, but by simpler processes than men. It has been computed that since the practice began in 4000 B.C., down to 700 A.D., when it practically ceased, probably as many as 730,000,000 bodies were embalmed in Egypt; of which many millions are yet concealed. Important finds are made from time to time, as in 1881, when upwards of thirty mummies of potentates, including that of Rameses II., were discovered together at Deir-el-Bahari. Mummies, it may be observed in passing, were used in the 15th and 16th centuries of the Christian era for drugs and other medical purposes, and as nostrums against diseases, and a peculiar brown colour, used as the background of pictures, was obtained from the bitumen.

Mummy Case of Queen Ahmes Nofretari: Height 9 feet. (From Maspero's *L'Archéologie Égyptienne.*)

Despite a general correspondence in methods of embalming, the medicaments employed do not always correspond; the Persians employed wax; the Assyrians, honey; the Jews, aloes and spices; Alexander the Great was preserved in wax and honey, and some Roman bodies have been found thus embalmed. In Burma the bodies of priests were stuffed with spices and honey, and coated with wax and gold-leaf. The art of embalming was probably never wholly lost in Europe; De Bils, Swammerdam, Clauderus, Gooch, Bell, and others attained great success in the art; and a mode of embalming by incisions all over the body is detailed by Penicher. Ruysch, and after him William Hunter, injected essential oils through the principal arteries into the body. Boudet embalmed the bodies with camphor, balsam of Peru, Jew's pitch, tan, and salt. The discovery of Chaussier of the preservative power of corrosive sublimate, by which animal matter becomes rigid, hard, and grayish, introduced a new means of embalming by Beclard and Larrey; but owing to the desiccation, the features do not retain their shape. The discovery of the preservative power of a mixture of equal parts of acetate and chloride of alumina, or of sulphate of alumina, by Gannal in 1834, and of

that of arsenic by Tranchini, were followed by the use of chloride of zinc. Salt, alum, potash, arsenious acid, glycerine, methyl alcohol, and several alkalis are the essentials in some methods. Sir B. W. Richardson embalmed bodies by injection through the main arteries. See HEART-BURIAL.

See Pettigrew, *History of Mummies* (1834); Gannal, *Traité d'Embaumement* (1838); Magnus, *Das Einbalsamiren* (1839); Richardson, *The Asclepiad* (1888); Wallis Budge, *The Mummy* (1893); Elliot Smith, *Mummification in Egypt* (1907); *Migrations of Early Culture* (1915); and (with Dawson) *Egyptian Mummies* (1924); Garstang, *Burial Customs of Ancient Egypt* (1908).

Embankments, in Engineering, are masses of earth, rock, or other materials artificially formed, and rising above the natural surface of the ground. They are chiefly formed either (1) to carry railways, common roads, canals, &c. over depressions of the country; or (2) for hydraulic purposes, such as the formation of reservoirs for storing water, or as defences against the overflowing of rivers and the encroachments of the sea or of lakes.

In the formation of canals, railways, and other roads, embankment and *excavation* go hand in hand, and, under the name of Earthwork, form—especially in modern times, and since the development of the railway-system—a vast branch of industry, giving employment to many thousands of labourers, known in England as 'navvies.' See CANAL, DYKE, ROAD, RAILWAY, WATER.

Embargo (from the Spanish *embargar*, 'to inbar,' 'to arrest') is a temporary order from the Admiralty to prevent the arrival or departure of ships. It may apply to vessels and goods, or to specified goods only; it may be general or special; it may apply to the entering only, to the departure only, or to both entering and departure of ships from particular ports; and lastly, although issued by the Admiralty in England, it would be equally an embargo if issued by any other competent authority. Such embargoes are generally connected in some way or other with a state of war between two countries.

Embassy, in its stricter sense, is a mission presided over by an ambassador, as distinguished from a mission or legation intrusted to an envoy, or other inferior diplomatic minister. See AMBASSADOR.

Ember Days, in the Roman and Anglican churches, are three days appointed four times in the year to be observed as days of fasting and abstinence; being the Wednesday, Friday, and Saturday after the first Sunday in Lent, after the feast of Pentecost, after the 14th September, and after the 13th December. The name is probably derived from the Saxon *ymb*, 'about,' and *ryne*, a 'course' or 'running,' and applied to these fasts because they came round at certain set seasons in the year. In the breviary and missal these days, as recurring in each quarter of the year, are called *quatuor tempora* (the canonists' *jejunia quatuor temporum*, or 'fasts of the four seasons'); and another derivation would make the term only a corruption of this title, perhaps through the German form, *quatember*. The ember days date from an early period in the church's history, and were introduced into England by Augustine. Originally they were only in part devoted to beseeching the grace of the Holy Ghost, as periods when ministers were admitted to holy orders; but it is to this purpose that the ember days are now particularly devoted, Roman Catholic clergy being ordained only on the Saturdays of the ember weeks, while the whole church fasts and prays, and a generally similar usage prevailing in the Church of England, which has appointed special prayers for use at these seasons.

Ember Goose. See DIVER.

Emberiza. See BUNTING.

Embezzlement, the felonious appropriation by clerks, servants, or others in a position of trust, of goods, money, or other chattels intrusted to their care, or received in the course of their duty, on account of their employers. It is essential to the crime of embezzlement that the article taken should not have been in the actual or constructive possession of the employer; for if it were, the offence would amount to larceny (see THEFT). Embezzlement is not a felony at common law; hence persons guilty of this crime sometimes escaped punishment. In consequence of a flagrant instance of this immunity, the Act 39 Geo. III. chap. 85, was passed, whereby embezzlement was made a felony. This act has been repealed, but the law has since been fixed by subsequent enactments, and is now included in the Act 24 and 25 Vict. chap. 96.

Embezzlement by clerks or servants is punishable by penal servitude or imprisonment. If the offender be a male under sixteen, he may also be ordered to be privately whipped, at the discretion of the judge. Questions of much nicety often arose as to whether the facts proved constituted the crime of embezzlement or that of larceny; but this distinction has ceased to be of any importance under recent acts, whereby it is made competent, on an indictment for embezzlement, to convict a man of larceny, and *vice versâ*. And hence, whichever of the two offences is charged against the servant, if the evidence shows he committed the other offence, then he may be found guilty of that other offence, and punished accordingly.

Embezzlement by bankers, brokers, factors, and other agents is now regulated by the statute cited above. Almost every conceivable species of fraudulent misappropriation by bankers and others is now a punishable offence. In particular, by the latter statute, embezzlement by a Bailee (see BAILMENT) is now indictable. A shopkeeper, for example, appropriating goods intrusted for repair, may be tried and convicted (see also FRAUD).

Embezzlement by bankrupts, or rather the pawning or disposing within four months before the bankruptcy of goods or any kind of property obtained on credit, is punishable by two years' imprisonment. See BANKRUPTCY.

Embezzlement of letters and newspapers by servants of the Post-office is also made highly penal by 7 Will. IV. and 1 Vict. chap. 36. The embezzlement of newspapers is punishable by fine or imprisonment; for embezzling a letter the extreme penalty is penal servitude for seven years, or (if the letter contain money or valuables) for life.

Embezzlement of the King's stores is punishable by penal servitude for fourteen years. In regard to this species of embezzlement, summary authority was given to comptrollers and other officers named, on proof of embezzlement of government stores below the value of twenty shillings, to fine the offenders to the amount of double the value of the article taken.

The American law is, in principle, the same as the English, but it seems that a person indicted for larceny cannot be convicted of embezzlement, or *vice versâ*. Embezzlement of national property is punishable by the law of the United States; other forms of embezzlement and fraudulent breach of trust are dealt with by the laws of the several states.

In Scotland, the crime of embezzlement, or breach of trust, is punishable at common law. The distinction between this crime and that of theft is substantially the same as between embezzlement and larceny in England. In both countries, the criterion relied upon to distinguish these crimes is

the question of possession by the owner; but in Scotland the tendency of the decisions of late years has been to regard the appropriation of articles intrusted for a temporary purpose as amounting to theft. In this respect the law of Scotland agrees with that of England in regard to embezzlement by a bailee.

Emblem. By many writers on this subject symbols and emblems are regarded as almost convertible terms, and hence the former is often used in a sense synonymous with the latter. But, according to Claude Mignault, the famous commentator on the emblems of Andreas Alciatus, in his tract 'Concerning Symbols, Coats of Arms, and Emblems,' there is a clear distinction between emblems and symbols, which, as he says, 'many persons rashly and ignorantly confound together.' This writer maintains that 'the force of the emblem depends upon the symbol, but they differ as man and animal;' his meaning being, that as all men are animals, but all animals are not men, so all emblems are symbols, but all symbols are not emblems. Hence he argues the two possess affinity but not identity, they have no absolute convertibility of the one for the other (H. Green, *Shakespeare and the Emblem Writers*, 1–3). But for all practical purposes there is little difference between the two terms. Of the many definitions given of emblem may be quoted that of Francis Quarles, who says 'an emblem is but a silent parable;' and Cotgrave describes it as 'a picture and short posie, expressing some particular conceit.' For printer's Emblems, see BOOK.

Emblements, growing crops of cereal and vegetable productions raised by the labour of the cultivator. Fruits of trees growing on the land, and grass, are not emblements. See LANDLORD AND TENANT, LEASE.

Emblic Myrobalans (*Myrobalani emblicæ*), the acid, astringent fruit of the Indian euphorbiaceous tree *Phyllanthus emblica*, is a source of tannin.

Embolism. See ARTERIES, PATERNOSTER.

Embossing. When a raised pattern is produced by blows or pressure upon sheet-metal, leather, cloth, paper, gutta-percha, &c., it is said to be embossed. A vase or dish formed of thin sheet-metal is sometimes decorated in relief by beating it up from the inner or under side. This operation is called beating up, bossing, or *repoussé*, and may be considered as an example of embossing by hand. A somewhat similar result is obtained by the use of a die and counter-die worked in a screw-press or by a falling weight, but this is usually called stamping (see DIE-SINKING, and STAMPING OF METALS). The term embossing is not applicable to decoration in relief produced by carving or chiselling, or by casting. Writing-paper and card are embossed with a steel die, the counter-die being formed of millboard or leather, faced with gutta-percha. The paper or card is damped, and a fly-press or lever-press is generally used.

Leather is embossed in several ways. For book-covers, even in the case of patterns in comparatively bold relief, like those used for photographic albums, brass dies and millboard counter-dies are used along with a lever or screw-press (see BOOK-BINDING). When for other purposes the ornament is to be in high relief, moulds or reverses of metal or wood are required, or separate ornaments of wood or papier-maché, fixed to a board, may be used. The leather is first softened with water, and then pressed with tools of various kinds into the moulds, or spread over the fixed ornaments, and worked into all their cavities with the fingers and a pointed tool. The hollows of the more deeply relieved portions are filled in with paper pulp and other substances.

At the present time, imitations of embossed leather for wall-decoration are very much in fashion. These are made of canvas, leather, paper, and various other substances. Even so fine a material as satin is embossed for this purpose. Embossed linen canvas made of a durable nature is coming much into use for decorative purposes. It is manufactured by passing the damped canvas over a metal roller, heated internally with steam, upon which the pattern is cut or engraved in intaglio. As the web passes over the roller, brushes or pads are applied to press the canvas into the indentations. By means of additional rollers, a backing of paper is pasted on, and when the whole is dry it is stiff and retains its shape. Japanese wall-papers, which are embossed in a somewhat similar manner to the linen canvas just described, but by the use of flat instead of cylindrical moulds, are now a good deal used in England. The patterns are often beautiful, the paper is strong, and the surface is made durable by coatings of oil and lacquer. Embossed canvas, paper, and leather for wall-decoration are commonly coloured and gilt.

Calicoes and other textiles are embossed by means of deeply engraved metal cylinders fitted into calender frames. The counter-roller is covered with felt, which yields sufficiently to allow the fabric to be pressed into the hollows of the die-cylinder. Sometimes the pattern is on two cylinders, being sunk on the one and raised on the other, after the plan of a die and its counterpart.

There is a method of embossing wood by saturating it with water, in which state a red-hot cast-iron mould is forcibly pressed upon it. Generally the wood is re-wetted, the mould re-heated, and the pressure applied several times before a complete impression of the mould is obtained. A curious mode of embossing wood was invented about 1830 by J. Straker. The design is drawn upon the surface to be thus decorated, and all the parts intended to be in relief are then carefully depressed by a blunt tool. The wood is next planed down to the level of the depressed portions. On being steeped in water, these will rise to their former level, forming an embossed pattern ready, when the wood is dry, to receive the finishing-touches of the carver. By a process invented in America, veneers of wood are embossed with metal dies. See DIE-SINKING.

The process of etching ornamental patterns with hydrofluoric acid on plate-glass, for the panels of lobby-doors, &c., is called 'embossing.'

Embowed, the heraldic term for anything bent like a bow—as, for example, the arm of a man.

Embracery, in the law of England, the offence of influencing jurors by corrupt means to deliver a partial verdict; the offence is punishable by fine and imprisonment.

Embrasures, in Fortification, are openings in the parapets, flanks of bastions, and other parts of the defence-works, through which cannon are pointed. See FORTIFICATION.

Embroidery (Fr. *broderie*) is the art of producing ornamental patterns by means of needle-work on textile fabrics, leather, and other materials which can be sewed over. The art is closely allied to tapestry-work, which is in fact intermediate between embroidery and weaving. The essential distinction is that, while embroidery is always worked upon an already woven texture, the basis of tapestry is a series of parallel strings or cords forming a kind of warp, to which the various coloured yarns required for the pattern form the weft; and thus the cloth-making and the building-up of the pattern are one operation.

The art of embroidery, arising out of the universal craving for ornamentation, may be said

to be coeval and co-extensive with the use of clothing and furniture. It is practised with interesting and characteristic variations by the rudest tribes; and it is held in high esteem by the most gifted and highly cultured of nations. That it was early practised in oriental nations we have abundant evidence. It is most probable that the coat of many colours bestowed by Jacob on his favourite Joseph was a triumph of needlework, as looms at that period were capable of producing simple striped and checkered patterns only. Remains of Egyptian embroidery, as ancient as the days of Jacob, exist still; and of the art as practised by the early Egyptians Sir J. Gardner Wilkinson remarks, 'the many dresses painted on the monuments of the 18th dynasty show that the most varied patterns were used by the Egyptians more than 3000 years ago, as they were at a later period by the Babylonians, who became noted for their needlework.' The knowledge and skill acquired in Egypt by the Israelites enabled them to embroider the elaborate priestly robes and tabernacle furniture, 'the cherubim of cunning work,' 'the pomegranates of blue and of purple and of scarlet,' and the other needlework enumerated in the Book of Exodus. The 'goodly Babylonish garment' secreted by Achan at Jericho was probably an example of Babylonian skill in needlework; and indeed the frequency of allusion to embroidery in Scripture, as well as in the works of classical writers from Homer downward, testifies to the high appreciation and importance of the art in early times. Then, as in later ages, the triumphs of the art were reserved for priestly robes and for temple adornment.

The knowledge of artistic embroidery came to Europe from the nations of the East, where the art had its early home, and where it still is most largely appreciated and practised. To the Greeks and Romans it came from Phrygia, whence at Rome the embroiderer was known as *phrygio*, and gold embroidered work was called *auriphrygium*, from which we have the ecclesiastical English term *orphrey*. It was in medieval times that the embroiderer's art attained its greatest perfection in Europe; and it is remarkable that the most highly appreciated examples of work were of English origin. The finest existing specimen of medieval embroidery—the Syon Cope, now in South Kensington Museum—is English work of the 13th century. It is richly charged with scriptural subjects, and carries the armorial bearings of several of the most illustrious English families of the period. In historical interest, however, this cope falls far behind the Bayeux Tapestry (q.v.). Under the influence of the Oxford movement, and along with a revival in church architecture and glass-painting, has come a great revival of church embroidery as applied to altar-cloths, vestments, banners, &c.

Practically, embroidery is divided into two distinct classes of work: (1) that which embraces all kinds of artistic needlework done by the hand; and (2) the manufacturing industry which includes all embroidery done by machinery, and also such hand-needlework as is done on the large scale by following patterns mechanically impressed on the fabric to be ornamented.

In art embroidery the materials employed are fine coloured worsted yarns called crewels, tapestry wools, embroidery silks, gold and silver threads, spangles, and plates or discs of metal. There may also be used portions of feathers, the elytra of beetles, pearls, and precious stones; but these find their place principally in oriental embroideries. The textile basis may be any cloth, but the fabrics principally used are stout makes of linen, silks, satins, velvets, and flannels. Small work is done without any special mounting, but for elaborate designs the fabric is fitted and tightly stretched on a frame. The variety of embroidery stitches is considerable, and must vary with the nature of the outline to be formed and the texture or subject to be imitated; and colours have, of course, to be carefully varied according to the necessities of the design when a coloured pattern is being worked. The principal stitches are the stem stitch, the satin stitch, the knotted stitch, the button-hole or blanket stitch, the chain or tambour stitch, the feather stitch, and the cushion or Berlin-work stitch, all of which may be best learned from practical manuals. In frame-work, 'couching' is largely employed, which consists in laying lengths of thread on the surface, and securing them by stitches through the cloth brought up at various points, variety of effect being obtained by the different disposition of these securing stitches. A distinct class of embroidery consists of appliqué or cut work, in which designs of different materials and colours are cut out and sewed down on the surface of the fabric to be ornamented. Inlaid appliqué consists of cutting precisely the same pattern out of two different fabrics, and inserting the one into the cut space in the other.

In its purely mechanical side, the embroidery trade embraces several distinct sections, of which may be enumerated (1) white embroidery, known also as Swiss or Scotch sewed work, for which work the muslin or other fabric is printed with a pattern made up of holes of different dimensions, which are either cut or punched out, and their edges sewn over with a button-hole stitch; (2) embroidery in gold, silver, and coloured silks, for official costumes, civil and military, badges, &c.; (3) embroidery in crewels, or other coloured wools, coloured silks, &c., mostly done for furniture decoration, such as borders of tablecovers, &c.; and (4) there may be included ornamental braiding with braids of various colours, principally for ladies' costumes. To a great extent these various kinds of embroidery can be worked by one or other of the machines which have been devised for embroidering. The first successful embroidery machine was that invented by M. Josué Heilmann, of Mülhausen, patented in England in 1829. With Heilmann's machine, or the modifications of it which have since been introduced, one person can guide from 80 to 140 needles working simultaneously, and producing so many repeats of the same design. The details of the construction of the machine are complex, but the principle of its action may be easily understood. The needles, with their eyes in the middle, are pointed at each end, so that they may pass from both sides of the work without being turned. Each needle is worked by two pairs of artificial fingers or pincers, a pair on each side of the work, and these grasp and push the needle through from one side of the work to the other. A carriage or frame connected with each series of fingers does the work of the human arm, by carrying the fingers to a distance corresponding to the whole length of the thread. The frame then returns to exactly its original place, and the needles are again passed through to the opposite set of fingers, which act in like manner. Were the work which is mounted in a frame to remain stationary, the needles would thus pass merely backwards and forwards through the same hole. But the frame is mounted to move in every direction, and according to its motion stitches varying in length and in direction are made corresponding to the lines of the design. The motion of the frame is governed by a pantagraph machine (see PANTAGRAPH), the free end of which, moving over an enlarged copy of the design, moves the frame at each successive stitch into the position required for the production of

the various repeats of the pattern. Embroidery patterns, in a variety of knotted, tambour, and other stitches, and ornamental braiding, are now very largely done by means of the Bonnaz machine, the invention of M. Antoine Bonnaz, first patented in Britain in 1868. This apparatus is in appearance and construction like the ordinary sewing-machine, but in place of a needle it has a hooked looper which passes down through the work and brings the thread up from below, looped around it to make a knotted stitch on plain for the ordinary tambour stitch. It is further provided with a universal feed-motion, so that the work can be guided to follow the most intricate and sharp-turning pattern. A modification, invented by M. E. Cornely, is in extensive use for ornamental braiding.

See Caulfeild and Saward, *Dictionary of Needlework* (1881); E. Glaister, *Needlework* (1880); Gay et Dupont Auberville, *Catalogue des Broderies au Musée des Arts Décoratifs* (Paris, 1880); L. Higgin, *Handbook of Embroidery*, ed. Lady Marian Alford (1879); Mrs Mary Barber, *Drawings of Ancient Embroidery* (1881); Lefébure, *Embroidery and Lace* (Eng. trans. 1888); Mrs Christie, *Embroidery and Tapestry Weaving* (1920), and *Samplers and Stitches* (1921); Kendrick, *Book of Embroidery* (1921).

Embrun, a fortified town in the French department of Hautes Alpes, crowns a rock-platform on the right bank of the Durance, and at the base of Mont St Guillaume (8344 feet), 23 miles E. of Gap by rail. It looks better from without than within; but its cathedral has a lofty Romanesque tower. Pop. 2400. Embrun occupies the site of *Ebrodunum*, capital of the Caturiges, and an important Roman station. It was the seat of a bishopric from 374 to 1802.

Embryo (Gr.), a term usually restricted (*a*) to the unborn young animal, or (*b*) to the rudimentary young plant, especially when within the seed. The term *fœtus* is equivalent to embryo, but is restricted to mammalian development. The term *larva* is also applied to a young animal which is more or less markedly different from the adult form. See EMBRYOLOGY, REPRODUCTION, SEED.

Embryology is that department of biology which reads the development of the individual organism. It is a succession of studies in anatomy and physiology which, when read into unity, give the history of the organism from its earliest individual appearance on to that vague point when it may be said to exhibit all the main features of adult life. The investigation necessarily takes two forms: a description of the structure of successive stages (*morphological*), and an analysis of the vital processes associated with each step (*physiological*). Nor is any embryological investigation complete which does not link the everyday development of individuals with the historical evolution of the race.

History.—Although the development of the chick, so much studied in embryological laboratories today, was watched 2000 years ago in Greece, it was only in the scientific renaissance of the 17th century that observation began to grow strong enough to wrestle with conjecture. Harvey, who towered as a strong genius above his contemporaries, and saw much farther, sought in 1651 to establish two main propositions: (1) that every animal was produced from an ovum—*ovum esse primordium commune omnibus animalibus;* and (2) that the organs arose by new formation (*epigenesis*), not from the mere expansion of some invisible preformation. These valuable generalisations were not, however, accepted, and even observations like those of Malpighi seemed for the time to tell against Harvey's prevision. The time was past for absolutely fanciful theories, and yet the dominant doctrine which persisted even into the 19th century was mystical enough. The germ, whether egg or seed, was believed to be a miniature model of the adult. 'Preformed' in all transparency, the organism lay *in nuce* in the germ, only requiring to be 'unfolded.' Just like a bud which hides within its hull the floral organs of the future, so was every germ. 'There is no becoming,' Haller said; 'no part of the body is made from another; all are created at once.' But the germ was more than a marvellous bud-like miniature of the adult; it included all future generations. That germ lay within germ, in ever smaller miniature, after the fashion of an infinite juggler's box, was the logical corollary of the theory of preformation and unfolding. One of the controversies of the time was whether ovum or sperm was the more important. The ovists asserted the claims of the ovum, which only required to be awakened by the spermatozoon to begin its unfolding. The animalculists, on the other hand, maintained that the male element contained the preformed germ, and that the ovum was merely for its preliminary nutriment.

All this was virtually shattered by Wolff (1759), who reasserted Harvey's epigenesis, and showed that the germ consisted of almost structureless material, and that the process of development was a gradual organisation. Yet Wolff's work had not the effect of entirely demolishing preformationist conceptions. They lingered on, and had this much truth in them that the germs are indeed potential, though not miniature, organisms. To some extent Wolff reacted too far against the mystics in his emphasis on the simplicity of the germ, so that a correction was necessary when the cellular character of the reproductive elements was realised about a hundred years later. The observation of structural progress was slow in gaining self-confidence, for it was not till 1817 that Pander took up Wolff's work virtually where he left it. He was immediately reinforced and soon left behind by Von Baer, whose results laid a firm foundation for modern embryology. Since the establishment of the Cell-theory (see CELL) in 1838–39, and the associated researches which showed that the organism starts from a fusion of two sex-cells, and that development consists in the division of the fertilised ovum and differentiation of the results, progress has been both sure and rapid. The more modern demonstration of the fact of evolution has afforded a fresh impulse by its interpretation of the present as the literal child of the past.

The egg-cell or ovum is in all organisms the starting-point of the embryo, but development can rarely begin till this female element is supplemented by the male cell or spermatozoon. These sex-cells are liberated units of the parent-organism, but in most cases they stand in marked contrast to the great congeries of cells which form the 'body.' All the component units of the organism are indeed lineal descendants of a fertilised ovum, but the 'body'-cells become greatly changed into muscle, nerve, skeleton, and the like, while the reproductive cells retain with more or less intactness the characters of the original parent germ. It is this fact which makes the reproduction of like by like possible.

The unicellular animals or Protozoa, having obviously no 'body,' are directly comparable to the sex-cells of higher animals. The 'body' is the addition which makes the difference. In a few Protozoa, however, the results of the division of a unit remain associated together, and a loose colony of cells arises. Such a Protozoon behaves like an ovum or like a primitive male-cell in any of the higher animals. The loose colony may be very unstable, and may soon resolve itself into its

component units, exactly as the primitive male-cell, which has divided into a clump of spermatozoa, breaks up and sets these active units free. But the colony may be more stable and retain its continuity (like a segmented ovum), thus bridging the gulf between unicellular and multicellular organisms. In such cases certain cells are set apart as reproductive, and eventually set adrift to start a fresh colony. This is the beginning of the differentiation of special reproductive cells. At first these were probably all alike and able to develop of themselves, but in a manner which does not concern us here (see SEX) they became differentiated as male and female elements, mutually dependent and complementary.

The ovum has all the essential characters of an ordinary animal cell. The cell-substance consists of Protoplasm (q.v.) and of material ascending to or descending from that climax. As in other cases, the cell-substance may be traversed by a network, —one of the intricacies which modern microscopic technique has revealed. Like other cells, the ovum includes a central differentiation or nucleus, technically called the germinal vesicle. This exhibits the essential nuclear elements in the form of rods, bands, or network, and other minute features described in the article CELL. The nucleus plays a most important part in the history of the ovum, and is believed to be the bearer of the hereditary characteristics.

As to the precise origin of the ova, it is enough here to state that in sponges they are simply well-fed cells in the general substance (middle stratum) of the sponge; that in Cœlenterates they may originate from outer or from inner layer; while in other animals they are almost always associated with the middle layer of the body, and as we ascend are more and more restricted to a distinct region or to a definite organ—the *ovary*.

The very young ovum is often at least like an Amœba (q.v.), and in Hydra (q.v.) this character persists. The first chapter in its history is one of nutrition and growth. This often occurs at the expense of neighbour cells, and the ovum may be the successful survivor of a clump. In other cases the nutriment, for immediate or future use, may be derived from the vascular fluid of the animal, or from special glands, which are sometimes simply degenerate portions of an originally larger ovary. The capital of nutriment thus derived is distinguished as the yolk. It varies greatly in quantity and disposition, and has great influence in determining the precise form which the future division of the ovum will take. It may be small in quantity and uniformly diffused through the cell, as in mammalian ova; there may be a larger quantity, which sinks to the lower part, as in frog spawn; there may be a very large amount, which quite dwarfs the genuine living matter, as in birds' eggs; or there may be a central accumulation, as in crustaceans and insects. The egg is very generally surrounded with some membrane, sheath, or shell, made by itself, or contributed by surrounding cells, or the product of special glands. In such envelopes there is often a special aperture (micropyle) through which alone the spermatozoon can enter. Hard shells like those of birds' eggs must obviously be formed after fertilisation has taken place.

The Male-cell or Spermatozoon.—In the unicellular organisms, among which we find the key to all beginnings, two cells, unable apparently to live independently, unite, and thus make a fresh start. In such cases the two units are usually similar in appearance, though doubtless different in chemical state. Sometimes, however, a small active cell unites with a larger and more passive neighbour, and here we find the first hint of the profound difference between the sexes—a difference of which the contrast between spermatozoon and ovum is literally a concentrated expression.

The spermatozoon is a true cell, though the nuclear portion often predominates over the cell-substance. It is one of the smallest animal cells,

Fig. 1.—Germ-cells:

a, ovum showing egg membrane, granules, and germinal vesicle; *b*, spermatozoon; *c*, hermaphrodite gland of snail, with ova and sperms; *d*, amœboid ovum; *e*, coalescence of sperm-cell and egg-cell.

as the ovum is one of the largest; it is highly active, while the ovum is peculiarly passive; it rarely bears any nutritive material, while the ovum is very generally weighted with yolk. In its minute size, active locomotor energy, and persistent vitality, the sperm-cell resembles a flagellate Monad among Protozoa, while the ovum is strictly comparable to an Amœba or to one of the yet more passive or encysted forms. In most animals the spermatozoon exhibits three distinct parts: (*a*) the 'head,' or essential portion, consisting almost wholly of nucleus; (*b*) the mobile 'tail' of contractile protoplasm which drives the 'head' along; and (*c*) a small middle portion connecting the head and tail.

In its origin the male-cell resembles the ovum, and the two cells are of course the physiological complements of one another. In history, however, the ovum is strictly comparable not to the sperm, but to the cell which divided to give rise to the sperms. The primitive-male-cell, or mother-sperm-cell, is the homologue of the ovum. Just as the latter divides in segmentation, so the mother-sperm-cell divides, and the divisions exhibited in what is technically called spermatogenesis are closely parallel to the various modes of segmentation exhibited by ova. The mother-sperm-cell segments, but the results have no coherence; they go asunder as spermatozoa. Thus, though all cells may be said to rank as equals, the sperm-cell has a longer history behind it than the ovum. The differences both in form and history express the great differences in chemical constitution which are summed up in the words male and female.

Maturation of the Ovum.—The egg-cell having attained its definite size or limit of growth, usually exhibits a somewhat enigmatical phenomenon known as the extrusion of polar globules. In the great majority of cases it buds off two tiny cells, by a process of cell-division, in which the nucleus plays its part. In the course of maturation, usually in the formation of the first polar body, a meiotic or reducing division takes place, the number of nuclear elements or chromosomes being reduced to half the normal number—in preparation for the entrance of the spermatozoon, which undergoes a similar reduction in the course of spermatogenesis. If there were not this reduction the number of chromosomes would be doubled in fertilisation. The polar cells come to nothing, though they may linger for a while in the precincts of the ovum. Their expulsion usually takes place before fertilisation has even begun, but sometimes is subsequent to the entrance of the spermatozoon into the ovum. In some parthenogenetic ova, which develop without fertilisation, only one polar globule is formed.

Fertilisation.—The 'ovists' thought that the

ovum was all-important, and only required the sperm's wakening touch to unfold its preformed model. The 'animalculists' were equally certain that the spermatozoon was all-important, and only required to be fed by the ovum. Even after the mutual dependence of the sex-elements had been recognised, the opinion prevailed that contact of the two was unessential, and that by an *aura seminalis* fertilisation was possible. In 1677 Hamm and Leeuwenhoek first distinctly saw spermatozoa; in 1780 Spallanzani showed by artificial fertilisation that the eggs must come into contact with the seminal fluid; in 1843 Martin Barry observed the spermatozoon in union with the ovum of the rabbit; in 1846 Kölliker proved the cellular origin and nucleated character of the male elements; and in 1872–75 Bütschli and Auerbach observed two nuclei in fertilised eggs. The dates of these representative discoveries show how gradually the result has been reached that the essence of fertilisation is the intimate union of a male and a female cell.

It is needless to cite the numerous investigators who have made the following statements possible:

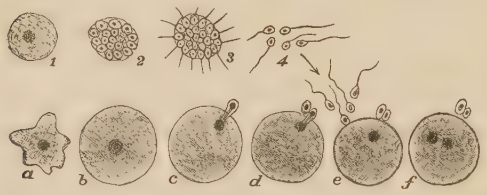


Fig. 2.—Development of Sperms; maturation and fertilisation of Ova (diagrammatic):

1-4, Division of a mother-sperm-cell or primitive-male-cell into a ball of spermatozoa which breaks up; *a–f*, maturation and fertilisation of ovum; *a*, amœboid young ovum; *b*, later stage; *c*, budding off of a first polar cell; *d*, budding off of a second; *e*, spermatozoa round ovum, one entering; *f*, male and female nuclei about to fuse on completion of fertilisation.

(1) Only one male element really unites with the egg-cell. By a sudden change after the entrance of one sperm the ovum usually ceases to be receptive. The entrance of more than one occasionally occurs, but the result is pathological. (2) The union is very intimate; the nuclei are at least as important as the protoplasm, and according to most authorities much more so. (3) The two nuclei are attracted or drawn to one another, and fuse intimately to form a single nucleus of double origin. (4) Intimate as the union is, its orderliness is not less conspicuous; half of the result is still traceable to the male and half to the female.

It may be said that fertilisation implies three or four distinct things. It implies a mingling or combination (amphimixis) of the paternal and maternal hereditary qualities, which are in great part at least bound up with the nuclear bodies or chromosomes. In the process of maturation, both of ova and spermatozoa, the number of chromosomes (which is definite for each species) is reduced to one-half; in fertilisation the number is obviously restored to the normal. It seems also certain that the spermatozoon supplies to the ovum some stimulus which sets the process of cleavage or segmentation agoing, or removes some inhibition which hindered this. Lastly, it is known that the spermatozoon introduces (in its middle piece) a minute body known as the centrosome (see CELL), which plays a very important part in the subsequent division.

In connection with the import of fertilisation it is interesting to notice (1) that a non-nucleated fragment of ovum may be successfully fertilised by a spermatozoon, and may develop into a normal embryo (merogony); and (2) that in several cases (sea-urchin, starfish, worm, mollusc) an ovum may be induced to develop in the absence of a spermatozoon, the normal liberating stimulus being replaced by a variety of artificial stimuli, such as temporary immersion in sea-water, in which the ordinary proportions of the salts have been slightly altered. Such experiments clearly indicate that each of the germ-cells, whether ovum or spermatozoon, has in it a complete equipment of hereditary qualities.

This artificial parthenogenesis, as it is called, occurs as high in the scale as Amphibia. If frog's eggs are pricked with a fine needle, and washed in blood, which need not be frog's blood, and then restored to their normal medium of pond-water, they develop readily and normally. The embryos have been reared to the stage of small frogs, and may be either males or females. In ordinary cases of artificial parthenogenesis there seem to be always two processes: (*a*) an exciting process, which induces a segmentation of the egg; and (*b*) a counteractive process, such as restoration to the natural medium. Unless the counteractive process occurs the segmentation of the egg ends fatally.

Segmentation.—Soon after the essential act of fertilisation has been accomplished in the intimate union of the nuclei, the egg begins to divide. What physical and chemical attractions and repulsions operate in this process we do not know. It is certain that the nuclear elements, which play a very important part throughout, have what we cannot but call a strong individuality of behaviour. It has been established that the double nucleus of the fertilised ovum is accurately composed half of female and half of male elements. When the egg divides into two, the nucleus of each daughter-cell is again half male and half female, and it is probable that this exact dualism persists yet further.

The different ways in which ova divide depend mainly upon the quantity and disposition of the passive yolk-material. (1) When there is very little nutritive capital, and that uniformly diffused, the whole ovum divides, vertically and horizontally, till a sphere of approximately equal cells is formed. This total segmentation occurs, for instance, in the ova of sponge, starfish, lancelet, and mammal. (2) In the ova of the frog, where the actual process of division may be most conveniently watched, there is more yolk, which has chiefly sunk to the lower hemisphere of the egg. Division is still total, but after a few segmentations it will be seen that the upper hemisphere cells are dividing more rapidly and are becoming markedly smaller than those in the lower part. The segmentation is total but unequal. (3) In the ova of birds and reptiles

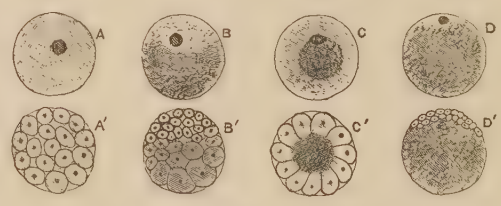


Fig. 3.
Relation of Yolk to division of Ovum (diagrammatic):

A, little and diffuse yolk.
B, more yolk at lower pole.
C, central yolk.
D, much yolk.
A′, total equal division.
B′, total unequal division.
C′, peripheral division.
D′, partial division.

and many fishes there is a large quantity of yolk, and the formative substance lies like a drop on the upper surface of the nutrient mass. Division is restricted to the formative protoplasm, and thus the segmentation is conspicuously partial. (4) In the

ova of crustaceans, insects, and their allies, the yolk usually accumulates in the centre of the ovum as a more passive, nutritive core, surrounded by the active, formative protoplasm. The latter divides, and forms a sphere or ellipsoid of cells around the less markedly divided yolk. In Peripatus—the survivor of ancestral insects—the whole ovum segments, but the cells are not for a while defined off from one another, so that the result looks like a giant Protozoon with numerous nuclei. Hints of this are seen in other cases.

Morula and Gastrula.—The result of segmentation is a ball of cells, differing according to the above described modes of division. When a wide cavity has been left, between the cells as they multiplied, a hollow sphere is formed, technically called a *blastosphere;* if no such conspicuous 'segmentation cavity' has been left the result is an almost solid mulberry-like ball of cells—a *morula.* When the division is partial, mainly confined to an area of formative protoplasm lying upon a nutritive mass, the result is a disc of cells which by-and-by spreads round the yolk. Such a segmented area is generally known as the *blastoderm.* (See D′, fig. 3.)

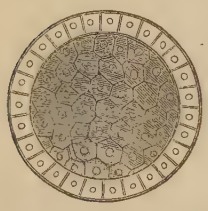


Fig. 4.—Section of hollow ball of Cells or Blastosphere.

The next decisive chapter is one of infolding, or the formation of a *gastrula.* In the simplest cases one hemisphere of a hollow ball of cells is dimpled or invaginated into the other. More accurately, the one hemisphere sinks into and becomes surrounded by the other. The sphere becomes a two-layered sack or gastrula, with an opening technically called the *blastopore.* In many other cases—e.g. fishes, reptiles, and birds—owing to the yolk, complete invagination is not possible. An infolding still occurs, but it is no longer conspicuous, and the gastrula-stage is thus disguised. It must also be noted that the two-layered condition may arise by *arrangement* of the cells, without there being any process that can be called invagination. Thus, in the oval ciliated embryo or *planula* of most Hydrozoa, the two layers have been frequently observed to arise by a process of internal differentiation, known as *delamination.*

Fig. 5. Gastrula: Showing ectoderm, ciliated endoderm, blastopore and central cavity.

The Germinal Layers.—Even in a simple colony of cells like a Volvox all the units do not remain alike. Inside cells are in different conditions from outside cells, and division of labour with consequent difference of structure is bound to occur. So again, in the ball of cells into which the ovum divides, the one hemisphere with heavier material is usually different from the upper hemisphere, which is specifically lighter and less encumbered with reserve material. Even in the morula or blastosphere differentiation has begun.

But we have just seen that by the folding of one hemisphere into the other, or in other ways, a gastrula often more or less modified arises. The embryo thereby attains definitely differentiated layers—outer and inner. The preformationists spoke of development as an unfolding; we now insist on an infolding. The layered character of the embryo was early recognised by Wolff, and yet more clearly by Pander and Von Baer, but its fundamental import can hardly be said to have been realised till Huxley in 1849 compared the outer and inner cell-layers of Cœlenterates to the outer and inner layers which embryologists had begun to demonstrate in development. Soon afterwards Allman gave to the outer and inner layers of Cœlenterates the names *ectoderm* and *endoderm,* which are now universally used for the outer and inner layers of every embryo. The results reached by Huxley and Haeckel, Kovalevsky and Ray Lankester, and many others, have made it certain that the formation of these two germinal layers is constant in animals, that they are exactly comparable throughout the series, and that with few exceptions they give rise to precisely the same adult structures.

In sponges and Cœlenterates only two genuine layers of cells are developed. A middle stratum, seen in faint suggestion in the common Hydra, may indeed appear, and may be of the greatest importance in the structure of the animal, but embryologists are not inclined to allow this—the so-called *mesoglœa*—to rank as a distinct layer.

In higher animals, however, there is a definite middle layer or *mesoderm* between the other two. Its history involves much greater difficulty than that of the ectoderm and endoderm; it seems as if it might arise in some half-dozen different ways. One common mode of origin has been emphasised by the brothers Hertwig in what they call the 'Cœlome-theory.' The inner layer arises by an infolding of the outer, and a primitive gut-cavity (*archenteron*) thus results. Now begins an outfolding. From the gut-cavity two sacks (*cœlome-pockets*) grow out, one on either side, insinuating themselves between the first two layers. The cavities of the sacks form the future body-cavity of the animal; the outer and inner walls form the corresponding two divisions of the mesoderm. However this middle layer arises, it finally exhibits an inner and an outer division, so that the Hertwigs speak of *four* germinal layers. The outer (parietal or somatic) portion of the mesoderm clings to the external body-wall, forming muscles and the like; the inner (visceral or splanchnic) portion cleaves to the internal organs.

Origin of Organs.—With few exceptions, the same organs and structures arise from the same layers—e.g. the nervous system from the ectoderm, the lining of the mid-gut from the endoderm. (*a*) *The ectoderm* or *epiblast* gives origin to outer skin or epidermis, external skeleton, superficial glands, sense-organs, nervous system, the infoldings at both ends of the gut, and probably to the primitive excretory (segmental) duct. (*b*) The *endoderm* or *hypoblast* forms the lining of the mid-gut, and necessarily, too, of outgrowths from it, such as the lungs and various glands. In vertebrates it also gives rise to that important skeletal axis—the notochord—which always precedes the 'backbone.' (*c*) The *mesoderm* or *mesoblast* gives rise to all the rest. That is to say, the under-skin, the muscles, the connective tissue, the internal skeleton, the lining of the body-cavity, the heart and the blood, and the like are all mesodermic. The reproductive organs, though to some extent structures by themselves, also arise, in the great majority of cases, in connection with the mesoderm. It must be noted, further, that while the main part of a structure is referable to one of the three layers, the entire structure is very often composite. Thus the eye of vertebrates mainly arises as an outgrowth from the brain, but some of the less essential parts are furnished by the mesoderm. The outgrowths from the mid-gut are in origin endodermic, but they too are always aided by the middle layer.

Physiological Embryology.—The immense progress of embryology within recent years has been almost wholly morphological. Of the physiological conditions of development we know relatively little. The later stages of embryonic life in higher animals have been studied by Preyer and others with much success, but this is but the threshold of investiga-

tion. A few luminous results as to the architectural conditions are due to the courage of His and Rauber, who have followed the earlier suggestions of Pander and Lotze. The task, which is involved in stupendous difficulties, has been continued in the experimental investigations of O. Hertwig, Fol, Pflüger, Born, Roux, Schultze, Gerlach, and others.

The deep questions of embryology, which were in Aristotle's mind when he wrote his *De Generatione*, are with us still. How are the heritable characters summed up potentially in the germ-cells? How do these characters gradually find expression or realisation in the individual becoming, so that what we call differentiation and integration result? What is the nature of that compelling necessity which mints and coins the chick out of that minute drop of living matter lying like an inverted watch-glass on the top of the yolk? What is the regulative principle of the ordered progress which, by intricate and often strangely circuitous paths, leads from apparent simplicity to obvious complexity—to the fully formed organism? And how is it that the germ-plasm, without encumbrance or embarrassment, has been continuously able to enregister within itself the gains of racial evolution so that these are entailed on the individual?

These questions do not at present admit of answer, and there are many expert embryologists, like Driesch, who are convinced that they are unanswerable in lower terms—that is to say, in terms of chemical and physical formulæ. Be this as it may, the history of biological science shows the value of pushing analysis as far as it can be applied. Thus, while the deeper questions remain unanswered, embryologists press on with their inquiry into the external factors of development—such as light, temperature, oxygen, osmotic pressure, and the chemical composition of the medium; and with their inquiry into the processes that actually go on in the developing embryo—the fermentations and other chemical changes, the phenomena of surface-tension and capillarity, the protoplasmic movements, the cell-divisions, the influence of part on part. It goes without saying that there is nothing known in regard to development which is at variance with the established results of chemistry and physics, but it is likewise certain that in the present state of science we cannot give a physico-chemical interpretation of even the simplest data of embryology.

Generalisations.—(1) *The Ovum-theory.*—In all cases of ordinary sexual reproduction among plants or animals the offspring develops from a fertilised egg-cell. This is the ovum-theory prophesied by Harvey in 1651, again almost realised by Wolff in 1759, but only demonstrated about a hundred years later when the organism was at length analysed into its component cells (see CELL). The fact that every plant or animal begins at the beginning again, at the level of the Protozoa or single-celled organisms, Agassiz does not hesitate to call one of the greatest discoveries in the natural sciences in modern times.

(2) *The Gastræa-theory.*—The simplest animals are single cells; these occasionally form loose colonies or balls of cells; next come sack-like two-layered organisms, such as the simplest sponges. These are the first three grades among living animals, but they also correspond to the first three chapters in the life-history of each organism. The single cell (the ovum), the ball of cells (the morula or blastosphere), the sack of cells in two layers (the gastrula), we have seen to be the first three stages in development. As this gastrula-stage always occurs, though sometimes disguised by the yolk, in the life-history of animals, Haeckel justly emphasised it as the individual's recapitulation of an ancestral state. The simplest, stable, many-celled animal he believed to be like a gastrula (see fig. 5), and he called this hypothetical ancestor of all higher animals a gastræa. A few living animals are still almost at this level; all animals pass through it in

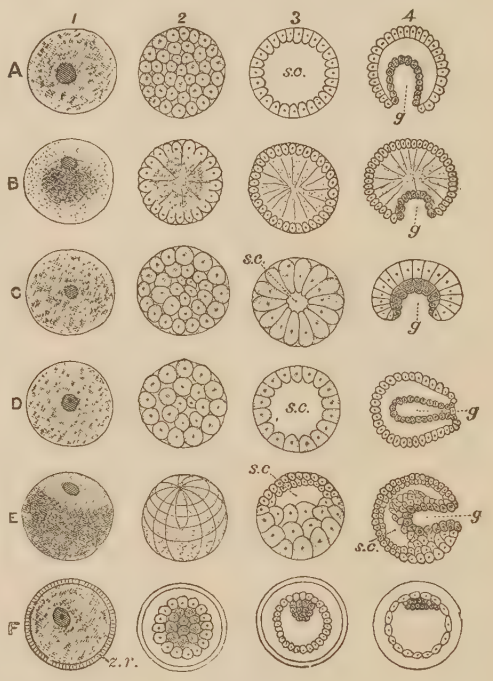


Fig. 6.

The First Stages in Development (not drawn to scale):
1, fertilised ovum; 2, ball of cells; 3, the same still more divided, or in section; 4, the gastrula (except in F); A, sponge, coral, earthworm, or starfish; B, crayfish, or other arthropod; C, river snail, or other mollusc; D, lancelet, tunicate, &c.; E, frog, or other amphibian; F, rabbit, or other mammal; *s.c.*, segmentation cavity; *g*, gastrula invagination; *z.r.*, zona radiata, or porous envelope. Darkly shaded cells are endoderm, lighter are ectoderm, dots are yolk granules.

their gastrula-stage. The gastrula is a recapitulation of the ancestral gastræa. Rival conceptions of what the first stable, many-celled animal was like have been since proposed, but the gastræa-theory still holds the field.

(3) *The Fact of Recapitulation.*—The gastræa-theory is only a special case of a more general proposition—that the individual recapitulates the history of its kind. That the past lives in the present, or that we individually retread, for instance in our intellectual development, the paths made by our ancestors, is a familiar idea which it is one of the charms of embryology to realise in the life-history of each organism. At an early date Von Baer expressed this in his law, that structural progress or differentiation in development was from a general to a special type. 'In its earliest stage,' he said, 'every organism has the greatest number of characters in common with all other organisms in their earliest stages; at each successive stage the class of embryos which it resembles is narrowed.' In the life-history of a mammal it is possible to trace how the germ at first lingers as it were among the Protozoa; how it divides and passes quickly through the transitional 'ball of cells' stage; how the embryo undergoes its first great differentiation, like all other multicellular animals, in becoming a two-layered gastrula, taking its place beside the ancestral Metazoa; how it by-and-by acquires some of the characters of a young worm, and then of a very simple backboned animal, like a primitive

fish; how with increasing complexity it ranks with reptilian embryos; and lastly, how the fœtus acquires mammalian features, vague and general at the outset, but gradually becoming like those of nearly related forms. Von Baer himself confessed, as every embryologist would do, that with three embryos of higher Vertebrates at the same stage before him, he could not, without close examination, tell one from the other. The accompanying

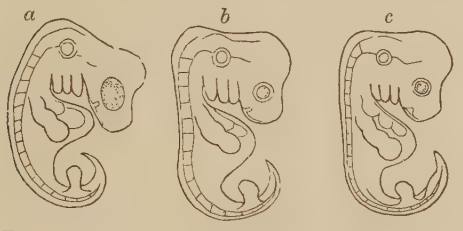


Fig. 7.—Embryos of fowl (*a*), dog (*b*), and man (*c*). (After Haeckel.)

figure of the embryos of a bird, a mammal, and the human species clearly illustrates this close resemblance in early life.

Spencer expressed the progress from simple to complex, from general to special, as a differentiation from homogeneous to heterogeneous, in which the individual history runs parallel to that of the race. The most luminous reading of the fundamental fact is that of Haeckel. The individual development is a recapitulation of the historic evolution of the race. A curve symbolising the turns and twists in the life-history of one of the higher Vertebrates, for instance, is seen to be a reflection of the great bends and branches of the genealogical tree which expresses the historic lineage. The development of the individual microcosm is a summary—often a shorthand summary—of the evolution of the macrocosm of the race. Most pithily, though most technically, he sums up his 'fundamental biogenetic law' in the words 'Ontogeny recapitulates phylogeny.' The fact is very vividly illustrated in many of the more patent life-histories, such as those of crustaceans, insects, and amphibians, where the hatched young follow the rails laid down by their respective ancestors (see AMPHIBIA, CATERPILLAR, CRUSTACEA). Parker happily compares watching development—in which he is one of the modern masters—to reading a palimpsest; below the superficial script there are older and ruder characters, and below these more primitive still. Two cautions must be emphasised. The development is often shortened in its path; circuitous twists, in what we believe to have been the historic course, are skipped by the individual; the momentous steps, however, are always paralleled in the two histories. The individual development may be said to follow the main line of progress, but does not go off into side-lines. Thus the resemblance is between embryos. The embryo bird is hardly like a reptile, but it is always in its development like an embryo reptile. Nor must it be imagined that this fact of recapitulation exactly explains itself. That the present is child of the past does indeed shed great light on the individual's recapitulation of ancestral stages, but the metaphors are apt to suggest that the developing organism has somehow a feeling for history, or that the hand of the past is literally upon it as it grows. It is necessary to get beyond mere metaphors of unconcious memory and the like, and to realise that the same internal conditions which in the long past led to certain momentous changes are still really present doing the same for the individual. The fundamental problem is to elucidate the chemical and physical conditions which represent the living hand of the past upon the development of the present, or to understand how the living matter of the embryo is at each stage both the material and the architect of its upbuilding.

(4) *Continuity of Germinal Protoplasm.*—In flowering plants there is a conspicuous contrast between the reproductive system and the general 'body.' In all organisms this antithesis is fundamental, and the recognition of the fact has shed much light upon the problems of development and heredity. In the simplest animals a portion of the cell is separated off to start a new individual; and as this is virtually continuous with the parent the reproduction of like by like is natural and necessary. In a few animals (some worm-types, crustaceans, insects, &c.), when the ovum has multiplied to a limited extent, by the usual process of division, certain of its descendants, as yet very like the original ovum, are set apart to form the reproductive cells of the offspring, and take no share in building up the 'body.' The germ-cells of the offspring, thus early insulated, are in a real sense continuous with the parental ovum; they retain some of the living capital intact, continue the protoplasmic tradition unaltered, and when themselves liberated will naturally do what the original germ-cells did. Thus the reproduction of like by like becomes more intelligible, and we reach the conception of a continuous necklace-like chain of immortal germ-cells from which the mortal bodies of successive generations are budded off. This conception has been more or less clearly suggested by numerous naturalists—Owen, Haeckel, Jäger, Brooks, Galton, Nussbaum, and others, but has been elaborated by Weismann in his theory of the continuity of the 'germ-plasma.' A continuous chain of germ-*cells* is only demonstrable in a few cases; often they become distinct only at a relatively late stage in the development of the offspring. Therefore Weismann insists not on a continuity of germ-cells from those of the parent to those of the offspring, but only on a continuity of 'germ-*plasma*.' 'In each development a portion of the specific "germ-plasma" which the parental ovum contains is not used up in the formation of the offspring, but is reserved unchanged for the formation of the germ-cells of the following generation.' The germ-plasma which keeps up the continuity has its seat in the nucleus, is a substance of definite chemical and special molecular constitution, has an extreme power of persistence and enormous powers of growth. The general idea is simple enough—an offspring starts with a capital of living matter which is virtually the same as that from which its parents started. Therefore the results are in a general way the same, and the constancy of the species is sustained. How this is modified by variations is not here relevant.

See BIOLOGY, CELL, EGG, FŒTUS, HEREDITY, PLACENTA, REPRODUCTION, SEX; also F. M. Balfour, *Comparative Embryology* (2 vols. Lond. 1880); M. Foster and F. M. Balfour, *The Elements of Embryology* (2d ed. by Sedgwick and Heape, 1883); A. C. Haddon, *Introduction to the Study of Embryology* (Lond. 1887); E. Haeckel, *The History of Creation*, and *Anthropogeny*; W. His, *Unsere Körperform* (1874); O. Hertwig, *Entwicklungsgeschichte* (1888); Preyer, *Physiologie des Embryo* (1884); Milnes Marshall, *Vertebrate Embryology* (1893); Korschelt and Heider, *Embryology of the Invertebrates* (trans. 1895); Minot, *Human Embryology* (1897); Roule, *Embryologie Comparée* (1897); Keith, *Human Embryology and Morphology* (1902); E. B. Wilson, *The Cell* (1900); Jenkinson, *Experimental Embryology* (1909); Driesch, *Science and Philosophy of the Organism* (1908).

Embryo-sac. See OVULE, SEED.

Emden, a port in the Prussian province of Hanover, situated a little below the embouchure of the

Ems into Dollart Bay, 77 miles WNW. of Bremen. It has retained not a few antique houses in the Dutch style, and is intersected by numerous canals, which are crossed by about thirty bridges. The harbour accommodation has been improved in connection with the making of the canal from the Ems (q.v.) to the Jade, and now comprises an inner and an outer harbour—the latter allowing large sea-going vessels to come to the quays from Dollart Bay (2 miles S.). The finest building is the town-hall (built in 1574–76), containing a library and a curious collection of ancient arms and armour. Emden has a large trade in corn, cattle, butter, cheese, coal, timber, wine, and tea, and manufactures machinery, cables, cement, leather, and tobacco, but its principal industry is deep-sea fishery and allied occupations. Pop. 27,000. Emden belonged originally to East Friesland, and after various vicissitudes was created a free imperial town under the protection of Holland in 1595, and remained so until 1744, when it passed to Prussia. After belonging successively to Holland, France, and Hanover, it again became Prussian in 1866.

Emerald (Span. *esmeralda*, Fr. *émeraude*, Ger. *smaragd*, Gr. *smaragdos*), a mineral generally regarded by mineralogists as merely another variety of the same species with the Beryl (q.v.), with which it essentially agrees in composition, crystallisation, &c., differing in scarcely anything but colour. The emerald, which, as a gem, is very highly esteemed, owes its value chiefly to its extremely beautiful velvety green colour. It is composed of about 67–68 per cent. of silica, 15–18 of alumina, 12–14 of glucina, and minute proportions of sesquioxide of chromium, magnesia, and carbonate of lime. Its colour is ascribed chiefly to the oxide of chromium which it contains. Its specific gravity is 2·70–2·76. In hardness it is rather inferior to topaz. The localities in which the emerald is found are very few. The finest have long been brought from Colombia (q.v.), where they are obtained from veins traversing clay-slate, hornblende slate, and granite; and valuable stones also come from the Upper Orinoco, in Venezuela. Stones of inferior quality are found in Europe, imbedded in mica-schist, in the Henbach Valley, in Salzburg. They also occur in the Urals; and some old mines in Upper Egypt have been found to yield them. This gem, known from very early times, was highly prized by the ancients. Pliny states that when Lucullus landed at Alexandria, Ptolemy offered him an emerald set in gold, with his portrait engraven on it. Many wrought emeralds have been found in the ruins of Thebes. Nero, who was near-sighted, looked at the combats of gladiators through an eye-glass of emerald, and concave eye-glasses of emerald seem to have been particularly esteemed among the ancients. As a precious stone, the emerald is rarely without flaw. Its value also depends much on its colour. A very perfect emerald of six carats has been sold for £1000. It appears not improbable that emeralds have been found in the East, in localities not at present known, but the name Emerald or Oriental Emerald is often given to a very rare, beautiful, and precious green variety of Sapphire (q.v.).

Emerald Copper is a beautiful and very rare emerald-green crystallised mineral, also called Dioptase, found first and chiefly in limestone in the hill of Altyn-Tübe (Altai Mountains), and also obtained in the Urals and the South American Cordilleras. It is composed of about 39 parts silica, 50 protoxide of copper, and 11 water.

Emer'itus (Lat.), a term applied originally to a Roman soldier who had *served out* his time, and been discharged on something equivalent to our half-pay. It is now commonly employed to designate certain functionaries, such as professors, who have been honourably relieved from the duties of their office, on account of infirmity or long service, and who are usually granted a retiring allowance.

Emerson, Ralph Waldo, one of the most original thinkers of his time, essayist, and poet, was born in Boston, Massachusetts, on the 25th May 1803, and died in Concord, Massachusetts, on the 27th April 1882. He came of what his own people would call the best New England stock, namely, from a long line of educated and respected ministers. His father was settled over a Boston congregation: an able preacher and an accomplished man of letters. His mother was a woman of high qualities and dignified bearing; his aunt, Mary Moody Emerson, who influenced him very strongly, was a strikingly original and a very cultivated woman. He was the third of seven children; two of his brothers, Edward and Charles, were distinguished for ability, but both died before middle age. His birthplace was within a few minutes' walk of that of 'the great Bostonian,' Benjamin Franklin. His father died when he was six years old, leaving his family in a straitened condition. At eight years old he entered the public grammar-school, and soon afterwards the Latin school. At the age of ten or eleven he was turning Virgil into English heroic verse, was fond of reading history, loved the study of Greek, and was given to frequent rhyming. He thinks the idle books under the bench at the Latin school were as profitable to him as the regular studies. One of his early schoolmates remembered him as 'a spiritual-looking boy in blue nankeens,' whom he loved when he looked upon him, he thought him 'so angelic and remarkable.'

Emerson did not take a very high rank in his college class, that which graduated at Harvard in 1821. He took a second prize, however, for an essay in English, and was chosen class poet after several others had declined. His college career had nothing of the singular brilliancy which characterised that of his brothers Edward and Charles. After graduating he kept school in different places, at the same time studying divinity under the direction of Dr Channing, and attending some of the lectures given at the Harvard Divinity School, the chief Unitarian theological seminary. He was grave, gentle, dignified as a teacher, never punishing except by words. He used to give the boys selections for reading—something from Plutarch's *Lives*, for instance—to carry home with them. In 1826 he was 'approbated to preach' by the Middlesex Association of Ministers, and after preaching in several pulpits—at the south, where he was obliged to go for his health, at New Bedford, at Northampton—he was, on the 11th of March 1829, settled as colleague with the Rev. Henry Ware, minister of the Second Church in Boston. In September of the same year he was married to Miss Ellen Louisa Tucker, who died, without leaving any children, in 1832. In this same year he preached a sermon in which he announced certain views with regard to the Lord's Supper which were disapproved by the larger part of his congregation. This sermon is the only one of his ever printed. In consequence of the difference of opinion between himself and his parishioners, he found it impossible to continue in the relation which had been harmonious and happy, and thus, with the most friendly feelings on both sides, he left the pulpit of the Second Church, and found himself obliged to make a beginning in a new career.

In 1833 he made a first visit to Europe, of which he has given a brief account in the work entitled *English Traits*. On his return he preached in different pulpits, and began devoting himself to delivering lectures and writing essays. His first

subjects were 'Water' and 'Relation of Man to the Globe'—hardly such as we should have expected from the spiritual philosopher and poet, his acquaintance with the physical sciences being apparently very limited. But he wished to make good the loss of his salary, and lectured on branches of knowledge in which he knew he could interest the public. After a short experience he ventured on subjects more congenial to his past studies and habits of thought—Michael Angelo, Milton, Luther, George Fox, and Edmund Burke. In 1834 Emerson fixed his residence at Concord, a pleasant farming town in Middlesex county, Massachusetts, famous for having been the scene of the opening conflict of the revolution. He lived at first in an old 'gambrel-roofed' house built by his grandfather, the Rev. William Emerson, and afterwards celebrated as the 'Old Manse' of one of Hawthorne's stories, and the place where for a time he resided. In 1835 he married his second wife, Miss Lydia Jackson of Plymouth, Massachusetts. After this marriage, Mr and Mrs Emerson removed to the house which he purchased, where he passed the rest of his days. His widow, born 1802, died 13th November 1892.

During several successive years he delivered courses of lectures in Boston; in 1835 ten lectures on English literature, in 1836 twelve lectures on the philosophy of history, in 1837 ten lectures on human culture.

Emerson made the personal acquaintance of Carlyle during his first visit to Europe in 1833. Carlyle was then living at Craigenputtock, where Emerson sought him out, and passed time enough with him for some conversation, of which he has given an account in the first chapter of *English Traits*. In the next year, 1834, a letter from Emerson to Carlyle began a correspondence which continued nearly forty years, closing with the letter from Carlyle to Emerson, dated April 2, 1872. This correspondence, which has been carefully edited by Professor Charles Eliot Norton, shows the two men with all their characteristics; different as optimist and pessimist, yet with many profound sympathies with each other. Emerson was very desirous of having Carlyle come to stay with him at Concord. It would have been a dangerous experiment in vital chemistry—hydrofluoric acid in a vessel of glass. The deaths of Emerson's younger brothers, Edward in 1834, and Charles in 1836, produced a very deep impression on his affectionate nature. He had a true admiration for both of them, which they well deserved. The youngest, Charles Chauncy Emerson, well remembered by the present writer, stands apart from all the young men he has known for the elevation and beauty of his intellect and character.

In 1836 a thin volume was published, entitled *Nature*, which, though appearing anonymously, was at once known as coming from Emerson. Like his early poems, it was read by few, understood by fewer still, little thought of or cared for by the general reading public, but made much of by a small circle of admirers. It is a kind of poetical rhapsody—prose with wings growing, but not strong enough to lift it into the atmosphere of rhythmical music. To those who like naturally, or have acquired the taste for, the Emersonian modes of thought and expression, it is fascinating. But it took twelve years to sell five hundred copies. The germs of many of Emerson's thoughts, afterwards expanded in his essays and poems, may be found in this dreamy little volume.

Nature was followed by 'The American Scholar,' an oration delivered before the Phi Beta Kappa Society of Harvard University. Few anniversary addresses have attracted so much attention. Mr Lowell says of it that 'its delivery was an event without any former parallel in our literary annals, a scene to be always treasured in the memory for its picturesqueness and its inspiration.' This grand oration was our intellectual declaration of independence. The orator did not spare his fellow-countrymen. 'We have listened too much,' he says, 'to the courtly muses of Europe. The spirit of the American freeman is already suspected to be timid, imitative, tame. The scholar is decent, indolent, complacent.' The young men of promise, he says, are discouraged and disheartened. 'What is the remedy? If the single man plant himself indomitably on his instincts and there abide, the huge world will come round to him. Patience—patience; with the shades of all the good and great for company; and for solace the perspective of your own infinite life; and for work the study and the communication of principles, the making those instincts prevalent, the conversion of the world.'

These two publications, the first in the series of his collected works, strike the keynote of his philosophical, poetical, and moral teachings. The 'Address before the senior class in Divinity College, Cambridge, July 1838,' which follows them, defined his position in, or out of, the church in which he had been a minister. Two or three sentences will sufficiently show where he stood: 'One man was true to what is in you and me. He saw that God incarnates himself in man, and evermore goes forth to take possession of his world. He said in this jubilee of sublime emotion, "I am divine. Through me God acts; through me speaks." . . . There is no doctrine of the Reason which will bear to be taught by the Understanding. The Understanding caught this high chant from the poet's lips and said, in the next age, "This was Jehovah come down out of heaven. I will kill you if you say he was a man."' In its simplest and broadest statement this discourse was a plea for the individual consciousness as against all historical creeds, bibles, churches; for the soul of each man as the supreme judge in spiritual matters. The delivery and publication of this address produced a great sensation in the religious world, especially among the Unitarians. Professor Andrews Norton attacked Mr Emerson's position in an article entitled 'The Latest Form of Infidelity.' Much controversy followed, in which Emerson took no part. He was not in the habit of defending his oracular statements. Delphi is not given to argument and explanation.

Whosoever has read carefully and lovingly these three essays, *Nature*, the *Phi Beta Kappa Oration*, and the *Divinity School Address*, can almost say of Emerson what he makes the Sphinx say of herself:

> Who telleth one of my meanings
> Is master of all I am.

These three essays take up about one-third of the first volume of his collected works, which are eleven in all. The titles of these volumes are as follow: Vol. i. *Nature; Addresses and Lectures;* ii. and iii. *Essays*, first and second series; iv. *Representative Men;* v. *English Traits;* vi. *The Conduct of Life;* vii. *Society and Solitude;* viii. *Letters and Social Aims;* ix. *Poems;* x. *Lectures and Biographical Sketches;* xi. *Miscellanies.* These titles, and the more special ones which are included within them, give a very imperfect and unsatisfying idea of the contents of the eleven volumes. If these were taken to pieces, and their leaves thrown into a basket or barrel and shaken up, they might be taken out and rearranged in a dozen different ways, and yet have cohesion enough to make almost as intelligible consecutive reading as they are in their present order. Their arrangement under their different heads is nearly as

arbitrary as that of certain stars which are grouped under the name of Corona, or Lyra, or Andromeda. His son, Dr Edward Emerson, gave this account of his way of building his lectures in a paper, to the reading of which I had the privilege of listening: 'All through his life he kept a journal. . . . This book, he said, was his "Savings Bank." The thoughts thus received and garnered in his journals were indexed, and a great many of them appeared in his published works. They were religiously set down just as they came, in no order except chronological, but later they were grouped, enlarged or pruned, illustrated, worked into a lecture or discourse, and after having in this capacity undergone repeated testing and rearranging, were finally carefully sifted and more rigidly pruned, and were printed as essays.'

We can easily understand that in adjusting his mosaic fragments to each other there are likely to be occasional misfits which puzzle weary eyes and brains. Still, there are subtle connections oftentimes in thoughts which at first sight seem unrelated, and the pious reader of Emerson will always find it worth while to seek for them, though some of them may be 'hard for the non-elect to understand.'

Emerson wrote occasionally in verse from his schooldays until he had reached the age which used to be known as 'the grand climacteric,' sixty-three. *Terminus*, which he read to his son in 1866, is, so far as I know, the last poem he wrote. It is a farewell to his literary life, though he made some efforts in after-years. His poems are to his prose what the corolla is to the calyx. Both spring from the same root; both are modifications of the same growth; the sepal often shows the delicacy and colour of the petal, and the petal often lapses into the homelier texture and complexion of the sepal. His poems are not and hardly can become popular; they are not meant to be liked by the many, but to be dearly loved and cherished by the few. Such poems as *The Problem*, *Fate*, and *Days*, once rightly read, are never forgotten. The influence of Marvell, of George Herbert, of the Persian poets, of whom he was very fond, may be frequently traced; but the writer he most reminds us of, whatever he writes, is—Emerson. His occasional lawlessness in technical construction, his sometimes fantastic expressions, his enigmatic obscurities hardly detract from the pleasant surprise his verses so often bring with them. His teachings have not always had a wholesome effect on his train of imitators and followers in poetry, or what was meant for poetry. It was very well for him to find fault with 'the tinkle of piano-strings,' and say that

> The kingly bard
> Must strike the strings rudely and hard
> As with hammer or with mace;

but if a self-crowned 'kingly bard' undertakes to play on the harp or piano with his fists instead of his fingers, we must beg leave to stop our ears. The magnificent lawlessness of 'Lord' Timothy Dexter in punctuation is a bad precedent for poets to follow in composition. The poetic license which we allow in the verse of Emerson is more than excused by the noble spirit which makes us forget its occasional blemishes, sometimes to be pleased with them as characteristic of the writer.

The idealist in philosophy, the rationalist in religion, the bold advocate of spiritual independence, of intuition as a divine guidance, of instinct as a heaven-born impulse, of individualism in its fullest extent, making each life a kind of theocratic egoism; all this may be seen in every one of his larger utterances. For him nature is a sphinx, written all over with hieroglyphics for which the spirit of man is to find the key. To interpret nature is the province of the thinker, and especially of the poet—not as Bacon intends, by the analysis of phenomena—'natural philosophy'—but by detecting the higher, hidden significance of all natural appearances. He had learned from his wise relative, Aunt Mary Moody Emerson, to 'scorn trifles;' he bettered his lesson by teaching that man is made to scorn heaven itself if a higher empyrean is offered to him.

> The fiend that man harries
> Is love of the Best. . . .
> The heaven that now draws him
> With sweetness untold
> Once found—for new heavens
> He spurneth the old.

Throughout his lectures and essays are scattered wise sayings, shrewd observations, delicate strokes of wit, curious gleanings from his widely discursive reading, and eloquent imaginative passages. But above all the special virtues to be found in his writings in prose and in verse we must recognise the sense of being in relation with a pure and lofty spiritual nature. 'Love of the Best' breathes in every expression of his thought. His writings must be read for their inspiring influence, their stimulus to high thought and endeavour, the noble manhood which pervades them. Recognising these as the chief claims of Emerson's essays and poems, we can delight in their singular and distinctive beauty of expression, their delicate wit, their iridescent variety of unexpected suggestions, their unaffected and often unconscious archaisms, which carry the reader's imagination back to his favourite Montaigne, their happy illustrations, their self-sustaining wisdom.

Emerson loved his quiet Concord life, the repose of which was, however, constantly broken by more or less welcome visitors, who sought him as an oracle. He was long-suffering with those 'devastators of the day,' as he called them, each of whom thinks of himself or herself as a privileged intruder. He travelled far and wide as a lecturer. In *English Traits* he has recorded not so much what he saw as what he thought while visiting England and Scotland, and in reflecting on his tour after his return. At home he was, according to village evidence, 'a first-rate neighbour, and one who always kept his fences up.'

Emerson was strongly opposed to slavery, but not conspicuous as an abolitionist. He would have bought out the slave-holders, and if men did not cling closer to their money than they do to their lives, his idea might have had some reason in it. He looked on at the 'Brook Farm' experiment with a kind of amused interest, but took no active part in the project. He listened to the long-haired reformers who swarmed at one time about the Chardon Street Chapel with a kindly curiosity, but his sense of humour as well as his good judgment was his safeguard, and he was not to be betrayed into any fanatical extravagance.

His personal appearance was that of the typical New Englander of college-bred ancestry. Tall, spare, slender, with sloping shoulders, slightly stooping in his later years, with light hair and eyes, the scholar's complexion, the prominent, somewhat arched nose which belongs to many of the New England sub-species, thin lips, suggestive of delicacy, but having nothing like primness, still less of the rigidity which is often noticeable in the generation succeeding next to that of the men in their shirt-sleeves, he would have been noticed anywhere as one evidently a scholarly thinker astray from the alcove or the study, which were his natural habitats. His voice was very sweet, and penetrating without any loudness or mark of effort. His enunciation was beautifully clear, but he often hesitated as if waiting for the right word to present

itself. His manner was very quiet, his smile was pleasant, but he did not like explosive laughter any better than Hawthorne did. None who met him can fail to recall that serene and kindly presence, in which there was mingled a certain spiritual remoteness with the most benignant human welcome to all who were privileged to enjoy his companionship.

The above article was by Oliver Wendell Holmes, who wrote also the great Life in 'The American Men of Letters Series' (1885). See also the authorised *Memoir of Ralph Waldo Emerson*, by James Elliot Cabot (1887); *Ralph Waldo Emerson, Life, Writings, and Philosophy*, by G. W. Cooke (1882); *Emerson at Home and Abroad*, by Moncure Daniel Conway (1882); *Emerson in Concord*, by his son Edward Waldo Emerson; and books by Alex. Ireland (1882), A. B. Alcott (1882), Joel Benton (1883), F. B. Sanborn (1885), R. Garnett (1888), Eliz. L. Carey (1904), Woodberry (1907), Perris (1910). His *Journals* from 1820 to 1873 were published in ten volumes in 1910-14. There is a standard edition of his works, edited by J. E. Cabot ('Riverside' edition, Boston, 11 vols. 1883-84); that with preface by Lord Morley (Macmillan, 6 vols. 1883-84); and one edited by Sampson (5 vols. 1906); and the 'Centenary' edition in 12 vols. (Constable, 1906).

Emery, the 'Armenian whetstone' of Theophrastus, is a variety of Corundum (q.v.), the mineral species which embraces ruby, sapphire, and other oriental precious stones, variously named according to their colour. The precious stones mentioned consist of nearly pure alumina in a crystalline condition, while emery is an amorphous admixture of alumina with varying proportions of oxide of iron and silica. Next to the diamond, these minerals are the hardest substances found in nature; but the hardness of emery is modified by the amount of iron and silica which enter into its composition. In external appearance emery has nothing in common with the brilliant stones to which it is related, being a dense, opaque, dull, bluish-black substance, like a fine-grained iron ore. It occurs in large boulder-like masses on Naxos and elsewhere in the Greek Archipelago, near Ephesus, and at Westchester, New York. (Carborundum, a substitute, is made of carbon and silicon.)

It is prepared for use by first breaking it into lumps about the size of a hen's egg, then crushing these to powder by stampers. It is then sifted to various degrees of fineness, which are numbered according to the meshes of the sieve. Plate-glass manufacturers and others separate emery-powder into different degrees of fineness by the method of Elutriation (q.v.). Emery thus prepared is used for a great many important purposes in the arts. Being next in hardness to diamond-dust and crystalline corundum, the lapidary uses it for cutting and polishing many kinds of stone. Glass stoppers of all kinds are ground into their fittings with it. Plate-glass is ground flat by its means; it is also used in glass-cutting, and in grinding some kinds of metallic fittings. When employed for the polishing of metals, it has to be spread on some kind of surface to form a sort of fine file. *Emery-paper*, *emery-cloth*, *emery-sticks*, *emery-cake*, and *emery-stone* are various contrivances for such purposes. Emery-wheels are also largely used for smoothing and polishing the surface of iron castings, and in engineering work generally. These wheels consist principally of a mixture of emery-powder and hard vulcanised india-rubber. The polishing and buffing wheels employed by cutlers are also fed with emery-powder. See POLISHING.

Emesa. See HEMS.

Emetics, medicines given for the purpose of producing Vomiting (q.v.). They are given when it is desirable to relieve the stomach of some noxious or indigestible substance, such as a narcotic poison, or excess of food, or some special article of diet which has disagreed. In diseases of the respiratory organs, emetics are given as the quickest and safest method of removing accumulated mucus from the air-passages; and in Croup (q.v.) their action is especially favourable, being often followed by expectoration and a rapid improvement in the suffocative symptoms. Emetics are to be given with great caution, however, in all very depressed states of the system, as their primary action is to produce nausea, which is attended always with more or less diminution of the vital power, and often with great depression of the heart's action, amounting to syncope or fainting. Emetics may produce vomiting either by their local action on the throat, gullet, and stomach, or by their action through the blood on the nervous mechanism regulating the movements of the stomach. They are thus divided into two groups, *local* and *general* emetics; and the depressing effect of the former is much less than that of the latter. Some substances will produce vomiting in either way; so that the distinction between the two classes is not very definite. Among the chief emetics in use are mustard (two tablespoonfuls), common salt (a tablespoonful or more), alum (a teaspoonful), in a tumblerful of water, repeated after a quarter of an hour if necessary. These, with sulphate of copper or zinc, are mainly local in their action; ipecacuanha and emetin, squills, senega, tartar emetic and other soluble salts of antimony, apomorphia, are mainly general in their action. The production of vomiting is aided, whatever emetic is used, by copious draughts of warm water. Tickling the throat with a finger or feather is often an effective mechanical means to produce vomiting.

Emetin is the alkaloid which forms the active principle of ipecacuanha-root. It may be obtained by drying the powdered root-bark with milk of lime, and then exhausting with boiling chloroform. It is a white powder, becoming brown on exposure to light, slightly soluble in water, but readily in alcohol. When taken internally it exhibits violent emetic properties, $\frac{1}{20}$th of a grain sufficing to cause vomiting. The wood of the root contains no emetin; the virtue is in the bark. Emetin has been much used in dysentery and other diseases.

Emeu. See EMU.

Emigration in its established signification implies (1) permanently leaving a place to make a home elsewhere; (2) going out of one country to another, and generally to a distant part of the world; (3) going out from a community and leaving the bulk behind—in this sense the word is opposed to migration, which implies the movement of whole tribes or nations; (4) going out spontaneously, not as part of some systematic scheme of settlement—in this sense the word has been sometimes opposed to colonisation. In the country which people leave they are called emigrants or wanderers out; in that in which they settle they are called immigrants.

Among the principal causes may be noticed the pursuit of wealth, the pressure of population at home, and political, social, or religious discontent. The Spaniards went to America to get gold. Many of the Greeks in old times, like many of the English in our own, emigrated because of over-population. Political and social discontent, as well as over-population, accounts in great measure for the large numbers of Irish emigrants. The burden of compulsory military service is supposed to have been one determining cause of German emigration. And religious oppression led to the emigration of the Huguenots from France to England, and of the Puritans from England to North America.

In ancient times, when the Mediterranean was the centre of the world, the Greek race sent out

most emigrants and colonists. The Phœnicians were rather traders than settlers, and the Roman colonies were mainly military stations, carefully designed by government. The Greeks settled along the shores of the Mediterranean, from Cyprus to Marseilles, and their settlements were quite independent of, and in many cases greater than, the mother-cities.

Between ancient and modern times there intervenes a long period, during which there was a perpetual ebb and flow of races throughout Europe; but the movements of the barbarians who overran the provinces of the Roman empire, and even the later and more organised enterprises of such peoples as the Normans, fall rather under the head of migration, invasion, or conquest than under that of emigration. At the end of the 15th century, the discoveries of Vasco da Gama and Columbus disclosed new lands to which Europeans might emigrate, and stimulated the restless spirit which prompts to emigration. The Spaniards went to the west, the Portuguese to the east; and, being natives of the south of Europe, they were better fitted than the more northerly nations to make their homes in hot climates. Large numbers of Spaniards emigrated to the West Indies and to Central and South America. The Portuguese were fewer in numbers, and the East Indies, to which at first they chiefly went, were less suitable than America for European settlement; still, at the present day, their descendants are left in India, Ceylon, and elsewhere. To Brazil, which was outside their beat, they found their way by accident, and that country became the home of many Portuguese. Among the nations who followed the Portuguese and Spaniards to the east and west were the Dutch, the French, and the English. The Dutch, though great traders, did not send out many emigrants compared with other colonising peoples; but in addition to those who were attracted to the East Indies by commerce, Dutchmen emigrated to what is now known as New York, and still more to the Cape of Good Hope. The French were rather conquerors than settlers, but many Frenchmen emigrated to various parts of the world, as to the islands of Mauritius and Bourbon, to some of the West Indian islands, to Louisiana, and notably to Canada, where their descendants are now multiplying very fast. The English emigrated principally to the West Indies, to North America, and later to Australasia and South Africa.

European emigration increased by leaps and bounds in the 19th century, because the population of Europe had increased so enormously. It is obvious that the favourite fields for European emigration must be (*a*) countries with a suitable —i.e. a temperate—climate; (*b*) countries which have not an over-large population already; (*c*) countries which have large resources—i.e. large facilities for making wealth. Tried by these tests, it is clear that, as has actually been the case, the United States and British North America, Australia, New Zealand, South Africa (though there the native population is large), and the more temperate parts of South America—e.g. the Argentine Republic—would be the places which would attract most emigrants. The Teutonic nations have supplied the largest number, including English, Germans, and Scandinavians. The Germans have gone in great measure to the north central districts of the United States, the Swedes to Minnesota and Canada. Of the Celtic peoples the Irish have emigrated in largest numbers, mainly to the United States. In New York city the Irish element is exceptionally large. France sends out few emigrants; but there is a large stream of Italians to the Argentine Republic.

There are always many persons of an ambitious or roving disposition who will emigrate; but emigration is not suitable for all, and those who are in good situations will do well as a rule to stop at home. Emigration was called by J. S. Mill 'the safety-valve of the labour-market;' but it does not consist in sending all the most skilful workmen out of the country, for these, generally speaking, can get work here, and have therefore less inducement to emigrate. It appeals more strongly to that vast body of ordinary men and women who are crowded out by competition, or who want to give their children better chances than they had themselves. Paupers, criminals, or other undesirable persons are prevented from landing by numerous Immigration Restriction Acts; but thousands of suitable persons have emigrated to the advantage of themselves and the country of their choice. The capital which they take with them is not wholly lost by the mother-country, for every settler in the dominions oversea buys much home produce; and many millions of pounds have been sent back by them to help friends and relations at home. See COLONY, COOLIES, IMMIGRATION.

Émigrés, the name given more especially to those persons who quitted France during the Revolution. After the insurrection at Paris, and the taking of the Bastille, 14th July 1789, the princes of the royal family departed from France. They were followed, after the adoption of the constitution of 1791, by all who considered themselves aggrieved by the destruction of their privileges, or who were exposed to persecution. Nobles quitted their châteaus; officers, with whole companies, passed the frontiers. Crowds of priests and monks fled to escape the oath of allegiance to the constitution. Belgium, Piedmont, Holland, Switzerland, and, above all, Germany, were overrun with fugitives of every age. Only a few had been able to save their property; the greater portion were in a state of destitution, and sank into utter demoralisation. A court had formed itself round the princes at Coblenz; a government, with ministers and a court of justice, had been established, and communication was kept up with all the foreign courts unfavourable to the Revolution. This conduct embittered France, aggravated the position of the king, and drove the revolutionary party forward in their sanguinary career. Under the command of the Prince of Condé, a body of émigrés was formed, which followed the Prussian army into Champagne. The result was that the severest laws were now put in force against the émigrés; their lands were confiscated; the penalty of death was proclaimed against any one who should support or enter into communication with them; thirty thousand persons were placed upon the list of émigrés, and exiled for ever from the soil of France, although many of them had refused to bear arms against their country. Not until after the failure of their attempt to land at Quiberon in 1795 did the émigrés abandon all thoughts of penetrating into France by force of arms. Condé's corps, after the peace of Lunéville, was obliged formally to dissolve, and sought an asylum in Russia. Even under the Directory, however, many had endeavoured to obtain permission to return to France. The general amnesty proclaimed by the First Consul was therefore joyfully hailed by the greater portion of the émigrés, though many did not return home till after the downfall of Napoleon. Dignities, pensions, and offices were now showered upon these faithful adherents; but, according to the charter of 1814, they were unable to recover either their estates or their privileges. Finally, on the motion of the minister Villèle, the émigrés who had lost their landed estates received, by the law of the 27th April 1825, a compensation of 30 million francs yearly on the capital of 1000 million francs. After

the July revolution the grant was withdrawn. See Saint-Gervais, *Histoire des Émigrés Français* (1823); a book by Lebon (1882); but especially E. Daudet, *L'Histoire de l'Émigration Française* (3 vols. 1886–89).

Emilia, a name now employed to designate a compartimento of Central Italy, comprising the provinces of Bologna, Ferrara, Forli, Modena, Parma, Piacenza, Ravenna, and Reggio Emilia. The name is derived from the ancient *Via Æmilia* (a continuation of the *Via Flaminia*, or great northern road), which passed through these territories. See ITALY.

Eminence, a title given by Urban VIII., in 1631, to cardinals, who up to the period of his pontificate had been called Most Illustrious.

Eminent Domain, a phrase which occurs more commonly in its Latin form, *dominium eminens*, denotes the universal right in the public over property, by virtue of which the supreme authority in a state may compel a proprietor to part with what is his own for the public use. Thus a private owner may be compelled to give up part of his land that a public highway may be made through his ground. For the just exercise of this right there must be a necessity or clear public utility in the work proposed; and the expropriated owner must be compensated for his loss. The right is now exercised only under well-defined statutory regulations, such as the Lands Clauses Consolidation Acts, which regulate the purchase of lands for railways and other public undertakings.

Emin Pasha. See SCHNITZER (EDUARD).

Emir (plur. *Omrah*), an Arabic word, equivalent to 'ruler,' is a title given in the East, and in the North of Africa, to all independent chieftains, and also to all the actual or supposed descendants of Mohammed through his daughter Fatima. The latter are very numerous throughout the Turkish dominions, but, although entitled by birth to be classed among the first of the four orders of society, they enjoy no particular privileges or consideration, and are found engaged in all sorts of occupations. Their privileges are confined to a few unimportant matters, chiefly to the exclusive right to wear turbans of a green colour, that having been the favourite colour of the Prophet. They are placed under the supervision of the Emir-Beshir. The title Emir, in connection with other words, likewise designates different offices. *Emir-el-Mumenin*, 'Prince of the Faithful,' was the title assumed by the khalifs themselves, while *Emir-al-Omrah*, 'Prince of Princes,' was the title of their first minister. The Turkish master of the horse was styled *Emir-Achor;* the standard-bearer, *Emir-Alem;* and the leader of the caravans of pilgrims to Mecca, *Emir-Hadji*. *Amir*, *Ameer*, and *Amere* are other spellings of the same word. Admiral (q.v.) is a derivative.

Emission Theory. See LIGHT.

Emmanuel, or IMMANUEL (Heb., 'God with us'), was the symbolical name of the child announced by Isaiah to Ahaz and the nation (Isa. vii. 14), and applied by St Matthew to the Messiah born of the Virgin (Matt. i. 23).

Emmaus, a village of Judea, not far from Jerusalem (Luke, xxiv. 13), which after the Jewish war was colonised with 800 Roman veterans. A writer in the quarterly statement of the Palestine Exploration Fund (January 1883) identifies it with the valley of the Urtas, 7 miles from Jerusalem, and south of Bethlehem, where costly baths have been discovered.

Emmenagogues, medicines intended to restore, or to bring on for the first time, the menses in women. See MENSTRUATION.

Emmerich, an old walled town of Rheinland, on the Rhine, near the borders of Holland, 94 miles by rail E. of Rotterdam. It has manufactures of iron, glass, tobacco, &c., besides an active river trade. From a small Roman colony the town grew in importance until, in the 15th century, it had 40,000 inhabitants; from 1592 to 1811 it was the seat of a famous Jesuit seminary. Pop. 13,000.

Emmet, ROBERT, an ill-fated Irish patriot, was born in Dublin in 1778, the youngest son of the physician to the viceroy. At fifteen he entered Trinity College, where Moore was a fellow-student, but an academic career of exceptional promise was soon cut short by his joining the United Irishmen. He next travelled on the Continent, interviewed Napoleon and Talleyrand in 1802 on behalf of the Irish cause, and returned the next year to devote his own fortune of £3000 to buying muskets and manufacturing pikes. With a few confederates he laid a plot to seize Dublin Castle, and secure the person of the viceroy, but the rising proved a complete failure, and Emmet, who had arrayed himself for the occasion in a green coat, white breeches, and cocked hat, had the mortification to see nothing result from his enterprise but a few ruffianly murders. He escaped to the Wicklow Mountains, but returning for a last interview with his sweetheart, Sarah Curran (q.v.), the daughter of the orator, was arrested, put on trial on 19th September 1803, condemned to death, and hanged the following day. Just before receiving sentence he delivered a speech which still thrills the reader.—His elder brother, THOMAS ADDIS EMMET (1764–1827), a Dublin barrister, was counsel for the United Irishmen, was imprisoned and exiled, and became Attorney-general of New York State.

Emollients (from Lat. *mollis*, 'soft'), substances used to soften the textures to which they are applied, as poultices, fomentations, &c., externally, and Demulcents (q.v.) internally.

Emotion, a word used in philosophy with some considerable variety of meaning. The phenomena of the mind may be divided into three groups—cognitions, emotions, and volitions, into intellect or thought, feeling, and will. The emotions taken in this sense constitute one of the great groups of mental activities. They may be pleasurable, painful, or neutral, and may be arranged according as they arise directly out of the senses, movements, and appetites or not. In the latter case they comprise feelings of freedom and restraint, wonder, terror, love, self-complacency, the sense of power, anger, love of knowledge, artistic emotions, the moral sense, &c. As they combine and pass into one another by infinite gradations, a systematic and exhaustive classification is impossible. Sometimes emotion implies that the feeling is keenly experienced, so as to occasion mental disturbance. The expression of the emotions, especially in the face, was carefully studied by Sir Charles Bell; and Darwin's *Expression of the Emotions in Man and Animals* (1873) is a monument of patient observation and insight. The emotions act powerfully on the organic functions of the body, as illustrated in blushing, quicker or slower pulsation of the heart, cold perspiration, &c. The term *feeling* is used with even greater laxity than emotion. It is sometimes the perception we have of extreme objects, of their being hard or soft, hot or cold, in which case it is the intellectual function of sensation, or the sensation itself. Again, it may be specifically pleasure, pain, or the neutral emotion, or emotion in the widest sense. Or it may be used loosely for almost any kind of consciousness, as by James Mill. The higher feelings, as the appreciation of the sublime and beautiful, approval and disapproval, are often termed sentiments. See the article PSYCHOLOGY, and the list of works there cited.

Empecinado, Don Juan Martin Diaz, el, one of the leaders of the Spanish revolution of 1820, was born in 1775, and entered the Spanish army in 1792. He carried on a guerilla warfare against the French during the Peninsular struggle, and acquired great distinction. In 1814 he was appointed colonel in the regular army, and the king himself created him maréchal-de-camp; but in consequence of petitioning Ferdinand, in 1815, to reinstitute the Cortes, he was banished to Valladolid. On the outbreak of the insurrection in 1820 he took a prominent part on the side of the constitutionalists; after the triumph of the absolutists in 1823 he was arrested, exposed in an iron cage to the contumely of the passers-by, and finally, while struggling with his executioners, stabbed by one of the soldiers.

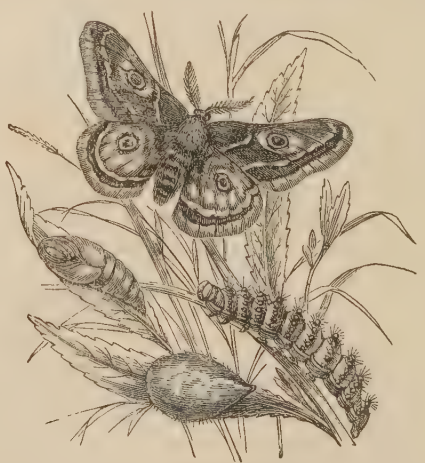
Empedocles, a Greek philosopher of Agrigentum, in Sicily, lived about 450 B.C. So great was the estimation in which he was held by his fellow-citizens as a physician, a friend of the gods, a predicter of futurity, and a magician, that they are said to have offered him the sovereignty. But being an enemy of tyranny, he declined it, and was the means of delivering the community from the dominion of the aristocracy, and bringing in a democracy. There was a tradition that he threw himself into the crater of Etna in order that his sudden disappearance might beget a belief in his divine origin; this, however, can only be regarded as a mere fable, like the story told by Lucian, that Etna threw out the sandals of the vain philosopher, and thus destroyed the popular belief in his divinity. In Matthew Arnold's poem, *Empedocles on Etna,* the philosopher is represented as superior to vanity and superstition, but moody and out of sympathy with his contemporaries.

In Empedocles philosophic thought is bound up with poetry and myth even more closely than in Parmenides (q.v.). His general point of view is determined by the influence of the Eleatic school upon the physical theories of the Ionic philosophers. He assumed four primitive independent substances —air, water, fire, and earth, which he designates often by the mythical names Zeus, Hera, &c. These four *elements,* as they were called, kept their place till modern chemistry dislodged them. Along with material elements he affirmed the existence of two moving and operating powers, love and hate, or affinity and antipathy, the first as the uniting principle, the second as the separating. The contrast between matter and power, or force, is thus brought out more strongly by Empedocles than by previous philosophers. His theory of the universe seems to assume a gradual development of the perfect out of the imperfect, and a periodical return of things to the elemental state, in order to be again separated, and a new world of phenomena formed. Of his opinions on special phenomena may be mentioned his doctrine of emanations, by which, in connection with the maxim that like is known only by like, he thought to explain the nature of perception by the senses. He attempted to give a moral application to the old doctrine of the transmigration of souls, his views of which resembled those of Pythagoras.

The fragments of Empedocles were edited by Karsten (1838) and Stein (1852). See Zeller's *Greek Philosophy* (trans. 1881), Benn's *Greek Philosophers* (1882), and Gomperz's *Greek Thinkers* (4 vols. 1901–13).

Emperor (Lat. *imperator*), a title formerly borne by the heads of the Roman empire, which in the modern world became the highest title of sovereignty. In Rome the *imperium* of a magistrate, whether king or consul, was the power which he possessed of bringing physical force into operation for the fulfilment of his behests. This power was conferred by a *lex curiata,* and it required this authorisation to entitle a consul to act as the commander of an army. In the case of the kings also the imperium was not implied in their election, but was conferred separately, by a distinct act of the national will. Now it was in virtue of this imperium that the title imperator was given to its possessor. Far from being an emperor in the modern sense, he might be a consul or a proconsul; and there were, in fact, many imperatores, even after the title had been assumed as a prænomen by Julius Cæsar. It was this assumption which gradually gave to the title its modern signification. In republican times it had followed the name, and indicated simply that its possessor was *an* imperator, or one possessed of the imperium; now it preceded it (see Cæsar), and signified that he who arrogated it to himself was *the* emperor. Nor was it, as has often been mistakenly asserted, merely a military command; it included also the supreme judicial and consequently also the administrative power; and under the empire the office was free from the temporal and local limitations which had accompanied its enjoyment during the republic. From the emperors of the West the title passed to Charlemagne, the founder of the Holy Roman Empire. When the Carlovingian family expired in the German branch, the imperial crown became elective, and continued to be so until, in 1806, Francis II. resigned the title, and withdrew to the government of his hereditary dominions, under the title, assumed in 1805, of Emperor of Austria. The title of *imperator,* like that of *basileus* (Gr., 'king'), was frequently assumed in England by the Anglo-Saxon monarchs. Henry VIII.'s parliament in 1532, abolishing appeals to Rome, declared that 'this realm of England is an empire;' Spenser's *Faerie Queene* was dedicated to the 'Empress Elizabeth, Queen of England, France, and Ireland, and of Virginia;' the prayer-book rubrics said James I. was 'endowed with a crown imperial.' The rulers of Abyssinia and Japan have been called emperors, as were those of Austria, Brazil, China, France, Germany, Hayti, Korea, Mexico, Morocco, Russia, and Turkey. See Byzantine Empire, Czar, France, Germany, Imperialism, India, Rome; Lord Cromer's *Ancient and Modern Imperialism* (1910), and Sir C. P. Lucas's *Greater Rome and Greater Britain* (1913).

Emperor Moth (*Saturnia carpini*), nearly related to the silkworm moths (Bombycina). With the exception of the Death's Head, it is the largest



Emperor Moth, with Caterpillar, Pupa, and Cocoon.

British moth. Its expanse of wings is about three inches; the female is mainly gray, the male from reddish-brown to orange-yellow; each wing bears

a large black eye, with surrounding rings. The caterpillar is green, with short hair, black cross bands, and yellow or reddish tubercles. The cocoons are formed internally of stiff convergent elastic threads, which resist intrusion, but readily admit of egress. The Great Peacock Moth (*Saturnia pyri*) is a very large European form about twice the size of the Emperor. See SILK.

Emphysema, in Medicine, an unnatural distension of a part with air. Emphysema of the cellular texture is usually caused by a wound of the lungs or upper air-passages, from which air escapes during respiration into the cellular tissue. It may be confined to the immediate neighbourhood of the wound, or may extend all over the body. Emphysema is rarely produced otherwise than mechanically; but in gangrene and after death various bacteria may produce decomposition and give out gases, which penetrate and distend the tissues with which they are in contact.

Emphysema of the lungs is the name applied to two distinct conditions. (1) *Interlobular* or *cellular* emphysema, allied to the form described above in that it depends on a wound of the delicate lining-membrane, and that air occupies the interstices of the cellular tissue, is not common, and occurs only in childhood. (2) *Vesicular* emphysema consists in an unnatural distension of some of the natural air-cells or *vesicles* of the lungs, and is almost invariably present in those who have long suffered from chronic bronchitis or asthma, or have in any way been obliged to make excessive respiratory efforts—e.g. in the blowing of large wind-instruments. The walls of the affected vesicles become thinned, and may ultimately disappear between two or more in contact with each other, so that though the apparent size of the lung increases, the surface available for aeration of the blood is actually much diminished, and great shortness of breath results. The same process is common in the horse, and familiar under the name of 'broken wind.' The only treatment possible is that of the condition to which the emphysema is due; for the affected vesicles cannot be restored to their original condition.

Emphyteusis (Gr., 'implanting'), in Roman law, a perpetual right in a piece of land, for which a yearly sum was paid to the proprietor. It much resembled a feudal holding. See FEU, FEUDALISM.

Empiricism, the name applied to a school in philosophy which admits of nothing as true but what is the result of experience, rejecting all *a priori* knowledge. It arose out of the system of Heraclitus which is elaborately refuted in the *Theætetus* of Plato, and was abhorrent to the lofty idealism of Socrates. Aristotle was an empiricist in so far as experience (*empeiria*) was to him the realisation of the ideal or formal. The philosophy of Descartes established a kind of compromise between one part of knowledge regarded as innate, and another part as empirical or imparted from without. The founder of modern empiricism was Locke, who makes experience the basis of all knowledge, comprehending alike sensation and reflection. Condillac and the other French *philosophes*, rejecting reflection, pushed to an extreme the sensational side of Locke's philosophy, while Berkeley and Hume developed it on other lines to widely differing conclusions. The Common Sense school maintained that the ground of all knowledge was certain primary beliefs or first principles; Kant, on the other hand, found in the *a posteriori* facts of experience the first form of a consciousness which in its ultimate development must become *a priori*. The two elements are inseparably united; thus the *a posteriori* element, the facts, exist for us only under *a priori* conditions. This may almost be said to mark the turning-point of the new philosophy which has demonstrated that the distinction itself is not absolute, or rather that the distinction is itself transcended in the essential unity of knowledge.

The name *empiric* is applied also to one who depends on the accumulations of experience in any branch of knowledge, as in medicine, rather than on the strictly scientific methods of inference and deduction. See, on the one hand, MEDICINE; and, on the other, QUACK DOCTORS.

The term *Empirical Laws* is applied to such as express relationships, which may be merely accidental, observed to subsist among phenomena, but which do not suggest or imply the explanation or cause of the production of the phenomena. They are usually tentative, and form stages in the progress of discovery of causal laws. Bode's law of the distances of the planets from the sun is an example.

Employers' Liability. See FACTORY ACTS, MASTER AND SERVANT.

Em'poli, a town of Italy, in a beautiful and fertile district on the left bank of the Arno, by rail 22 miles WSW. of Florence and 27 E. of Pisa. The collegiate church (1093), with a fine original façade, though the rest of the building was considerably altered in 1738, contains some good paintings and sculpture. Pop. 22,000.

Emporia, capital of Lyon county, Kansas, on the Neosho, a tributary of the Cottonwood River, 61 miles SSW. of Topeka by rail. It has railway-shops and a college. Pop. 11,000.

Empson, SIR RICHARD, the unpopular agent of Henry VII., was the son of a wealthy citizen of Towcester, Northamptonshire, and was trained for the bar. In 1491 he became Speaker of the House of Commons, and in 1504, now a knight, High Steward of Cambridge University, and Chancellor of the Duchy of Lancaster. Throughout Henry's reign he was employed like Edmund Dudley (q.v.) in exacting taxes and penalties due to the crown. His conduct, defended by himself as strictly legal throughout, was by the people regarded as infamous and tyrannical, and in the second year of Henry VIII.'s reign he was convicted of tyrannising and of constructive treason, attainted, and beheaded on Tower Hill with his partner Dudley, 17th August 1510.

Emption. See SALE OF GOODS.

Empye'ma (Gr.), an internal suppuration, a word now applied exclusively to a collection of pus in the pleura. See PLEURISY.

Empyre'an, a word used by the old metaphysical natural philosophers to designate the highest region of light, where the purest and most rarified elements of fire (Gr. *pyr*) existed; and by medieval and modern poets to indicate heaven, the source of light and the home of the blessed.

Empyreuma (Gr. *empyreuō*, 'I kindle'), the burned smell and acrid taste which result when vegetable or animal substances are decomposed by a strong heat. The cause of the smell and taste resides in an oil called *empyreumatic*, which does not exist naturally in the substance, but is formed by its decomposition.

Ems, a river in the north-west of Germany, rises in Westphalia, on the south-west slope of the Teutoburger Wald, flows first in a north-west and then through a moory region in a northern direction, and empties itself into Dollart Bay, an estuary of the German Ocean, after a course of 205 miles. It is navigable as far as Greven (139 miles). In 1818 it was connected by a canal with the Lippe, and thus with the Rhine. A canal uniting the Ems with the Jade was made in 1890, and one connecting the Ems with Dortmund in 1896.

Ems, or BAD EMS, a bathing-place known to the Romans, and celebrated in Germany as early as the 14th century. It is situated on the river Lahn, 10 miles ESE. of Coblenz by rail. Pop. 7500, a number more than doubled by patients. Its warm mineral springs belong to the class containing soda; the only essential difference between the numerous springs is in the temperature, varying from 80° to 135° F., and in the greater or lesser amount of carbonic acid gas contained in them. Here in 1870 Benedetti got his final answer from King William.

Emu (*Dromæus*), a genus of running birds or Ratitæ in the cassowary family. There are two species, both Australian—viz. the Common Emu (*D. novæ hollandiæ*) and the Spotted Emu (*D. irroratus*). They differ from the Cassowaries (q.v.) in several marked features—e.g. the head and neck are feathered except on cheeks and throat, there is no 'helmet,' nor are there wattles on the neck, the bill is broad, and the claws of the three toes are almost of equal length. The emu is a large bird, standing about 6 feet in height. The plumage is like that of the cassowary; the colour is predominantly dull brown, darker on the head, neck, and middle line of the back, lighter beneath. The naked parts of head and neck are grayish-blue, the bill and feet brownish. The young are striped with black. The wings are of course rudimentary, but the legs serve the bird well both in running and kicking.

Common Emu (*Dromæus novæ hollandiæ*).

Timid and peaceful in character, the emu trusts to its speed for safety. It is valued on account of its beef-like flesh, abundant oil, and edible eggs, but is unfortunately being destroyed with too great carelessness. The plains of the interior are now the chief haunts; the food consists chiefly of roots, fruits, and herbage. The note is a curious booming sound. The emu is not polygamous like the Ostrich (q.v.); true pairing occurs. The eggs are placed in a scooped-out cavity in the earth; they have a dark-green shagreen appearance, and measure on an average 4 × 3½ inches. About forty are laid in a summer; the male incubates the first set, and is then relieved by the female, who has by that time finished her laying. The period of incubation is three months. The development was carefully studied by Haswell (Linn. Soc., N.S.W., 1887). The Spotted Emu, restricted to Western Australia, has often bred in captivity or attempted domestication in Britain and elsewhere. Emeu is an older spelling of the name.

Emulsin, or SYNAPTASE, is a peculiar ferment present in the bitter and sweet almond, which forms a constituent of all almond emulsions. When bitter almonds are bruised, and water added, the emulsin acts as a ferment on the amygdalin, and decomposes the latter into volatile oil of bitter almonds, prussic acid, grape-sugar, and water (see ALMONDS, VOLATILE OIL). The vegetable albumen of almonds is almost entirely composed of emulsin, which, when separated, is a white substance, soluble in water, and is distinguished by its remarkable power of causing the fermentation of amygdalin. It consists of carbon, hydrogen, nitrogen, and oxygen.

Emulsion is the term applied to those preparations in pharmacy in which oleaginous substances are suspended in water by means of gum, sugar, carrageen, yolk of egg, &c. The production of these emulsions is often not an easy matter, and requires judgment and skill. In general it will be found that the bulk of the emulsifier must first be taken, while the oil should only be added little by little, rubbing together in a mortar, and taking care that it is completely absorbed or emulsified before further additions. Should too much be added, the effect is to throw out most of what has already been incorporated, and it is then almost impossible to remedy the error. The emulsion of cod-liver oil is probably known to all, but there are many emulsions in which solid substances have to be suspended, and to them the directions above given are not always applicable.

Emys, a genus of Marsh Tortoises, including *E. lutaria*, found in south and middle Europe, North Africa, and south-west Asia. The other species are oriental and American.

Enamel (Fr. *émail;* originally *esmail*, from the same root as *smelt*), the name given to vitrified substances applied chiefly to the surface of metals. Enamelling is practised (1) for purposes of utility, as in making the dial-plates of watches and clocks, coating the insides of culinary vessels, &c.; and (2) for producing artistic designs, portraits, and for ornamental purposes generally. The basis of all enamels is an easily fusible colourless glass, to which the desired colour and opacity are imparted by mixtures of metallic oxides. The mass, after being fused together and cooled, is reduced to a fine powder and washed, and the raw material thus obtained is variously applied to the surfaces to be covered according to the class of enamel being made. The whole is then exposed in a furnace (*fired*, as it is called) till the enamel is melted, when it adheres firmly to the metal. The metal most commonly used as a ground for enamel is copper; but for the finest kinds of enamel-work gold and silver are also used.

Artistic or Ornamental Enamelling.—This art is of great antiquity; it was to a limited extent practised by the Greeks; but enamels were more largely employed by the Romans, under whose dominion the art passed into Gaul and Britain. Enamelling has also been practised from a remote period in the East, Persia, India, China, and Japan, under a separate and distinct development; but there is nothing from which it can be inferred that the various methods were in use earlier than in Europe. As a decoration enamelling was more popular and attained to greater perfection in the middle ages than in classic times. It was extensively practised at Byzantium from the 4th until the 11th century, and afterwards in Italy, in the Rhenish provinces, and at Limoges in the south of France. The Byzantine and other early styles of enamel-work, down to the 14th century, were generally employed in ornamenting objects connected with the service of the church. Enamel was also greatly used in ornamenting jewelry, and vessels made for use or display in the mansions of the rich, such as salt-cellars, coffers, ewers, candlesticks, &c.; but these objects were principally made in the painted

enamels introduced in France towards the end of the 15th century.

Distinguished with reference to the manner of execution, enamel-work may be divided into four kinds: (1) *Cloisonné*, or inclosed, the method of the Byzantine school, in which the design is formed in a kind of metal case, generally gold or copper, and the several colours are separated by very delicate filigree gold bands, to prevent them running into one another. Of this style the grandest example extant is the famous *Pala d'oro* in St Mark's Church, Venice, some portions of which are Byzantine of the 10th century. (2) *Champlevé*, practised by the Rhenish and early Limoges schools. In this process the ornamental design, or the figures which were to be filled in with colour, were cut in the metal (generally copper) to some depth; and wherever two colours met, a thin partition of the metal was left to prevent the colours running into each other by fusion when fired. (3) Translucent enamel, which had its origin and was brought to great perfection in Italy, was composed of transparent enamel of every variety of colour, laid in thin coatings over the design, which was incised on the metal, generally silver, the figure or figures being slightly raised in low relief, and marked with the graver, so as to allow the drawing of the contours to be seen through the ground, instead of being formed by the coarse lines of the copper, as in the early Limoges enamels. (4) Surface-painted enamels, which may be divided into two stages. The first stage, which is known as the late Limoges style, sprang up about 1475, and flourished till 1630. In this the practice was to cover the metal plate with a coating of dark enamel for shadows, and to paint on this with white, sometimes having the hands and other parts of the figures completely coloured. The designs of the middle and best period were generally taken from well-known paintings or engravings of the period, and were strongly influenced by the Italian art of the time. This style soon degenerated, and gave place to the latest or *miniature* style, which was invented before the middle of the 16th century by Jean Toutin, a goldsmith at Châteaudun, and carried to the highest perfection by Jean Petitot, a miniature-painter, who was born at Geneva, 1607, and resided long in England, and then in Paris. On his method the plate is covered with a white opaque enamel, and the colours are laid on this with a hair-pencil, and fixed by firing. The paints are prepared by grinding up coloured enamels with oil of spike, and when fused by the heat, they become incorporated with the enamel of the ground. The earlier enamellers of this school occupied themselves with miniatures, snuff-boxes, watch-cases, and other trinkets, till the period of the Revolution, when the art fell into disuse in France. In England, however, it was carried on with much success; and copies of portraits and pictures on a much larger scale than the French miniatures were executed by Henry Bone (1755–1834), and the German, Karl Muss (died 1824). Works of this description possess the obvious advantage of durability; but those various qualities of texture, and the delicacy of colour for which good works in oil or water-colour are prized, cannot be attained in enamel copies. The greater part of the artistic enamel-work of the present day is of Japanese fabrication, and consists of cloisonné work on a copper basis. Both in Paris and in Birmingham enamel-work of this class has been attempted with success; but designs can be executed in Japan at prices which defy the competition of western traders. In China both cloisonné and painted enamels are made in characteristic Chinese designs. At Jeypore in India a limited quantity of enamel-work on gold is executed in translucent colours which possess incomparable brilliancy. Enamel incrustations of various kinds are very largely used in the jewelry, goldsmith, and silversmith trades of Europe. See H. H. Cunynghame's *Enamelling on Metals* (2d ed. 1906) and *European Enamels;* A. Fisher's *Enamelling upon Metal* (1906); and for enamelled earthenware, see the article POTTERY.

Enamelled Iron.—Since the beginning of the 19th century many attempts have been made to cover iron with a vitreous surface, and several patents have been taken for such methods of enamelling. The chief difficulty in applying enamels to iron arises from the tendency of the metal to oxidise before it reaches the temperature at which the enamel fuses, and to become brittle from the oxide combining with the silica of the enamel. This action being superficial, the mischief is the greater in proportion to the thinness of the iron. Therefore it is much easier to enamel thick cast-iron vessels than thin vessels made of sheet-iron. A glass may be made by combining either silicic acid or boracic acid with a base; the latter fuses at a lower temperature than the former, but the glass is much dearer and not so durable as the silica glass. The enamels used for coating iron consist of a mixture of silica and borax, with various basic substances, such as soda, oxide of tin, alumina, oxide of lead, &c. Lead is not, or ought not to be, used in the enamel for coating culinary vessels.

A great variety of articles, many of them beautifully decorated in colours, such as grate-fronts, clock-dials, panels of different kinds, sign-boards, tablets, and name-plates, are now executed in enamelled iron at a moderate cost. It is also applied to corrugated roofing. The effect of heat on enamelled iron especially is to expand the metal more than the enamel, and cause the latter to peel off. Acids find their way through minute invisible pores, which exist in the best enamel; and when once they reach the iron, they rapidly spread between it and the enamel, and undermine and strip it off. This kind of action is curiously shown by filling an enamelled vessel with a solution of sulphate of copper. The acid attacks the iron wherever pores exist, and little beads of metallic copper are deposited at all such spots; these beads go on growing until they are large enough to be very plainly seen. This is the severest test for trying the continuity of enamelled surfaces to which they can be subjected, as sulphate of copper will penetrate the glaze and body of ordinary earthenware.

The enamel of teeth is the very hard translucent white layer covering the working surfaces of the Dentine (q.v.) or ivory of the teeth of most mammals. See TEETH.

Enara, a lake in the extreme north of Finland, with an area of 550 sq. m. and numerous islands. It discharges into the Arctic Ocean.

Enarea, formerly a kingdom of Africa to the SW. of Shoa, but since the last decade of the 19th century a district or province of Abyssinia. It is a land of forest-clad hills, rising beyond 8000 feet, with their slopes covered with the wild coffee-plant.

Encænia. See COMMEMORATION.

Encalada, MANUEL BLANCO (1790–1876), born in Buenos Aires, studied at Madrid and in the naval academy at Leon, and after deserting from the Spanish ranks, joined the Chilean revolutionary party, and served with distinction both in the artillery and in the navy. Appointed second to Lord Cochrane, he became rear-admiral in 1819, major-general of infantry in 1820, and in 1825 head of the army. He was for two months president

of the republic in 1826, governor of Valparaiso in 1847–52, and minister to France in 1853–58.

Encaustic. See MURAL DECORATION, TILES.

Enceinte. See FORTIFICATION.

Encephalartos. See CYCADS.

Encephalitis Lethargica, a rare disease characterised by a condition of profound physical and mental lethargy. Some degree of fever and constitutional disturbance is usually, but not invariably, present. The lethargic semi-conscious condition of the patient may last for days or for weeks, and is not infrequently fatal. The causation of the disease is unknown. No constant changes have been found in the brain in fatal cases. There is no specific treatment for the disease.

Encephalocele, a tumour projecting through the skull in one of the parts where the bones are incomplete in infancy, and consisting of a protrusion of the membranes of the brain, containing a portion of brain itself. In *meningocele* the membranes only project. The most common situation of such tumours is in the middle line and at the back of the head. Surgical interference is scarcely ever justifiable, and all that can usually be done is to give uniform support to the tumour, and to defend it from injury.

Enchondroma is the term employed in Pathological Anatomy to signify an abnormal cartilaginous growth. These growths most commonly occur in connection with the bones, but they are not unfrequent in some of the glandular structures. See TUMOURS.

Encina, or ENZINA, JUAN DE LA, the founder of the secular drama in Spain, was born about 1469, not far from Salamanca, at the university of which town he was educated. He held successively the offices of secretary to the first Duke of Alva, musical director in Pope Leo X.'s chapel at Rome, and prior of Leon in Spain. He died at Salamanca in 1534. Besides his *Cancionero,* a collection of poems which went through six editions between 1496 and 1516, he wrote in 1521 a poor poetical account of a pilgrimage which he made to Jerusalem two years previously. But his fame rests on the fact that he wrote fourteen dramatic poems (*Representaciones*), half of them of a religious cast, but the other half altogether secular, these last the first of the kind acted in Spain, in 1492. These pieces possess no great merit, being almost destitute of plot, and showing little dramatic structure or spirit. See the edition by Cañete and Baobieri (Madrid, 1891).

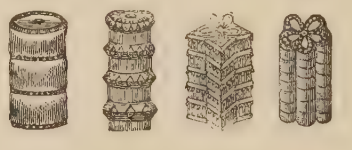
Encke, JOHANN FRANZ, astronomer, was born at Hamburg, September 23, 1791. After studying at Göttingen, he served, during the campaign of 1813–14, in the artillery of the Hanseatic legion, and in 1815 in the Prussian army, as lieutenant of artillery. On the establishment of peace he left the service, and became assistant, and afterwards principal astronomer, in the observatory of Seeberg, near Gotha. In 1825, chiefly at the instigation of Bessel, he was called to Berlin as secretary of the Academy of Sciences and director of the observatory. While at Gotha, the astronomical prize offered by Cotta was awarded to Encke by the judges Gauss and Olbers, for his determination of the orbit of the comet of 1680. This led him to solve another problem, which had been proposed along with the other—viz. the distance of the sun. The solution, by means of the two transits of Venus in 1761 and 1769, is published in two separate tracts (*Die Entfernung der Sonne*, Gotha, 1822–24). In 1819 he proved that the comet discovered by Pons, November 26, 1818, revolves in the hitherto incredibly short period of about 1200 days, and had been already observed in 1786, 1795, and 1805. It has since gone by the name of Encke's comet, and has appeared regularly; the period of its recurrence being 3·29 years, or about $3\frac{3}{10}$ years (see COMET). Encke's researches on this subject are contained in the *Transactions of the Berlin Academy.* In 1830 he undertook to edit the Berlin *Astronomical Almanac,* in which he published a number of astronomical treatises (separately published, 3 vols. 1866). Four volumes appeared of his *Astronomical Observations at the Berlin Observatory* (1840–56). He died 2d September 1865. See his Life by Bruhns (Leip. 1869).

Enclosures. See COMMONS.

Encore ('again'), a French expression, generally used in England by the audience of a theatre or concert-room when requesting the repetition of the performance of a piece of music. It is not used by the French themselves, who, in similar circumstances, exclaim *bis* ('twice').

Encratites. See TATIAN.

Encrinites, fossil Crinoids, often known as stone-lilies. They occur very abundantly, and often seem as thick in a limestone or marble bed as straws in a corn-rick. See CRINOIDS.



Encrinite Stems (Mountain Limestone).

Encrinurus, a genus of trilobites, of Ordovician and Silurian age.

Encumbered Estates Court, created in 1849 to facilitate the sale of encumbered estates in Ireland, and superseded by the Landed Estates Court in 1859, made 3457 sales, producing a sum of £25,190,839.

Encyclical (*literæ encyclicæ*), a letter addressed by the pope to all his bishops, condemning current errors or advising the Christian people how to act in regard to great public questions. It differs from a Bull (q.v.) mainly in that the latter is usually more special in its destination. The famous encyclical, *Quanta Cura,* in 1864, by Pius IX., was accompanied by a *Syllabus* condemning specifically eighty errors in religion, philosophy, and politics. And its aim was revived in that issued by Pius X. in 1907 condemning 'Modernism,' and restoring Aquinas to sole and supreme authority.

Encyclopædia (from the Greek *enkyklios,* 'circular' or 'general,' and *paideia,* 'discipline' or 'instruction') is in modern usage a work professing to give information in regard to the whole circle of human knowledge, or in regard to everything included within some particular scientific or conventional division of it. The character of such works has of necessity varied from generation to generation, with changing conceptions of the scope and value of our knowledge and of the mutual relations of one department with another. An encyclopædia as such cannot rise above the general culture of its time; the medieval encyclopædia will be as medieval in the distribution and perspective of its subjects as in the selecting and presenting of its facts. As knowledge has increased it has become more and more necessary, in order to say something (and the most important something) about everything, to be content not to say everything about anything. And while, in the 10th century, one laborious student might undertake to give the world a conspectus of all that was of worth in its literature and science, a modern work of

similar scope demands the co-operation of hundreds of intellects. The word was first used in the sense of 'the circle of doctrine,' or learning (not a book), by Sir Thomas Elyot in *The Governour* (1531).

Though several of the ancient philosophers of Greece, and notably Aristotle, carried their investigations into every department of inquiry within their intellectual horizon, none of them seems to have compiled exactly what we now call an encyclopædia. Speusippus, indeed, is credited with something of the sort; but his works exist only in fragments. The great Latin collections of Terentius Varro (*Rerum humanarum et divinarum Antiquitates* and *Disciplinarum libri ix.*), dating from 30 B.C., and the so-called *Historia Naturalis* of the elder Pliny (23–79 A.D.), may thus be considered as the first specimens of their class. The 5th century saw the production of a curious and oddly written encyclopædia by Martianus Capella; in the 7th, Isidorus Hispalensis compiled his *Originum seu Etymologiarum libri xx*, which was afterwards abridged and recast by Hrabanus Maurus. Under the calif of Bagdad, Alfarabius or Farabi, in the 10th century, wrote an encyclopædic work, *Ihsa Alulum*—remarkable for its grasp and completeness; but this has hitherto been left in manuscript (a fine copy is preserved in the Escurial). Vincent of Beauvais (Vincentius Bellovacensis), who probably died in 1264, gathered together, under the patronage of Louis IX. of France, the entire knowledge of the middle ages in three comprehensive works—*Speculum Historiale*, *Speculum Naturale*, and *Speculum Doctriniale*, to which an unknown hand soon after added a *Speculum Morale*. About the same time Brunetto Latini was engaged on his *Livres dou Tresor* (printed in Italian in 1474, and in the original French in *Documents inédits*, 1860). The *De proprietatibus rerum* of Bartholomeus de Glanville deserves mention as being of English origin and highly successful in its day. Written about 1240, this became exceedingly popular in the translation (1398) by the Cornishman John Trevisa. In 1541 the name Cyclopædia is first used as the title of a book by Ringelberg of Basel, and in 1559 Paul Scalich styles his work *Encyclopædia seu orbis disciplinarum tum sacrarum tum profanarum.* Among the numerous encyclopædias of the 17th century it is enough to mention Antonio Zara's (Venice, 1615) and Alsted's (7 vols. fol. Herborn, 1630), both in Latin; Moreri's *Grand Dictionnaire historique* (Lyons, 1674), which reached a 20th edition in 1759; Hofmann's *Lexicon Universale* (2 vols. fol. Basel, 1677; 4 vols. fol. Leyd. 1698), which was the first attempt to bring the whole body of science and art under the lexicographic form; Thomas Corneille's *Dictionnaire des Arts et des Sciences* (2 vols. Paris, 1694; and most famous of all, Bayle's *Dictionnaire historique et critique* (4 vols. Rotterdam, 1697), which was mainly designed as corrective and supplementary to Moreri. This last appeared in several English editions generally more or less expurgated or modified, as in that issued at London (10 vols. fol. 1734–41); and J. G. de Chaufepié published a *Nouveau Dictionnaire* as a supplement (4 vols. Amsterdam, 1750). It was in the course of the 17th century that encyclopedists began regularly to employ the vulgar tongues for their work, and to arrange their material alphabetically for convenience of consultation. Of the vast *Bibliotheca Universale*, planned by Coronelli to fill 45 folio volumes, only a small portion saw the light (Venice, 1701–6). The series of great encyclopædic works in modern English practically began by the anonymous *Universal, Historical, Geographical, Chronological, and Classical Dictionary* (2 vols. 1703), and the *Lexicon Technicum* of Dr John Harris (Lond. 1704). Ephraim Chambers followed in 1728 with his *Cyclopædia, or an Universal Dictionary of Arts and Sciences* (2 vols. fol.), which presents a distinct advance in the construction of such works, the author endeavouring to give to his alphabetically arranged materials something of the interest of a continuous discourse by a system of cross references. A sixth edition of this popular work appeared in 1751–52, and a supplement in 2 fol. vols. in 1753. Dennis de Coetlogon published *An Universal History of Arts and Sciences* (2 vols. fol. Lond. 1745). A revised and enlarged edition of Chambers's was published in 1778–88 by Abraham Rees, who, besides incorporating the supplement with the main body of the work, added a large amount of original matter.

It was a French translation, by John Mills, of Chambers's *Cyclopædia* which originally formed the basis of that famous *Encyclopédie* which, becoming in the hands of D'Alembert and Diderot the organ of the most advanced and revolutionary opinions of the time, was the object of the most violent persecution by the conservative party in church and state, and suffered egregious mutilations at the hands not only of hostile censors but of timorous printers. So thoroughly was it identified with the philosophic movement of the time that the term *Encyclopédiste* became the recognised designation of all attached to a certain form of philosophy. Appearing at Paris in 28 vols. between 1751 and 1772, it was followed by a supplement in 5 vols. (Amst. 1776–77), and an analytical index in 2 vols. (Paris, 1780). Voltaire's *Questions sur l'Encyclopédie* (1770) formed a kind of critical appendix. La Porte's *Esprit de l'Encyclopédie* (Paris, 1768) gave a résumé of the more important articles, and under the same title Hennequin compiled a similar epitome (Paris, 1822–23). Numerous editions of the whole work, more or less expurgated or recast, were issued outside of France; and many minor encyclopædias, such as Macquer's *Dictionnaire Portatif des Arts et Métiers* (1766), Barrow's *New and Universal Dictionary of Arts and Sciences* (1 vol. fol. 1753), and Croker, Williams, and Clerk's *Complete Dictionary of Arts and Sciences* (3 vols. fol. 1766), were to a considerable extent quarried out of their massive predecessor, or moulded according to the method expounded by D'Alembert in his preliminary dissertation. In 1780 a privilege was obtained by C. J. Panckoucke for the publication of an *Encyclopédie Méthodique, ou par Ordre des Matières*, which was at first intended to be little more than a rearrangement and supplementing of the matter of Diderot's work; each main subject having a separate 'dictionary' for itself. But its method was too much for it; the scheme, though 166 vols. had been issued by 1832, was never completely realised.

Between 1768 and 1771 there appeared at Edinburgh in 3 vols. 4to the first edition of the *Encyclopædia Britannica*, which was from the beginning a kind of compromise between the alphabetical and the scientific distribution of subjects. Colin Macfarquhar, Andrew Bell, and William Smellie share the credit of the plan. Biographical and historical articles were first introduced in the 2d edition (10 vols. 4to, 1776–1784). The third edition (18 vols.) was completed in 1797; the fourth (20 vols.) in 1810; the fifth, a mere reprint, in 1817. To the sixth edition (1823) Constable, the publisher, prefixed the well-known volume of preliminary dissertations by Dugald Stewart, Playfair, &c. The seventh edition, edited by Macvey Napier, was published by Messrs Black between 1830 and 1842. The eighth (21 vols. and index) appeared 1853–61, under the editorship of Dr Thomas Stewart Traill; and the ninth, edited by Professors Thomas S. Baynes and W. Robertson Smith, was completed in 24 vols. in 1875–88 (Index, 1889). This last

edition was 'pirated' in America by the firm which added a supplementary *Encyclopædia Americana* (4 vols. 1883–89). The ninth edition was reissued in 1898 by *The Times*, exactly as it stood when first printed; and with nine supplementary volumes, new index volume, and maps (1902–3), claimed to be a tenth. The eleventh in 29 volumes was published by the Cambridge Press in 1910–11. With three new volumes (1922) it made the twelfth.

Many notable encyclopædias had meanwhile been appearing—the *Edinburgh Encyclopædia* (18 vols. 1810–30), edited by Sir David Brewster; Wilkes's *Encyclopædia Londinensis* (24 vols. 4to, 1810–29); *Encyclopædia Perthensis* (23 vols. 1816); the *Encyclopædia Metropolitana* (30 vols. 1818–45), arranged, according to a philosophic plan by Coleridge, in four divisions: (1) pure sciences, (2) mixed and applied sciences, (3) biography and history, and (4) miscellaneous and lexicographic articles; the *Penny Cyclopædia*, edited by Charles Knight for the Society for the Diffusion of Useful Knowledge (29 vols., 2 supplemental, 1833–46); and the *English Cyclopædia* (22 vols. 1853–61; a synoptical index, 1862; four supp. vols. 1869–73), founded on the copyright of the *Penny Cyclopædia*, but rearranged into four divisions—viz. geography, natural history, biography, and arts and sciences. In spite of the value of much of its material, this last encyclopædia, like Panckoucke's vast enterprise and Coleridge's ingenious scheme, furnished another proof that no encyclopædia can well be thoroughly popular which is not executed on the plan of a single alphabet. It is partly their rigid adherence to this method that has given their success to the popular German encyclopædias.

The encyclopædia now known as Brockhaus's *Konversations-Lexikon*, which was started by Löbel at Leipzig in 1796, and passed into the hands of F. A. Brockhaus in 1808, gave a great impetus to the production of similar works. It is still one of the most popular of German encyclopædias (new ed. 17 vols. 1908–10). Its principal rivals are Pierer's, and Meyer's *Konversations-Lexikon*. The former (1822–36, 26 vols., with 14 supplemental vols. 1840–56) reappeared in 12 vols. in 1888–93; while the latter has become in completeness and compression the best work of its kind (1st ed. 15 vols. 1857–60, with yearly supplements; 7th ed. 12 vols. 1924 *et seq.*). In all a free use is made of maps, tabular conspectuses, woodcuts, and lithographic illustrations. The Brockhaus *Lexikon* became the basis or model of encyclopædias in most of the civilised languages of Europe—Spanish, Italian, Danish, Swedish, &c.—amongst those in English *Encyclopædia Americana* (14 vols. 1829–46); *New American Cyclopædia* (16 vols. 1858–64), edited by Ripley and Dana (new ed. 16 vols. 1873–76); and *Chambers's Encyclopædia* (10 vols. Edin. 1860–68, edited by Dr Andrew Findlater; new ed. recast and rewritten, 10 vols., edited by Dr David Patrick, 1888–92, and revised from time to time; new ed. 1922 *et seq.*). Others are the *Harmsworth Encyclopædia* (8 vols. 1905), prepared by Messrs Nelson, and reissued as Nelson's in America (12 vols.) and in Britain (25 vols. 1911–12); Johnson's *Illustrated Universal Cyclopædia* (4 vols. N.Y. 1874–78; new ed. 8 vols. 1890–95); the (American) *International Encyclopædia* (1884; partly based on Chambers's; new ed. 1922); the *Globe Cyclopædia* (1879); the *National Encyclopædia*; Blackie's *Modern Cyclopædia*.

Notable modern French works are Pierre Larousse's *Grand Dictionnaire du XIX^e^ siècle* (15 vols. 4to, 1866–76, with three supplements); *Le Nouveau Larousse* (7 vols. 1901–4); and Berthelot and Dreyfus, *La Grande Encyclopédie* (31 vols. 4to, 1886–1903).

Among all European encyclopædias (and a few only have been mentioned; for every leading language could furnish a list) one stands out as a unique example of protracted production. A defect inherent in the constitution of every large encyclopædia brought out in successive volumes is that, as regards literature and the progressive sciences, the earlier portions are passing out of date before the later portions have come into existence. This characteristic is almost caricatured in the famous *Allgemeine Encyclopädie der Wissenschaften und Künste*, which was originally undertaken by Professors Ersch and Gruber in 1818, continued slowly to appear in three several sections of the alphabet, and remains incomplete. There have appeared some 170 parts, many of them containing the most elaborate monographs on individual subjects to be found in literature. An encyclopædia of the sciences to extend to perhaps 1000 volumes, in 40 sections, systematic, not alphabetic, was begun in 1910 under the editorship of Professor Toulouse. A copy of the great Chinese cyclopædia in 5020 Chinese volumes (6109 general headings), printed at Peking in 1726 by command of the Emperor Kang-Hi, reached the British Museum in 1878. *The Great Standard of Yung Lo*, an encyclopædia begun in 1408, and extending to 11,100 vols. (each 1½ inches thick), perished, with the library that contained it, in the attack on the legations at Peking in 1900, the only other copy having been destroyed by fire in Nanking in 1644. A few volumes survive.

An attempt to remedy the defect of protracted production has frequently led to the issue of supplemental volumes, planned so as to bring up the earlier articles to the same time-level as the later articles (notably Brockhaus's, Meyer's, and Appleton's *American Cyclopædia*).

In contrast with the larger encyclopædias may be mentioned the modern attempts to boil down the circles of the sciences into portable form, as in the abridgments (in 1 to 3 vols.) of Brockhaus and Meyer. Similar productions are Beeton's Dictionaries and several 'Young Folk's' Encyclopædias, English or American.

The modified term 'cyclopædia' is sometimes used in the same sense as encyclopædia, and sometimes restricted to a work dealing with one subject —for which encyclopædia is now also in use. Thus the *Encyclopædia Biblica* (4 vols. 1899–1903) deals with Biblical and theological subjects, as the Hauck-Herzog *Realencyklopädie* (22 vols. 1906–9) does with theology. There are also a great *Catholic Encyclopædia* (15 vols. and supplement, 1907–22) and a *Jewish Encyclopædia* (12 vols. 1900–7), encyclopædias of law, medicine, &c. *The Teacher's Encyclopædia* (1911) deals with educational matters, and there is an *Encyclopædia of Religion and Ethics* (1908 *et seq.*), edited by Dr Hastings. But many such works—e.g. Hastings's *Dictionary of the Bible* (5 vols. 1898–1904), a *Dictionary of Political Economy* (3 vols. 1894–98; new ed. 1923 *et seq.*), edited by Sir R. H. I. Palgrave, and Grove's *Dictionary of Music* (4 vols. 1878–90; re-edited in 5 vols. by J. A. Fuller-Maitland, 1904–10)—even when equally comprehensive in scope, are content with the less lofty title.

Encyclopédistes, a group of French *philosophes* of the 18th century, leaders in the enlightenment, believers in reason, with deistic or materialistic tendencies, enemies of ecclesiastical absolutism, so called from their connection with the *Encyclopédie* (see ENCYCLOPÆDIA) of Diderot (q.v.) and D'Alembert (q.v.). See also BUFFON, GRIMM (F. M.), HOLBACH, ROUSSEAU (J. J.), and Morley's *Diderot and the Encyclopædists*.

Encystment, in biology, is the formation of a resistant sheath on passing into a resting stage. See CELL, and for examples AMŒBA, GREGARINIDA.

Endecott, JOHN, colonial governor of Massachusetts, was born at Dorchester, England, in

1589, and landed as manager of the plantation of Naumkeag (Salem) in 1628. Giving place in 1630 to John Winthrop, he headed a sanguinary expedition against the Indians in 1636, was deputy-governor in 1641–44, 1650, and 1654, and governor in 1644, 1649, 1650–53, and 1655–65. Endecott was an austere Puritan, choleric, benevolent, and brave. He died at Boston, 15th March 1665.

Endemic (from Greek *en*, 'among,' and *dēmos*, 'people'), a term applied to diseases which affect numbers of persons simultaneously, in such a manner as to show a distinct connection with certain localities. Endemic diseases are usually spoken of as contrasted with Epidemic (q.v.) and Sporadic (q.v.). The term endemic indicates that the disease affects habitually, in greater or less numbers, the population within certain geographical limits; while a disease is called epidemic when at times it breaks out and spreads without reference to locality; and, on the other hand, it is regarded as sporadic if it occurs in isolated cases only. Many diseases which are capable of transmission from one human being or one animal to another are at times epidemic, for longer intervals endemic, and at times are kept in existence only by the occurrence of occasional or sporadic cases. For example, cholera and plague, which at times have swept across Europe in devastating epidemics, are constantly endemic in certain cities of India. Smallpox, which at the present day is endemic in many parts of China, has, in the past, at frequent times broken out in serious epidemics. The disease known as cerebro-spinal meningitis is at times epidemic among troops or in certain districts, and again for long periods occurs only at rare intervals in scattered sporadic form.

The causes which make a disease cling to certain localities in endemic form, or which effect its change from endemic to epidemic character, are various. Not all endemic diseases are transmissible from person to person. Some peculiarity of the soil or water or the amount of sunshine may render a disease common among a certain people or in a given valley, while others a little way off are immune.

Goitre is one of the most marked examples of endemic disease occurring here and there all over the world, usually in deep valleys and on elevated plains—e.g. in Derbyshire, in Switzerland, and in the Himalayas—while localities not far removed from these are free. The cause has been assigned to the drinking of water rich in magnesia and lime, but this theory will not explain the fact that similar water is constantly drunk in many districts free from the disease. Devonshire colic is an old example of endemic disease brought on by mineral poisoning in certain districts, in this case due to lead occurring as an impurity in cider. Similar endemic diseases due to the habits of life followed in certain areas are found in the lead-poisoning of the Staffordshire earthenware workers and the 'grinder's phthisis' of the Sheffield cutlers.

In other cases the endemic character of the malady is determined by the presence of some insect which conveys the material of the poison. Malaria, yellow-fever, and sleeping sickness belong to this latter group of endemic diseases, and in these instances the occurrence of the disease is sharply limited to certain woods, swamps, river valleys, or tracts of country infested by the particular species of insect. In the case of malaria the poison causing the disease is of a protozoan nature, and is carried by the *Anopheles* mosquito, in the body of which it undergoes development. Yellow-fever, due to a poison of undetermined nature, has been proved to be transmitted from sick to healthy by the *Stegomyia* mosquito. Both of these diseases are eradicable or controllable by measures directed against the mosquito, such as drainage of swamps, removal of decaying vegetation, and the like. It is by these means that the Panamá Canal Zone, formerly the home of these diseases, has been rendered habitable by the white man.

Still other diseases are limited in their distribution because the disease is common to man and some lower animal, such as the house rat in the case of plague; the disease therefore may be limited to particular districts or even quarters of a city where these animals inhabit, and the sudden development of an epidemic character in the disease may be due to migrations of the affected animals. A similar relationship between man and animals explains the fact that many diseases due to animal parasites are endemic in limited areas.

Leprosy, and in a less degree tuberculosis, are examples of chronic disease of microbic origin which are of greater frequency in some parts of the globe than others. Thus leprosy, while practically unknown in Britain, France, and Germany, is endemic in Norway, Southern Russia, and Turkey, and is still more common in tropical countries of the East. In the case of this disease, the reason why it should be endemic in some places and not in others is still undetermined.

Enderby Land, on the Antarctic Circle, near the middle of the 'Enderby Quadrant' (0° to 90° E. long.), was discovered by John Biscoe in 1831, on a whaling voyage, and named in honour of his employer, Samuel Enderby, an adventurous London merchant, grandfather of Chinese Gordon. His fleet of whalers first rounded the Horn, and actually opened up the Southern Ocean, discovered the Auckland Islands, and carried the first batch of convicts to Botany Bay. Biscoe, from stress of weather and extreme cold, could not approach Enderby Land within 20 or 30 miles, and was thus unable to say whether it was an island or a strip of continental coast.

Endicott, JOHN. See ENDECOTT.

Endive (*Cichorium Endivia*), an annual or biennial plant, of the same genus with Chicory (q.v.), has been in cultivation since classic times as a garden vegetable, its blanched leaves being much used as a salad. The green-curled variety is the staple one, the white-curled is good for summer and autumn, and the broad-leaved is used for stews and soups. In Britain the seed is usually sown from the middle of May to the end of June, and by a little care and protection plants may be kept fit for use throughout most of the winter.

Endlicher, STEPHEN LADISLAS, a systematic botanist, was born at Pressburg, 24th June 1804. He was destined for the priesthood, but in 1827 commenced botanical and linguistic studies, and in 1840 he became professor of botany in Vienna. Much disturbed by the events of 1848, he fell into melancholy, and in 1849 put an end to his own life. His *Genera Plantarum* (1836–40) has had great influence on succeeding botanists.

Endocarditis, disease of the internal surface of the heart, resulting in the deposit of fibrin upon the valves. See HEART (DISEASES OF).

Endocarp. See FRUIT.

Endocrine Glands, or DUCTLESS GLANDS, are organs of internal secretion. See GLANDS, HORMONES, and articles on the various glands.

Endoderm. See EMBRYOLOGY.

Endogamy. See MARRIAGE.

Endogen, Lindley's disused name for Monocotyledons (q.v.). See also DICOTYLEDONS, BARK, DRAGON-TREE.

Endomorph, a mineral inclosed within another, the latter being a *perimorph*. Such inclusions

are very common in the constituent minerals of crystalline schistose and igneous rocks.

Endophagy. See CANNIBALISM.

Endosmose. See OSMOSE.

Endy'mion, a youth in Greek Mythology, celebrated for his perpetual sleep on Mount Latmos, in Caria. His beauty warmed the cold heart of Selēnē (the moon), who came down to kiss him and lie by his side. Different reasons were given for his sleep, the most general as well as the most poetic being that Selēnē had sent him to sleep that she might kiss him without his knowing. The story inspired the fresh fancy of the young Keats, who shaped it into an imperishable poem.

Enema. See CLYSTER.

Enemy. According to the doctrine of the civil law, as formulated by Ulpian (Digest, 49, 15, 24), those only are enemies 'who have publicly declared war against us or we against them.' In the earlier ages of the Roman republic such a declaration was most solemnly made to the foreign state by the *feciales*, a college of priests who acted as guardians of public faith, and was attended by elaborate religious rites. The various ceremonies accompanying the declaration of war are described by Livy (book i. 24). So now, in order to constitute an enemy, there must exist between duly organised governments a state of war, the commencement of which must be preceded or accompanied by some form of public declaration. The most authoritative statement of the existing law is contained in the rules formulated at The Hague Convention in 1907, which provide that hostilities 'must not commence without a previous and explicit warning in the form of either a declaration of war, giving reasons, or an ultimatum with a conditional declaration of war;' and that 'the existence of a state of war must be notified to the neutral powers without delay, and shall not be held to affect them until after the receipt of a verification, which may, however, be given by telegraph.' In the Great War these rules of The Hague Convention were observed by the belligerents, although hostile acts are alleged to have been committed by both French and German troops before war was formally declared. These rules do not exclude a surprise attack, for they do not prescribe that any period of time shall elapse between the notification and the commencement of hostilities. Where a conditional declaration of war is made by presenting an ultimatum to be accepted within a given time, a state of war commences on the expiry of the time mentioned, if the demands of the ultimatum are not accepted.

The commencement of war immediately affects the position of the citizens of the belligerent states. The principle is that the subjects of an enemy state are themselves enemies. The right to recover debts from, and the liability to be sued by, enemy subjects are suspended during the war. Commercial intercourse with the inhabitants of the enemy country is prohibited, and, under the law of Great Britain, such intercourse, except with the license of the crown, is illegal. In ancient times the property of alien enemies residing within the hostile state might be confiscated, and their persons could be seized. But the usage of nations for a long period has modified this stern rule of the ancient law. It is provided in Magna Charta that, upon the breaking out of war, foreign merchants found in England, and belonging to the country of the enemy, should be 'attached without harm of body or goods' until it should be known how English merchants were being treated in the country of the enemy; 'and if our merchants,' says the charter, 'be well intreated, then theirs shall be like.' The statute of staples, 27 Edw. III. chap. 17, made a still more liberal and precise enactment in favour of such foreign merchants residing in England. Forty days were allowed them, after the proclamation of war, to remove from the kingdom themselves and their goods, and if by reason of accident that time were not enough, forty days more were to be conceded to them. Modern usage allows to alien enemies, who are not combatants, either active or reservists, in the enemy forces, a reasonable time to withdraw from the territory of the hostile state on the outbreak of war. Enemy subjects who are permitted or compelled to remain in the territory of the belligerent state may have restrictions put upon their freedom. Thus by the Aliens Restriction Act, 1914, and the Orders in Council made under that act, many restrictions were imposed during the recent war on enemy subjects resident in this country. These restrictions took various forms, such as internment, registration and surveillance, removal from specified districts, and prohibitions against the possession of certain articles, ranging from firearms to pigeons and cipher codes. The old practice of confiscating on land the property of enemy subjects, whether resident in the territory or not, is obsolete.

In determining 'enemy' character there are two tests, the national and the territorial. When the question is as to a man's personal rights—e.g. whether he is liable to be interned, or whether he may live in a prohibited area—the main test is nationality. On the other hand, when the question is as to his rights as a party to a contract or as a litigant, the main test is territorial, that is to say, the place in which he resides or carries on business. If he is voluntarily resident, or carries on business, in enemy territory, he is an alien enemy for purposes of trade and litigation, whatever his nationality may be. The question as to the circumstances in which an enemy character is to be attributed to a corporation received much consideration during the recent war. A corporation or company *primâ facie* takes its national character from the country in which, and under whose laws, it is incorporated; but the judgment of the House of Lords in *Daimler Co.*, 1916, 2 A.C. 307, established that, if the agents of a company or corporation, or the persons who are *de facto* in control of its affairs, are 'enemies,' the company or corporation is in the position of an enemy. The national status of individual shareholders does not of itself affect the national character of the company; but the enemy status of individual shareholders and their conduct are elements to be considered in determining whether the agents of the company are in fact adhering to, taking instructions from, or acting under the control of, enemies.

In modern times certain general rules have been laid down for the purpose of regulating the rights of offence and defence, and setting limits to the violence permissible against enemies. In 1874 an international conference held in Brussels devoted much time to the elaboration of rules for military warfare. The most authoritative statement of the existing rules on this subject is contained in the 'regulations' annexed to The Hague Convention of 1907, which amended the provisions of the Declaration of Brussels and of the Convention of 1899. The laws of war, as there enunciated, prohibit, *inter alia*, the use of poison or poisoned weapons; the killing or wounding of an enemy who has surrendered; the use of arms, projectiles, or substances likely to cause unnecessary suffering; and any destruction or seizure of enemy property not imperatively called for by military necessity. Any compulsion of the population of occupied territory to take part in military operations against their country is forbidden; and

neither requisitions in kind nor services can be demanded from the inhabitants, except for the needs of the army of occupation. The Hague regulations, while recognising military necessity as a legitimate element for consideration, were intended to prevent a belligerent from having recourse at discretion to such a plea. The German Official Instructions on the usages of war on land, however, treated The Hague regulations with scant respect, and set up military necessity as the governing factor in the operations of war. (These Instructions are translated, with a critical introduction, by J. H. Morgan—*sub nom.*, *The German War-Book.*) In the Great War the application of the military usages laid down by Germany in these Official Instructions aroused the indignation of the civilised world.

Experience during the recent war has demonstrated that the international code of rules, which seeks to control, and impose limitations on, the conduct of military operations, is the weakest part of international law. The existence of rules, which are not observed and cannot be enforced, only serves to discredit the law. A renewal of the attempt to establish rules for the control of hostilities cannot be more successful in the future than it has been in the past, unless unity of international action is secured and an effective sanction is found for the enforcement of rules which are formulated by international agreement. The application of science to warfare, the progress of invention, and the increasing efficiency of aircraft, submarines, bombs, poisonous gases, and other instruments of destruction, will inevitably render war in future more intolerable than it has been in the past. The very nature of war is altering; for war tends more and more to become not merely a conflict between opposing armies or navies, but a contest in endurance between the whole organised societies of the belligerent states. It seems certain that, if wars are permitted to continue, the sufferings of the civilian populations from blockade, bombardment, and other military operations will be vastly greater even than those undergone in the late war. The hope of mankind lies not in devising rules for controlling the methods of warfare, but in founding an international order which will prevent the recurrence of war between civilised states. For other information on the rules and usages of war, reference is made to the articles CONTRABAND OF WAR, BLOCKADE, NEUTRALITY, PRIZE, PRISONERS OF WAR, GENEVA.

Energumen. See DEMONOLOGY.

Energy. The term *energy* as applied to a material system is used to denote the power of doing work which is possessed by that system. There is no manifestation of energy apart from matter. In consequence of this, matter is sometimes defined as the vehicle or receptacle of energy. A bullet projected vertically upwards possesses a great amount of energy; it can do work in overcoming obstacles to its motion. But the higher it rises the less resistance can it overcome; and at last, having reached the greatest height it can attain, it seems incapable of doing work. Yet it is not really incapable of doing work. It will gradually acquire speed in the downward direction, and will finally (the resistance of the air being neglected) reach the ground with the same speed as it had at first, and is thus capable of doing the same amount of work. Therefore, when at its highest position and seemingly incapable of doing work, it really possessed energy as at first. Hence we are led to recognise two leading types of energy —energy of *motion* and energy of *position;* or, as they are usually called, *kinetic* energy and *potential* energy. We have many examples in nature of both types. Currents of air or of water possess kinetic energy; a stone resting on the brow of a cliff, and water at the edge of a fall, possess potential energy.

But although energy may be classed under one or other of these two types, there are many forms in which it is manifested. There is energy of *visible motion* and energy of position in *visible arrangements* of bodies, as in the bullet moving upwards or downwards, or at rest at its highest position. A bent spring evidently possesses potential energy. An oscillating pendulum possesses alternately kinetic energy and potential energy. At the extremity of its swing the energy is entirely potential; at the middle of its range the energy is entirely kinetic; at intermediate positions it is partly of one kind, partly of the other. *Heat* is another form of energy. The particles of a hot body are in rapid motion, and the hotter the body the more rapid is the motion. The motion is on an invisibly small scale, but it can be communicated to other matter in such a way as to produce visible motion. Thus the invisible motions which constitute heat are applied in the steam-engine or air-engine to produce visible motion of a piston, and so to perform mechanical work. When Heat (q.v.) becomes *latent* in a body, part at least of the energy is spent in overcoming molecular forces, and the relative distances of the molecules of the body are altered; and so we have potential energy stored up in the molecules. Again we have the so-called *radiant energy*—energy propagated by means of undulations through the ether. This includes light as well as radiant heat, the two differing merely as regards wave-length. So also it includes the electro-magnetic waves recently experimentally demonstrated by Hertz, the wave-length of which may be many feet, or even miles, instead of $\frac{1}{40000}$ of an inch as in orange-coloured light. Vibrations in the particles of a hot or luminous body are communicated to the ether, and propagated by wave-motion through it at the rate of 186,000 miles per second. In the ether, therefore, the energy is partly potential, partly kinetic (see ETHER). There is also energy of *chemical separation.* Carbon and oxygen combine in the burning of ordinary fuel, and the energy which they contain in their separated state is used to produce mechanical work, as in the steam-engine; and in the explosion of gunpowder visible energy of motion is produced even more directly from the energy of chemical separation of the constituent substances. We have also potential energy of *electrical separation,* for if two conductors be charged with electricity, one positively and the other negatively, an attraction between them becomes apparent. In approaching each other the charged bodies can be made to do work. Again, when we have *electricity in motion* in a conductor, we have another means of producing work. The current of electricity produces heat and also tends to produce motion of other conductors in which electric currents flow. The attraction or repulsion between magnets can also be made to produce work, and so also we can get work from the mutual action between magnetised bodies and conductors in which electric currents flow.

Thus we see that energy may be manifested to us in a number of different forms; but as we do not yet know the ultimate nature of matter or of electricity, we cannot assert that the forms which we have just considered are all essentially distinct. It is not impossible that the energy of chemical separation is due to electrical separation, or that energy resulting from magnetisation is due to motion of electricity.

In the above remarks we have spoken not only of the production of work from energy, but of the

production of one form of energy from another, and of the passage of potential energy into kinetic energy. This change of energy from one form to another is known as the *Transformation of Energy*, and distinguishes it from matter. While matter is passive or inert, energy is continually in process of transformation—indeed we are cognisant of energy only in virtue of its change. We should never know that a moving cannon-ball possessed energy if we did not see its destructive effects; we should never know that electrified clouds possessed energy did we not see damage done by lightning.

Of the transformation of energy a few examples must suffice. We cause carbon and oxygen to combine in the furnace of a steam-boiler, or hydrogen and oxygen to combine in the cylinder of a gas-engine. This produces invisible motion of molecules, which in turn produces visible mechanical motion of the piston and connected mechanism. This motion may be communicated to a 'dynamo,' causing conducting wires to move in a magnetic field. Thus electric currents are produced in the wires. These currents may produce heat in, and cause radiation from, a highly resisting carbon filament. Or they may produce magnetic effects, and finally mechanical motion, in a motor. Thus energy may be applied by means of the dynamo and motor to the production of mechanical work in a place where it would not be easy to use an engine directly.

In the case of the telephone, the condensations and rarefactions of the air (which produce sound when they impinge on the ear) cause vibrations of the telephone diaphragm. As this motion occurs in the near neighbourhood of the pole of a magnet, electric currents of varying intensity and direction are produced in a coil of wire surrounding the pole. These currents pass round the magnet of the receiving telephone, and produce magnetic effects similar to those occurring at the sending instrument. Therefore similar mechanical effects are caused, and so like sounds are heard.

In the voltaic battery energy of chemical separation is transformed into energy of current electricity. The electric current may be passed through slightly acidulated water. The water is thus broken up into its constituents, so that energy of chemical separation is again obtained.

Many other examples of the transformation of energy might be given, but it is sufficient to remark that any form can be directly or indirectly transformed into any other form. A matter of greatest importance to us is the determination of the sources or source from which ultimately we derive mechanical work. The work obtained from animal labour is derived from the chemical energy of the food supplied to the animal. This food is vegetable food either actually or ultimately; for, even if it be actually animal, the energy of such food is ultimately traceable to the vegetable world. Now all vegetables grow by means of solar radiation, which decomposes carbonic acid in their tissues, so that energy obtained from animal labour is obtained actually from the sun. And if we use fuel in an engine, the energy of the fuel is in the same way due to the sun. If we use wind-power to drive our machines, the energy is also solar, for it is the sun which causes the atmospheric currents. So also the work obtainable from moving water, except in the case of tidal currents, is due to the heat radiated from the sun. Thus the sun is the great source of our energy; and, if he ceased to supply us with it, we could no longer produce work, except indeed in so far as he has already supplied us with a store in potential forms.

We have already stated that the energy of a material system is sometimes exhibited in one form, sometimes in another, but this statement may be greatly extended. If no energy leaves the system, and if no new energy enters it, the quantity which disappears from one form reappears entirely in another. This is known as the principle of the *Conservation of Energy*. In the case of the bullet projected upwards, the potential energy in the highest position would be the exact equivalent of the original kinetic energy, if none were communicated to the air or other bodies. The same would hold in the case of the pendulum, if no energy were given from the system to the air or the supporting arrangement. [At one time the expression conservation of *force* was used instead of conservation of *energy*, but the word 'force' meant then what we now call 'energy.' The conservation of force, as we now use the word, means something totally different. See FORCE.]

The law of conservation of energy may be stated as follows: The total amount of energy in a material system cannot be varied, provided the system neither parts with energy to other bodies nor receives it from them. This law is merely a generalisation from observed facts; a single known exception would cause us to abandon or modify the statement. But the amount of positive proof in favour of the law is now exceedingly great, perhaps the strongest proof being afforded by the accuracy of scientific predictions founded upon the assumption of its truth. As an example, we may refer to the prediction of the lowering of the freezing-point of water by pressure. The assertion of the principle of conservation of energy is equivalent to a denial of the possibility of the 'Perpetual Motion' (q.v.).

In a scholium to his third law of motion, Newton asserts that 'if the action of an external agent is estimated by the product of its force into its velocity, and the reaction of the resistance in the same way by the product of the velocity of each part of the system into the resisting force, arising from friction, cohesion, weight, and acceleration, the action and reaction will be equal to each other, whatever be the nature and motion of the system.' Now the product of a force into the velocity produced by it is simply the rate at which the force does work. Hence, as was first pointed out by Thomson and Tait in their work on Natural Philosophy, this statement of Newton's is almost a complete statement of the principle of conservation of energy. Newton did not know what becomes of work spent in overcoming friction; he believed that it disappeared from the system. Had he known that it was converted into an exact equivalent in the form of heat, his statement would have been complete. It was not until long after Newton's time that Heat (q.v.) was recognised to be a form of energy. The experiments of Rumford and Davy first led to this result. Rumford's experiments were made in 1798 and 1799, on the work done, and the heat produced, in the boring of cannon. He concluded that heat must be due to motion. Davy's experiments on the melting of ice by friction were also made about the same time, but it was not until 1812 that he came to the conclusion that 'the immediate cause of the phenomenon of heat is motion, and the laws of its communication are precisely the same as the laws of the communication of motion.' From data given by Rumford, it may be calculated that 940 foot-pounds of work are necessary to produce heat sufficient to raise the temperature of one pound of water by 1° F.—the foot-pound being the work done in raising a pound through one foot against gravity. The researches of Colding and Joule, however, have given a far better determination of the mechanical equivalent of heat; and Joule's experiments, especially, extend to many forms of energy, and prove their exact

equivalence. His experiments on the heating of water by friction gave results varying from 770 to 774 foot-pounds as the *mechanical equivalent* of heat. His final result was 772, the possible error being much less than 1 per cent. Many indirect methods have also been used by Joule and others. Thus, the mechanical equivalent may be directly determined by observing the quantity of heat developed during the passage of an electric current of known intensity through a conducting wire of known resistance. The result for heat being assumed, it is easy to find the work-equivalent of other forms of energy. Thus, we can determine the equivalent in work of the energy of chemical separation—e.g. by dissolving zinc in sulphuric acid, and observing the heat developed. If the zinc be dissolved in a voltaic cell which is producing a current, heat is evolved in the various parts of the circuit in proportion to their resistance. Thus, by placing in the circuit a wire of great resistance, almost all the heat will be developed in the wire, and so may readily be measured. Again, by making the current produce work through the agency of an electro-magnetic engine, the work may be directly measured, care being had to take account of energy lost in the process by friction or otherwise. Less heat is developed in the circuit in proportion as the work done is greater, the total energy being constant. So, by expending work in driving a magneto-electric machine, we may find the work-equivalent of electric energy. As the electric energy ultimately becomes heat, Joule used this method in one of his determinations of the quantity of heat produced from a known amount of work.

We have seen that we can neither increase nor diminish the total quantity of energy in the universe, while any one form of it may be changed into any other; but we have made no inquiry as to whether or not all forms are equally transformable. The question is obviously of vital importance to us; for, if one form be less transformable than the rest, when we change any other kind into this one, we shall not be able completely to retransform it. Thus there will be a tendency for all forms to be reduced to this more permanent form, and we shall not be able so readily to obtain mechanical work from it. Lord Kelvin first pointed out that there is in nature a universal tendency to this *Dissipation* (or, as it has since, and perhaps preferably, been called *Degradation*) *of Energy*. The final form which all energy tends to take is that of heat. But heat tends continually to diffuse so as to equalise temperature; and, when there is no difference of temperature between the source and condenser of a heat-engine, no work can be obtained from it, for the amount of work which can be obtained from a given quantity, H, of heat (see THERMODYNAMICS) is $JH\frac{T - T_0}{T}$, T and T_0 being the absolute temperatures of the source and condenser respectively, while J is the mechanical equivalent of heat. Obviously $JH\frac{T_0}{T}$ is the quantity of energy lost for useful purposes so far as this engine is concerned. This shows that all the amount of heat supplied cannot be transformed into work, unless the condenser be at the absolute zero of temperature. If we take as our source of heat in one case a cubic foot of some metal at a given absolute temperature, and in another case two cubic feet of the same metal containing together the same quantity of heat as the one cubic foot formerly contained, and therefore at half the temperature provided the specific heat be constant, it is obvious, from the above expression, that twice as much heat will be lost in the second case as in the first. Hence, we see that heat at low temperature is much less useful than the same quantity of heat at high temperature. And a corresponding statement is true for other forms of energy. Thus, if we have two Leyden jars alike in every respect, and charge one with a certain quantity of electricity, we can get a certain amount of work from the arrangement, which is made evident by the loudness of the sound and the brightness of the flash on discharge. But if we first divide the original charge between the two jars, and then discharge them, we can only get half the amount of energy. The reason is that the potential is only one-half of what it was in the first case; and the higher the potential of a given quantity of electricity is, the greater is the amount of work it can do, just as the usefulness of heat depends upon temperature. In fact, if V be the potential of the charge E in the first case, $\frac{1}{2}$ VE is the energy; but in the second case the charge of each jar is $\frac{1}{2}$ E, and the potential of each is $\frac{1}{2}$ V, so that the energy in each is $\frac{1}{8}$ VE, the total amount being therefore $\frac{1}{4}$ VE, or only half of the original energy. The remaining half is accounted for by the energy spent in dividing the charge—light, sound, and heat being produced. Again, work may be obtained by letting compressed gas expand; and the amount of work depends upon the pressure. The gas may be allowed to expand without doing work, but energy will be dissipated, for the expanded gas, being at less pressure, cannot do so much work as it could do before expansion.

Examples of the degradation of energy are everywhere seen in nature. The fact that the optical image of a body is less distinct than the object itself is due to the fact that some of the so-called radiant energy is absorbed by the reflector, and takes the form of heat. The vibrations of a tuning-fork die down because the energy is communicated to the surrounding air, but they also diminish because of the production of heat from internal friction in the vibrating body. The stilling of storms is accompanied by dissipation of energy. Possibly starlight is weakened in its passage through the ether. Indeed, no instance of transformation of energy can be pointed out in which there is not also dissipation of energy.

As we have already remarked, since all forms of energy tend to take the form of heat, and since heat is constantly tending by conduction and otherwise to equality of temperature, it follows that, unless the universe be infinite, energy will ultimately become useless for the production of work. The total amount of energy will, in accordance with the principle of conservation, be the same as at first, but any transformation of it will be impossible. There are two ways in which we may regard the energy of a given system; we may regard it from without the system, or from within. When we speak of the total energy of a system, we regard it from the outside. Thus, if we consider a thermal system, the total energy is the work which could be done by the heat in passing from the system to its surroundings, these being supposed to be constantly at the absolute zero of temperature. But the available energy (called in this case the *thermo-dynamic motivity*) is usually regarded as the greatest amount of work which can be obtained by equalising the temperatures of its various parts amongst themselves. [The motivity might, of course, also be regarded from without. In this case it would be the quantity of work obtainable by reducing all the parts of the system to some definite temperature.] The available energy of the universe, supposed finite, will therefore ultimately be zero. The energy of relative motion of its parts tends, in virtue of friction, to take the form of heat. Though we have no direct confirmation of the statement, yet we may conclude from analogy that the relative

motion of the planets and of all heavenly bodies tends to cease. Thus, ultimately, potential energy of gravitating matter must become kinetic energy of visible motion, and then heat; so that the universe will at last contain only one huge material body rotating about its centre of inertia, and the rotation too must cease in time. And even the molecular motions must largely cease, being communicated to the ether. All this is, of course, pure speculation. We might even, if we considered it profitable, speculate further with Rankine and others as to the possibility of the restoration of the availability of energy. If the universe be finite we may have reflection of radiant energy from its boundaries. A material body coming into a focus might be instantly vaporised, the radiant energy becoming again high-temperature heat.

The second law of Thermodynamics (q.v.) is essentially a statement, for the case of heat and mechanical work, of the principle of the dissipation of energy. Its proof, as given by Lord Kelvin, depends upon the assumption that we cannot produce work from heat which is entirely derived from the colder of two bodies used as the source and condenser of a heat-engine. On an excessively small scale heat does pass in nature from a cold part of a body to a hot part, so as to increase the difference of temperature. In an excessively small portion of a gas, the quicker moving particles may be found in one part and the slower moving particles in another, even although the motion was uniform at first. Similarly, by moving in portions of the sides of a vessel containing gas when no particles were impinging upon them, we could increase the motivity of the system without doing work. As this is practically impossible, we see that the truth of the second law of thermo-dynamics depends essentially upon the extreme smallness and the great number of the particles of a body; so that, in the case of the gas, the motivity is increased only because work is done in compressing the gas which takes the form of heat, and is then removed from the system. Thus, while there is increase of motivity of the energy of the system, there is degradation of external energy.

If at any instant the motion of every particle of matter in the physical universe were reversed, the dissipation of energy would cease. Available energy would increase, for everything would occur over again exactly as in past time, but in the reverse order. This increase of availability would, however, only last until the configuration which existed at the commencement of the present order of things was reached, when dissipation of energy would again occur. This reversal of motion might occur in a system containing a very few particles, but we must regard it as an impossibility in the physical universe as a whole.

See the articles in the present work on THERMODYNAMICS, HEAT, LIGHT, ELECTRICITY, RADIUM, FUEL, &c. On the subject of the preceding article, see Tait's *Recent Advances in Physical Science* (1876) and *Thermodynamics* (1877); Balfour Stewart's *Conservation of Energy* (1880); Clerk Maxwell's *Heat* (1875); and recent works on Radio-activity.

Enfantin, BARTHÉLEMY PROSPER, one of the chief representatives of the Saint-Simon school of Socialism, was the son of a banker in Paris, where he was born 8th February 1796. He went to the Ecole Polytechnique in 1812, but having joined the pupils who left school and fought against the allies on the heights of Montmartre and St Chaumont, he was expelled in 1814. Enfantin saw Saint-Simon only once, and apparently joined the school about the time of the death of the master in 1826. After the July revolution of 1830 Enfantin associated himself with Bazard for the active propagation of Saint-Simonism. Bazard expounded it in its relations to philosophy and politics; Enfantin mainly in its relations to the social state. Soon, however, a schism broke out between the two on the question of marriage and the relation of the sexes. Enfantin recognised two sorts of marriage, one permanent, to suit steady and constant temperaments, the other changing and temporary, to suit the lively and mobile. A theory so subversive of social order led to the intervention of the government. The 'Supreme Father' (as his disciples were wont profanely to call him) was, in 1832, sentenced to two years' imprisonment and to a fine of 100 francs. Being released at the expiration of a few months, Enfantin went to Egypt for a time. He was subsequently appointed a member of the Scientific Commission for Algiers, and on his return from Africa wrote a sensible, interesting book, entitled *Colonisation de l'Algérie* (Paris, 1843). After the revolution of 1848 he edited the journal entitled *Le Crédit Public*. He afterwards held an important situation on the Lyons and Mediterranean Railway. He died August 31, 1864. That Enfantin was endowed with very extraordinary powers of fascinating and managing men is shown by the influence he exercised over a numerous body of clever and enthusiastic disciples. His plans for the construction of the Suez Canal paved the way for the great project later realised by Lesseps. The principal works of Enfantin are his *Doctrine de Saint-Simon*, in conjunction with others (1830); his *Traité d'Économie Politique* (1831); *La Religion Saint-Simonienne* (1831). An edition of the collected works of Saint-Simon and Enfantin (Paris, 1865 *et seq.*) extended to 40 volumes (17 of them Enfantin's).

Enfeoffment. See FEOFFMENT.

Enfield, an urban district of Middlesex, 12 miles by rail N. of London, with a population of over 60,000, is the seat of a government small-arms factory. See RIFLES. Charles and Mary Lamb lived for a time in Enfield before removing to Edmonton.

Engadine, a famous valley in the Swiss canton of the Grisons, and one of the loftiest inhabited regions in Europe, extends north-east for about 65 miles along the banks of the Inn and its lakes, from the foot of Mount Maloja to the village of Martinsbruck. It is divided into two portions—that toward the south-west, called the Upper Engadine, and that toward the north-east, the Lower Engadine. The latter is the more wild and bleak; but the Upper Engadine, although it is more open, and possesses fine meadow-lands, has also an inclement climate throughout, except in the extreme south-west. In the Lower Engadine, abutting on Italy, a Swiss national park for the complete preservation of natural life was established in 1919. The Inn has many villages upon its banks, the highest of which, St Moritz, is 6090 feet above sea-level, while the lowest, Martinsbruck, is 3343 feet. Most of these villages have of late years become, as health and pleasure resorts, clusters of inns. The influx of many strangers has altered many of the old habits of the people; but, though no longer the nearly invariable rule, it is still not uncommon for the young men to betake themselves to the large towns of the Continent, whence they return, with the little fortune gained as confectioners or waiters, to end their days in their cold, lovely valley. The people are almost all of the Reformed or Calvinistic Church. The language most generally spoken is Ladin, a Romance tongue, differing from the other Romance dialects of the Rhætian Alps, and bearing a resemblance to Italian.

Engagement, THE, between Charles and the Presbyterians. See NEWPORT.

Engelhardt, Johann Georg Veit (1791–1855), professor of Theology at Erlangen, wrote a church history (1834) and a history of dogma (1839).

Engels, Friedrich, socialist, was born 28th November 1820, the son of a Barmen manufacturer, and while conducting a branch of his father's business at Manchester wrote his work on the condition of *The Working Classes in England* (1844; new ed. 1892; trans. N.Y. 1887). He is best known as the friend, colleague, and continuator of Marx (q.v.; and see Socialism), and author of works on the family (1884); Feuerbach's philosophy (1888); and on the development of Socialism (4th ed. 1891). In 1850–69 again at Manchester, he subsequently lived mainly at London, and died 5th August 1895. See Life by Bernstein (1896).

Enghien, (1) a summer resort of the Parisians, 7 miles N. of Paris, on a small lake, with five sulphur-springs; pop. 6000.—(2) A manufacturing town in the Belgian province of Hainault; pop. 5000.

Enghien, Louis Antoine Henri de Bourbon, Duc d', only son of the Duc de Bourbon, was born at Chantilly, 2d August 1772. In 1792 he entered the corps of *émigrés* assembled by his grandfather, the Prince of Condé, on the Rhine, and commanded the vanguard from 1796 until 1799. At the peace of Lunéville, in 1801, he went to reside at Ettenheim in Baden. When the Bourbon conspiracy, headed by Cadoudal, Pichegru, &c., against the life and authority of Bonaparte, was discovered at Paris, the latter chose to believe that the Duc d'Enghien was privy to it, and unscrupulously resolved to seize the person of the duke. On the night of the 14–15th March 1804 the neutral territory of Baden was violated, and the duke, with two attendants, was captured, and carried prisoner to Strasburg, and thence to Paris and Vincennes. On the early morning of 20th March he was tried before a military commission, consisting of eight officers, and after a five hours' examination was condemned to death. Half-an-hour later, between four and five, he was shot in the castle moat, and buried in the grave already dug for him. So cruel and audaciously criminal an act has fixed a deep stigma on the character of Bonaparte. M. Dupin published the records of the trial, and showed the illegality of the proceedings of the military commission. This illegality was publicly acknowledged by General Hullin, the president of the court. Thiers as far as possible exculpates Bonaparte, while Lanfrey adopts the most adverse verdict, and Welschinger lays much of the guilt on Talleyrand. Fouché said that it was worse than a crime—it was a blunder. See *Le Duc d'Enghien*, by Welschinger (1888; new ed. 1913); his *Correspondence* (1904–10); and *The Cambridge Modern History* (vol. ix. 1906).

Engine. See Dynamo-electric Machines, Internal-combustion Engine, Steam-engine, Steam Turbine, &c.

Engineering, the business of the engineer, is the art of designing and superintending the execution of works of a constructive character, such as roads, railways, bridges, canals, harbours, docks, works for supplying water to towns, drainage and sewerage works, as also the working of metals and the making of machinery.

The duties of the military engineer are defined in the next article. The civil engineering profession is subdivided into several sections. The railway engineer projects and superintends the execution of railways and all the works in connection with them, such as the alteration of roads and streams, the construction of viaducts, bridges, cuttings, and embankments. The hydraulic engineer plans and superintends the works connected with the supply of water to towns, irrigation, drainage, the protection of low lands from inundation, and the use of water as a motive-power. The dock and harbour engineer has the management of all works connected with the sea or navigable waters, such as the construction of piers, breakwaters, docks, harbours, and lighthouses.

The mechanical engineer is principally concerned in the manufacture of machinery, the working of metals, the construction of ships, steamers, cannon, and all the various structures in which the metals bear a prominent part. The marine engineer makes parts of ships, and the machinery in ships and boats; or he takes charge of an engine on board ship. Then there are mining engineers, who discover minerals and manage mines; sanitary engineers, who are specially engaged in the drainage of towns; and electric engineers and many other less prominent divisions of the profession. Any one who tends an engine is also called an engineer. In many engineering works the *contractor* takes a very important part; he executes the works from the designs, and under the direction and superintendence of the civil engineer, and on his ability and good management the success of undertakings very materially depends.

Among the most notable of the engineering works belonging to very remote antiquity are the pyramids of Egypt. The rude stone monuments of the north, as at Stonehenge and Carnac, also testify to some engineering skill. The harbours and temples of ancient Greece are very memorable. The buildings of ancient Rome—its theatres, temples, baths, and aqueducts, its roads, bridges, and drainage-works, vie in extent and magnificence with the most celebrated works of modern days. From classical times down to the commencement of the 18th century the most extensive works executed were the canals, embankments, and other hydraulic constructions used by the Dutch for the purposes of inland navigation, and to protect their low lands from the sea; the canals of North Italy; and the cathedrals and fortifications of medieval Europe.

Civil engineering, as a distinct *profession*, may be said to have originated, in England, about the middle of the 18th century; since that time the improvements in the steam-engine by James Watt, its subsequent application to the railway-system by George Stephenson, and its use in navigation have given a great impulse to commerce and civilisation. Among celebrated engineers are the Stephensons, Rennies, the Brunels, Telford, Smeaton, Ericsson, Eads, Krupp, Fairbairn, Armstrong, Siemens, Bessemer, Fowler, and Baker.

The education of engineers should embrace a fair knowledge of pure mathematics, and of the mixed sciences of natural philosophy, such as mechanics, hydrostatics, hydraulics, and optics, as also of drawing and arithmetic. The principal society of engineers in Britain is the Institution of Civil Engineers, established in 1818, 'for facilitating the acquirement of professional knowledge, and for promoting mechanical philosophy.' There are now everywhere colleges and schools in which engineering is a special study.

The more important operations in engineering, and the most famous triumphs of the art, are treated of under such heads as Aqueduct, Breakwater, Bridge, Canal, Dock, Harbour, Internal-combustion Engine, Lighthouse, Mining, Railways, Road, Shipbuilding, Steam-engine, Strength of Materials, Traction-engines, Water. For machinery, see also the articles on Printing, Weaving, Spinning, Metallurgy, and the other arts and trades discussed in this work.

Engineers, The Corps of Royal, formed in 1763, is an important branch of the British army. A similar organisation exists in all regular armies. The duties devolving upon military engineers

include the design, construction, and maintenance of fortifications. In war, the nature of their duties may be judged from the units into which the corps is divided—5 field troops, 16 field companies (these two, of which the former move with the cavalry, have the very active duties entailed by close relation with the fighting troops, entrenching, bridging, preparing localities for defence, road-making, hutting, demolitions, water-supply, and all operations requiring technical skill), 3 bridging 'trains,' 3 balloon companies, 14 telegraph companies (airline, cable, and wireless), 1 search-light company, 3 railway companies, 31 fortress, with 9 depot or training companies at Chatham and 1 in India, 2 survey companies. The numbers date from before the Great War, during which there was a vast increase. The field company has a *personnel* of 215, with 73 horses. The men, who are called sappers, are enlisted, for the most part, with a previous knowledge of some handicraft of a kind likely to be useful, and they receive 'engineer' pay in addition to ordinary pay. The duration of colour service and reserve service varies in the different branches, but the two together amount to 12 years.

In India, the rank and file of the 'sappers and miners' are Indians, commanded by British officers, and the units (28 companies) correspond to those at home.

Except those of the coast battalion and the quartermasters, who rise from the ranks, all officers pass through the Royal Military Academy or Royal Canadian Military College (see COMMISSION), and begin their career by a special course at the School of Military Engineering at Chatham, the headquarters of the corps. There are also, for later instruction, the balloon school and the electric-lighting schools at Portsmouth and Plymouth. They receive 'engineer' pay besides their ordinary pay, and often hold, especially in India in the Public Works and other departments, posts which carry large salaries, irrespective of their army rank. Promotion is by length of service, up to the rank of major, and is not dependent on a vacancy.

At the War Office there is an Inspector of Royal Engineers, and officers of the corps are to be found in most departments of army headquarters (see ARMY ADMINISTRATION). An assistant-adjutant-general has charge of 'personal services,' that is, of the officers of the corps. The Ordnance Survey is carried out by the Royal Engineers, the chief office being at Southampton. The special reserve (see ARMY) and the territorial engineers are 'Royal' engineers. The former has 2 siege companies, 3 railway companies, and about 100 unattached officers. The Territorial Force has over 100 companies, comprising all the varieties, details of which can be found in the official Army List (q.v.), and a large number of unattached officers. Australia, New Zealand, and Canada have their companies, &c., of Royal Engineers, and Hongkong, Singapore, and Ceylon have engineer volunteers. See Major-General Whitworth Porter's *History of the Corps of Royal Engineers* (2 vols. 1889).

Engineers, in the Royal Navy, are the class of officers who attend and manage the machinery on board vessels of war. On the first introduction of steam into the service engineers were obtained from private engineering establishments, or from merchant-steamers, and their exact status was undefined and ambiguous. In 1847 and 1848 their position became more recognised, and the higher grades were raised from the rank of *warrant* officers to that of *commissioned* officers of a civil branch. This introduced a higher class of men into the navy. At the present day the use of steam and electricity for every purpose has so enormously increased in warships that the engineers' position has become one of the first importance, and high emoluments, with enhanced rank, have induced some of the ablest men to serve afloat. Till 1903 the grades were those of chief-inspector of machinery, inspector of machinery, fleet-engineer, staff-engineer, chief-engineer, engineer, and assistant-engineer, ranking with colonel, lieutenant-colonel, major, captain, and lieutenant in the army respectively. All these commissioned officers were strictly examined before admission; their rank and promotion being by selection, and dependent on skill, character, &c. For many years engineer officers had been dissatisfied with their position as non-executives in view of the growing importance of their duties and the largely increased engine-room staff under their orders, over whom they could exercise no executive control. In order to settle the difficulty the Admiralty at the end of 1902 brought out an order altering completely the whole system of entry and training of naval officers, including the engineers. Under this system (as has been said at NAVY) all officers for the executive and engineer branches of the navy enter under identical conditions as naval cadets between the ages of $13\frac{5}{12}$ and $13\frac{9}{12}$, and are educated and trained together until passing as sub-lieutenants. The next stages of their education are as indicated at NAVY; and when they have been to sea for three years, and been confirmed as sub-lieutenants, they are distributed between executive and engineer branches. As far as possible they are allowed to choose which branch they will join; but at the time of the entry of cadets, parents or guardians must undertake for them that they are prepared to serve in any branch if required. Sub-lieutenants of the engineering branch go through a special course at Keyham, at the end of which they are eligible for promotion to the rank of Lieutenant (E), and may rise to the rank of Rear-admiral (E). During the transition period following on the introduction of the new system the Admiralty granted executive titles to the engineer officers then on the lists, and arranged that they should be known as Engineer-lieutenants, Engineer-commanders, and so on; and, from 1st January 1915, they were classified as part of the military branch of the navy. Under the scheme of pay introduced in 1919 for naval officers, the salaries of engineer officers of old and new styles were made the same.

Engis, a cave beside the Meuse, near Liége. The much-discussed Engis skull, found there by Schmerling in 1833, is now thought to be Neolithic.

England is the southern, the largest, and by far the most populous portion of Great Britain, the largest and most important of European islands. Separated from Belgium, Holland, Germany, and Denmark by the North Sea, from France by another 'streak of silver sea,' the Channel, and from Ireland by the Irish Sea, the kingdom of England has a land frontier of about 120 miles towards Wales and 70 miles towards Scotland. In shape it forms an irregular triangle, of which the eastern side measures in a straight line about 350 miles, the southern 325 miles, the western 425; but its shores are so deeply indented by bays and estuaries as to make the coast-line longer in proportion to the size of the land than in any other country but Scotland and Greece.

England has for hundreds of years been one of the leading powers of Europe, one of the great moving forces of the world, and, through her colonies, a veritable mother of nations; but her area is relatively very small. The area of the British Islands (121,700 sq. m.) is but $\frac{1}{186}$th of the surface of the world. The colonies and dependencies of the empire of which England is the centre cover a fifth of the land-area of the globe. England,

with an area of 50,874 sq. m., is considerably less than half the size of Rumania (122,282 sq. m.), less than a fourth of France (212,659 sq. m.), and is but little larger than the single state of New York (49,170 sq. m.); it is not a fifth of the size of Texas (265,896 sq. m.); and, indeed, twenty-eight of the states in the Union are each larger than England; several, in fact, much larger than the whole United Kingdom.

Her name 'this noble realm of England' owes to the *Engle* or Angles, who with the kindred Jutes and Saxons (*Seaxe*) descended on the greater part of what used to be known as Albion or Britain (see BRITANNIA), and conquered and occupied it in the 5th and following centuries (see ANGLES, ANGLO-SAXON). These kindred peoples all learned to call themselves *Englisc* or English, and by *Englaland* they understood the whole area now occupied by them—an area which in the 7th century extended over more than the half of the island, from the Forth to the English Channel. South-eastern Scotland, as occupied by the Angles, and not by Saxons or Jutes, was in the stricter sense English; and the people of the non-Celtic parts of Scotland, though now markedly differing from the southern English, are in blood and in mental and physical type at least as English in the wider sense as the people of Oxford or Kent. Political circumstances led the English and Anglicised Celts of North Britain beyond Solway and Tweed to become the subjects of the alien Scottish king, but their language they still called *Inglis*, as distinguished from the Erse of their Scottish or Gaelic fellow-countrymen.

The people of England constitute nearly three-fourths of the inhabitants of the British Islands; the English language in some form is that of all but a small minority; English literature is the common inheritance of the whole; the constitution and polity of England, slightly modified, is the British constitution under which the three kingdoms unitedly became glorious, and has been the original model for the free constitutions of all free peoples the whole world over. Hence it is not strange that not only by Englishmen, but also by many foreigners, the name of England is frequently used to designate not merely Great Britain and sometimes the British Islands, but even on occasion the entire British empire.

The physical features, as also the geology, of the British Islands are obviously so closely connected that it is convenient to treat of them collectively under the heads of GREAT BRITAIN and of IRELAND. General facts which concern the three kingdoms jointly are separately discussed under such heads as AGRICULTURE, ARMY, COLONIES, COUNTY, EDUCATION, EMIGRATION, NAVY, PARLIAMENT, RAILWAYS, &c. Here, on the other hand, some of the facts distinctive of England, which admit of being succinctly stated, may well be noted.

The area of England is 50,874 sq. m., so that, as the area of the British Islands, with Scotland, Wales, Ireland, Man, and the Channel Islands, is 121,700 sq. m., England alone covers about 42 per cent. of the whole. The population of England in 1650 is estimated to have been about 5,000,000, the increase up to that date having been slow. In 1750 it was probably 6,000,000. From that date the increase was rapid; in 1821 the population of England was 11,281,957; in 1831, 13,090,615; in 1841, 15,002,443; in 1851, 16,921,888; in 1861, 18,954,444; in 1871, 21,495,331; in 1881, 24,614,001; in 1891, 27,483,551; in 1901, 30,807,310; in 1911, 34,045,290; in 1921, 35,678,530. At the census of 1881, the population of England was 69·8 per cent. of the total population of the United Kingdom (35,241,482). England in 1921 made up about 76·6 per cent., or some three-fourths of the total population (47,307,601, Irish figures being for 1911). The density of the population in England is greater than in any other corresponding European state except Saxony. In 1921 it was for England 701 per sq. m.; whereas for Scotland it was only 164 (in Saxony in 1919 it was 807). In England there were, in 1921, 43 towns with more than 100,000 inhabitants (in 1881, 20 such towns), in Scotland only 4, in Ireland 2. In England there were 96 above 50,000, in Scotland 11, in Ireland 3. At the census of 1921 the population of England, and of the administrative counties separately (including county boroughs within their boundaries) was as follows:

Counties.	Area in statute acres (land and inland water).	Population.
Bedfordshire	302,942	206,478
Berkshire	463,830	294,807
Buckinghamshire	479,360	236,209
Cambridgeshire	315,168	129,594
Cheshire	657,950	1,025,423
Cornwall	868,167	320,559
Cumberland	973,086	273,037
Derbyshire	650,369	714,539
Devonshire	1,671,364	709,488
Dorsetshire	625,612	228,258
Durham	649,244	1,478,506
Ely, Isle of	238,073	73,778
Essex	979,532	1,468,341
Gloucestershire	805,842	757,668
Herefordshire	538,924	113,118
Hertfordshire	404,523	333,236
Huntingdonshire	233,985	54,748
Kent	975,965	1,141,867
Lancashire	1,194,555	4,928,359
Leicestershire	532,779	494,522
Lincolnshire—		
The Parts of Holland	263,355	85,225
The Parts of Kesteven	469,142	108,237
The Parts of Lindsey	972,796	408,643
London	74,850	4,483,249
Middlesex	148,692	1,253,164
Monmouthshire	349,552	450,700
Norfolk	1,315,064	504,277
Northamptonshire	585,148	302,430
Northumberland	1,291,515	746,138
Nottinghamshire	540,123	641,134
Oxfordshire	479,220	189,558
Peterborough, Soke of	53,464	46,954
Rutlandshire	97,273	18,368
Shropshire	861,800	242,959
Somersetshire	1,037,594	465,682
Southampton	958,896	910,333
Staffordshire	741,318	1,349,225
Suffolk, East	557,353	291,006
Suffolk, West	390,916	108,982
Surrey	461,833	930,377
Sussex, East	530,555	532,206
Sussex, West	401,916	195,795
Warwickshire	605,275	1,390,092
Westmorland	504,917	65,740
Wight, Isle of	94,146	94,697
Wiltshire	864,101	292,213
Worcestershire	458,352	405,876
Yorkshire, East Riding	750,115	460,717
Yorkshire, North Riding	1,362,058	456,312
Yorkshire, West Riding	1,773,529	3,181,654
York, City of	3,730	84,052
Total	32,559,868	35,678,530

The climate of Britain is insular and comparatively equable, milder on the whole than that of any region on the same northern parallel (see CLIMATE), with smaller extremes of heat and cold, with colder summers and warmer winters. England is milder than Scotland, and though moist compared with continental countries, less moist than Ireland. In spite of its dull skies and frequent rains, it was wisely said by Charles II. that the English climate 'invited men abroad more days in the year and more hours in the day than any other country.'

The situation of Britain has been shown to be in the very centre of the land-masses of the globe, a very great advantage for commerce and navigation; England, being nearer the European shores,

enjoys the advantage in higher measure than its sister-kingdoms. Its seas are less stormy, and it has a greatly more developed system of navigable rivers.

The north-west of England is mountainous and hilly, the east and south mainly a plain crossed by lines of low hills. The fertility of England is much greater than that of Scotland or Ireland, especially that of the wheat-bearing area of eastern England. The agriculturally productive area of England is estimated at 80 per cent. of its total, and of Wales 60 per cent., whereas that of Scotland is only 28·8 per cent., and of Ireland 74. England, whose surface has been said for variety to be an epitome of Europe, is very rich in minerals, of which coal and iron are incomparably the most important, making nine-tenths in value of the whole.

The people of England, as of other parts of the British Islands, are varied in physical character. Long skulls prevail to a much greater extent than among the neighbouring continental peoples. Besides the Nordic type, the Mediterranean is found, as well as intermediate long-heads. Some of these last, no doubt, result from crossing of Nordic and Mediterranean, but it is contended that others represent an undifferentiated long-headed population that has persisted from Aurignacian times. In the Neolithic and Bronze Ages immigrant broad-heads appear. Such were the beaker-folk or round-barrow men, who came probably from Galicia and Upper Silesia just before the Bronze Age began; the short-cist people; and perhaps a late Bronze Age Alpine people led by long-headed lords with leaf-shaped swords (see CELTS). Among Iron Age new-comers were the Belgæ, probably tall, fair, moderately broad-headed people. The Roman Conquest brought many new elements. The Angles, Saxons, Jutes, Danes, and Northmen were mostly tall, fair, and long-headed. Some broad-heads came in with the Conqueror; and since then peaceful immigration of all sorts has combined with other influences—industrialism, town-life, colonial enterprise, &c.—to modify the compound.

What is certain is that out of these various stocks a well-marked people has been formed, strenuous, self-reliant, resolute in defence of its rights, daring, laborious, industrious, and ambitious. Its essential character, with marked modifications, it has transmitted to the great daughter-nation of the United States, and to the colonies of Britain. And this race it is which has given its language and in part its institutions to over 150 millions of the world's inhabitants, and with the help of its Scottish and Irish kinsfolk has created for its and their offspring a glorious heritage in English literature. England became the classic land of liberty, where the power of the state, based on ancient precedent, was developed so as least to infringe on the freedom of the individual—a development sketched in the succeeding history, and continued on similar lines in the United States.

England became also the special home and headquarters of agricultural enterprise, mineral production, machine-making of all kinds and steam-power, of commerce, navigation, and shipping. England did not start in the race of commerce as early as many of those who are still her rivals. Long after France, Flanders, and parts of Germany were great manufacturing centres, England was an agricultural and pastoral country, wool its chief production and staple export. The woollen goods for its own use were mostly manufactured abroad. Edward I. did much to encourage such trade as there was in opening English ports to foreign merchants, and Edward III. induced many weavers, dyers, and fullers from Flanders to settle in England. In the 14th century woollen cloth was manufactured at Bristol, London, and Norwich, and began to be exported. Linen and silk weaving became of some importance. Coal was exported from Newcastle to France in 1325; but it was later ere English cutlery was known abroad. Great progress took place in Elizabeth's reign. The reign of William III. marked a new era, for the immigration of French refugees after the revocation of the Edict of Nantes in 1685 soon told on the quality and amount of English manufactures. But the great and rapid advance which made the commerce and manufactures of England the wonder of the world dates from the latter half of the 18th century, and was largely owing to the unparalleled development of machinery, the use of steam as a motive power, improved communication, and later, steam-navigation and railways.

It is very observable that the local distribution of the great industries of England has changed very greatly since the 17th century. At the Revolution period, most of the greater towns of England were in the south and east; but these have now been long outstripped by northern rivals, and what were then important manufacturing towns have in many cases sunk into mere villages. After London, the chief towns were Bristol and Norwich, each with some 29,000 inhabitants. Exeter with 10,000 was probably equalled by York. Worcester and Nottingham may be set down at 8000; while Leeds had but 7000, Manchester hardly 6000, Birmingham, Sheffield, and Liverpool perhaps less than 4000. Now English manufacturing industries have most of their special seats in the north. If we draw a line from the mouth of the Severn to the Wash, we find that to the south-east there are hardly twenty towns, not seaports or suburbs of London, which have a population exceeding 25,000; to the north-west of the line there are about a hundred inland towns of that size. It is very significant that all the coal of England is found north of the line named, about or near the populous money-making towns.

In no way can a better conception be formed of the state of England at different periods than from the works of topographers, foreign visitors, &c., such as Leland and Camden for the 16th century; Drayton and Fuller for the 17th; Defoe, Pennant, Pococke, Moritz, and Young for the 18th; Cobbett, Emerson, Hawthorne, Esquiros, Taine, Kohl, and Burroughs for the 19th. See also Escott, *England: her People, Polity, and Pursuits* (1879; 2d ed. 1886); W. Cunningham, *Growth of English Industry* (1882; 4th ed. 1905); *Social England*, edited by Traill (1893-96); H. de B. Gibbins, *Industry in England* (1912); G. H. Perris, *Industrial History of Modern England* (1920); Beddoe, *Races of Britain* (1885); Fleure, *Races of England and Wales* (1923).

HISTORY OF ENGLAND.

Though the history of England cannot properly be said to begin till the 5th century, when the Teutonic tribes who have given the country its name established themselves in the island, it is of some importance to understand the condition of the people whom they supplanted. There can be little doubt that, speaking generally, the inhabitants of the island when conquered by the Romans were of Celtic origin. They were not indeed entirely homogeneous; two distinct branches of the Celtic language were spoken, the Gauls of France are mentioned by Cæsar as having exercised authority over the island, the Belgæ had certainly established themselves there, and certain tribe-names lead to the belief that men of Teutonic origin had already formed settlements. The island lying at the extremity of Europe had probably formed a natural refuge for tribes driven from their own lands, and a natural prey of those in search of new homes.

But on the whole there can be little question that the population was Celtic. It had passed beyond the age of barbarism, and when Claudius determined to complete the conquest which Cæsar's temporary raid in 55 B.C. had foreshadowed, some sort of general confederacy was in existence, a king of the name of Cunobelin reigned at Camulodunum, near Colchester, and the existence of not less than forty varieties of his coins bear witness to the greatness of his influence and the comparative civilisation of his rule. His son, Caractacus, and, eleven years later, Boadicea, queen of the Iceni, opposed a long and terrible resistance to the Roman arms; but the arrival of Agricola in 78, and his eight years of wise government, brought the country at length into the condition of a Roman province. The conquest of the whole island was, however, never completed. It seemed good to the Romans to limit their successes, and to attempt by great defensive works to exclude from their dominions the still unconquered Celts of the north. Lines were erected between the Firths of Forth and Clyde, and between Bowness and the mouth of the Tyne. The intermediate district was a scene of constant warfare, both lines were from time to time strengthened, and the more southern of the two changed during the 4th century into the great Roman Wall (see HADRIAN'S WALL). Within this limit the occupation of the country was complete. For two centuries it was probably merely a military occupation, and at no time does it appear that there were more than 20,000 Roman soldiers in the province; but as time passed on it appears certain that the influence of the conquerors became largely felt. Towns, the remains of which still exist, were built, bringing with them of necessity the close intercourse of trade, and numerous traces of villas in many parts of the country show the spread of peaceful Roman life. It was the policy of Rome in its provinces to debar the middle classes from the use of arms, and though possibly, as in India at present, the native nobles and princes were allowed to keep in some degree their rank, it was under the shelter of the Roman legionaries that civilisation advanced, and upon their prowess that safety from the threatened encroachments of unconquered Celts or marauding Teutons was secured. It is impossible to say how far civilisation had extended, or how far the language had been influenced by the Roman occupation. The close resemblance of many common agricultural terms, of the names of plants, and so on, to Latin words would lead to the belief that the language was Latinised. On the other hand, local names, the names of woods, mountains, and rivers, are largely Celtic. It seems not improbable that both high civilisation and Roman speech were chiefly concentrated along the great roads, and round the cities and stations with which these were lined.

The disturbances of the empire, and the danger which threatened it from the pressure of the outlying barbarians, compelled in 411 the withdrawal of the legions; and the half-Romanised inhabitants who had learned to rest on the support and valour of their conquerors were left to their own resources to withstand the unconquered Celts of the north, now known as Picts, and their piratical allies the Irish Scots. The movement of the barbarians had affected the people on the borders of the North Sea; the Jutes from Jutland, the Angles from Sleswick, the Saxons from Holstein and the neighbouring coasts were covering the sea with their expeditions. Summoned to the assistance of the civilised Britons, a party of Jutes found means to establish themselves in Kent. It was an example readily followed. Before the year 600 Saxons and Angles had formed settlements extending as far northward as the Forth. About that year the various princedoms may be regarded as merged in two considerable and rival powers, Northumbria and Kent; while a third, Wessex, fated ultimately to devour the other two, lay along the south, at present interested in extending its power westward. It still remains a question whether the invaders destroyed the conquered inhabitants or not. On the strength of certain expressions in the chronicler Gildas it has been held that no quarter was shown; but it is more probable that, as in other cases of conquest, the invaders settled down in the midst of the conquered population, content to rule as manorial lords over their own free followers and the slaves and dependents of their predecessors.

It was long before the various settlements of the Saxons were fused into one. Long before political union was reached, the unity of the people found expression in a single Christian church. While the powers of Northumbria and Kent were still balanced, the marriage of the king of Kent with a Frankish princess offered an opportunity for the evangelisation of the country. Augustine and his fellow-missionaries landed in Thanet in 596, and, well received by the king, found a home in Canterbury. A similar circumstance brought Christianity to the north; a Kentish princess married to Edwin of Northumbria took with her Paulinus, and established Christianity in York. The change of religion went near to destroying the Northumbrian power. Heathenism found a champion, and Penda, uniting the central tribes into the kingdom of Mercia, for a while established his supremacy over Northumbria, and drove the Roman priesthood to flight. The gap thus left was supplied by the devoted missionaries of the Celtic Church settled in Lindisfarne. But the restoration of the Northumbrian power was fatal alike to heathenism and to the Celtic Church. After the Council of Whitby in 664, the Roman Church regained predominance, and was organised in a single archiepiscopal see by Theodore of Tarsus, holding his appointment from Rome. After the fall of Penda, the supremacy of the northern kingdom was unquestioned, till some sixty years later it gave way to Mercia. About the year 800, however, both Mercia and Northumbria had to yield to the third power. Egbert, king of Wessex, who had seen something of centralisation in the court of Charlemagne, during the thirty-six years of his reign gradually brought under his power all the English kingdoms, whether Anglian or Saxon, and continuing the hereditary struggle of his people with the British populations, established a permanent superiority over all England, with the exception of the Britons north of the Dee.

But already an enemy had made its appearance to which the newly centralised kingdom was to yield. The Danes, issuing from the Scandinavian coasts, had before the death of Egbert begun to harry the country. At first as robbers, then as settlers, and finally as conquerors, for two centuries they occupy English history. During the reign of Ethelred their incessant but isolated incursions assumed the form of an invasion, East Anglia passed into their hands, and their leader, Guthrum, took to himself the title of king. For seven years Alfred on the throne of Wessex carried on a deadly struggle with this rival power, and at length concluded a treaty of partition at the Peace of Wedmore (878), surrendering to the Danes the north and east of England to be held by them as vassals of the Saxon king. The supremacy of Wessex was thus secured, and ripened in the following reigns into something little short of an imperial authority. Edward the Elder was not only recognised as the overlord of Mercia and Northumbria, but the Welsh kings swore alliance, and the kings of Scotland and Strathclyde acknowledged him as their father and

lord; he treated on equal terms and contracted marriage alliances with the greatest princes of Europe. His position was fully vindicated by his son Athelstan, under whom, perhaps, the West Saxon monarchy reached its highest point of greatness. The decisive battle of Brunanburh, in 937, won over a complicated confederation, dealt a death-blow to all opponents. The reign of Edgar the Peaceful, and the government of his great minister Dunstan, closed the period of Saxon greatness. From this time onwards weak kings, factious nobles, and a broken organisation were unable to resist the renewed incursions of the Scandinavian tribes. The jealousies between the various sections of the people, restrained by the strong central authority of the late kings, broke out afresh. The northern kingdoms where Danish law prevailed afforded a natural support for the invaders. The alliance of King Ethelred with the Normans, and his marriage with Emma, a Norman princess, only added a fresh element of weakness by the presence of her foreign followers. Recourse was had in vain to large payments to the Danes, and to the cruel and treacherous murder, on St Brice's Day, 1002, of the Danes settled in Wessex. Ten years later all opposition had been overcome, and Sweyn, the leader of the invaders, was practically king of England. He was succeeded by his son Canute, and though a brief outburst of vigour under Edmund Ironside enabled the English to secure a division of the country, the death of their leader compelled them to submit to Canute. Under its Danish king England was ably ruled, and was in some respects the head of a Scandinavian empire. But Canute's two sons failed to continue their father's work. Opportunity was allowed for the rise of Godwine, Earl of Wessex, and on the death of Hardicanute in 1042, Edward the Confessor, the son of Ethelred, resting on the support of the great earl, re-established the house of Cerdic on the throne. Educated in Normandy, he surrounded himself with foreign friends, and filled the high places of the kingdom with Frenchmen. As leader and representative of the national feeling, Godwine succeeded after a while in driving the foreigners from the country, and establishing himself in a predominant position over the south of England. In the north the influence of the earls of Mercia prevented his absolute supremacy. He handed on both his power and his rivalry with the northern earls to his son Harold. Successful against his rivals, Harold placed most of the earldoms in the hands of his brothers. So completely was he recognised as the first of Englishmen, that upon the death of the king the Witan (see WITENAGEMÓT) had no hesitation in electing him to the throne.

In thus choosing a king from beyond the limits of the royal family the Witan had transgressed a well-established English custom. A formidable rival claimant at once appeared. William, Duke of Normandy, a cousin of the late king, demanded the throne as next of kin, and pleaded the promise of the Confessor. A second enemy threatened Harold: his brother Tostig had proved a traitor and had been banished; he now returned in company with the Norwegian fleet. The northern earls opposed him, and Harold, hastening to their assistance, won the battle of Stamford Bridge over the invaders. But the decentralised character of the English constitution and the strength of family rivalry made lengthened union impossible. When, three days after, on the 28th of September 1066, the Norman duke landed at Pevensey, it was single-handed and with hastily collected forces that Harold met him. The great battle of Senlac, near Hastings, was decisive, Harold and his brothers were slain, and England was left without a king. Again the jealousy between Wessex and Mercia prevented either a combined national opposition or the election to the throne of a native prince. William had little difficulty in slipping into the vacant post and securing his election by the Witan. The series of local efforts at opposition which followed his election proved unsuccessful, and by 1070 his authority was recognised throughout the country.

The change of dynasty thus effected connected England with the great movements of the Continent. Up to this time it had been somewhat isolated. Though its church was in communion with Rome, and had frequent intercourse with it, it was distinctly a national church; though feudalism was rapidly advancing, it had pursued an independent and national course of development. It was in some degree as the champion of the great system of Western Christianity that William had put forward his claims, and he brought with him followers imbued with all the principles and forms of continental feudalism. All the varieties of class and of land tenure which had arisen spontaneously in England were now assimilated to those existing where complete feudalism was in force; the connection with Rome was ratified by an entire change in the episcopate. But William had no idea of assuming the position of a chief among equals, or of subordinating his authority to that of the church. He found in the organisation of the conquered kingdom principles which enabled him, while using feudal language, to be in fact an absolute king, and to set such limits to the power of Rome as to keep the church virtually in subordination. The Norman kings, when not engrossed in foreign enterprises, were occupied in establishing, in opposition to the nobility and the church, that powerful monarchy which the Conqueror had established. They found in the old institution of the national militia an instrument with which to oppose the feudal levies of the barons. An administrative system centred in the crown, and working chiefly through the machinery of the exchequer, went far to centralise the government. Triumphant suppression of insurrections enabled them to get rid of the feudal baronage of the Conquest, while a new nobility of administrative origin and attached to the national system gradually took its place. But the death of Henry I. leaving only a daughter, Matilda, gave room for a disputed succession. All the discordant elements which the royal power had held in repression burst into life. The reign of Stephen was a time of constant civil war, during which the nation learned from the intolerable tyranny under which it groaned the value of the repressing hand of royalty. The miserable time was brought to a close chiefly by the mediation of the church. Matilda's son Henry, already a powerful prince in France, was accepted as the heir to the throne, and practically intrusted with the restoration of order. It was with the general concurrence of the nation that he was able to re-establish upon a broader and better basis the powerful monarchy of his predecessors. A series of great administrative reforms brought justice and finance into the hands of the king and his intimate council or Curia Regis, and went far to break through the quasi-independence of the land-owners. The suppression of a great insurrection affecting all his possessions, and supported by the kings of France and Scotland, left him unquestioned master of his kingdom so far as the baronage was concerned. His attempts to reduce the church to subordination were less successful; the opposition of Becket to the enactments of the Council of Clarendon produced a disastrous struggle with Rome. But though technically worsted, Henry's power suffered no serious diminution from his defeat. He handed

on to his son a powerful and well-organised monarchy, in which the feeling of national unity had made great advances. His system proved strong enough to support the continued absence of Richard in the Crusades and in his French dominions; national life even acquired increased strength by the self-government which was thus forced on the administration.

In the hands of Richard's successor the evil effects of the enormous power concentrated in the crown became obvious. Boastful, tyrannical, and weak, John excited the anger of all classes. The disgrace he brought upon England, the shock thus given to the rising feeling of national pride, afforded an opportunity for the exhibition of the discontent he had roused. He allowed himself to be stripped of all his French possessions; he plunged into a struggle with the Papal See, was excommunicated and deposed, and formally surrendered his crown into the hands of the pope. The nobility, freed from connection with the Continent and supported by all parties smarting alike from the evils of misgovernment and the shame of disaster, appeared as the true leaders of the nation, and wrung from the humbled king that great charter which secured, in the form of a solemn treaty, the foundations of the future liberties of England. To make the charter a reality, and to secure the orderly development of these liberties, was the work of the great king Edward I. John's compact with the people proved insufficient to restrain the personal and capricious exercise of the royal power in the hands of his son, Henry III. The surrender of the crown proved more of a reality than was expected; the Papal See, unable to establish a temporal suzerainty, mercilessly fleeced the people and the church, and the country was filled as of old with foreigners, on whom wealth and high places were lavished. The finances fell into utter decay. At length a demand for money to support, in the interest of Rome, the claims of the king's son to the throne of Sicily brought matters to a crisis, and in 1258 the barons passed the Provisions of Oxford, drove Henry's foreign friends from the kingdom, and virtually superseded the crown by a committee of government. Henry's attempts to break from the restrictions laid on him produced an armed insurrection, and Simon de Montfort, at the head of the barons and the commonalty of the towns, defeating the royal forces at Lewes, established a revolutionary government of which he was practically the master. But the jealousy with which the nobility regarded the rise of Montfort allowed Edward the Prince of Wales to come forward as the leader of a party at once conservative and reforming. His accession to the throne gave him an opportunity of carrying out his views. In the parliament of 1295, a complete assembly of all estates, he gathered into a national centre all the scattered elements of representation and self-government which had long existed in the county courts. The principle that where all were concerned all should have a voice was acknowledged, and the national liberties were placed in the charge of an assembly in which all orders were included. At the same time the position of the crown was maintained and rendered effective by the large powers still left in the hands of the king's council. For many years the struggle between parliament and prerogative remained undecided; but armed with the power of taxation, and taking advantage of the wants or weaknesses of the sovereign, the parliament continued to make good its position as the national council. At the close of Edward III.'s reign it was able to attack and impeach the ministry. The success of Richard II. in ridding himself of the influence of his uncles by which his youth had been surrounded, and his vehement assertion of the powers of the crown, produced a revolution which closed the struggle, and Henry IV. came to the throne with a parliamentary title, while the council nominated in parliament became in fact a body of national ministers.

The rise of parliament had gone hand in hand with the assertion of national life. Edward I. had not only marked out the lines the constitution was to follow, he had rid England of foreign influences. Busying himself but little with the Continent, he had devoted his attention to the conquest of Wales and Scotland. His death before the completion of his conquest of the northern kingdom allowed the Scots to inflict a final defeat upon his weaker son at Bannockburn. But the national feeling of the English, in abeyance during the political disturbances of Edward II.'s reign, reasserted itself in the ambitious efforts of Edward III. to place himself upon the throne of France, and was strengthened by the brilliant victories which attended them. Though the victories were useless, and the war a series of raids rather than a well-considered conquest, the effects at home were of great importance. The continual want of money forced the crown to frequent concessions to the parliament; the spirit of the people was raised by success; and the life of the soldier played an important part in liberating the lower orders from serfdom. The villeinage of earlier times had been gradually declining, and rent and wages were taking the place of villein tenure and forced service. The terrible ravages of the Black Death upset for a while the economic arrangements of the country, and the attempt to drive back the liberated serf to his old position caused the great rising of Wat Tyler in 1381. The insurrection was suppressed, but a death-blow was practically dealt to serfdom. In close connection with this upheaval of the working-classes was the movement in opposition to the church. The doctrines of Wyclif and the Lollards, so much in harmony with the democratic movement, could not fail largely to influence it, and for a while hostility to the church played a considerable part in parliamentary history.

The completion of the constitutional system marked by the accession of Henry IV. did not prevent the recurrence of disorder, but during the reign of his son full harmony existed between the king and people. The disturbances which had broken out in France afforded an opportunity for renewing the war, and Henry V. found no difficulty in carrying the people with him in his victorious attacks upon that country. A statesman as well as a conqueror, his progress was very different from that of Edward III. The Treaty of Troyes seemed to promise the ultimate union of the two kingdoms, but the work of consolidation was scarcely begun when the great king died, intimating to those who should carry on the work that the occupation of Normandy should be the limit of their aims. The foreign success and domestic harmony was of short duration. Though the power of the nobles as feudalists had disappeared, they were still too strong to accept easily the co-operation of the other orders in a national system except from the hands of a powerful ruler. Their strength had been increased by the great position given to the royal princes. The parliamentary establishment of the younger branch upon the throne had opened the door to the rival claims of hereditary succession. A strong government was scarcely possible during the infancy of Henry VI., especially as the council of regency found in the Duke of Gloucester, a man of ill-regulated ambition, an opponent with whom it was difficult to deal. His greater brother, the Duke of Bedford, devoted himself chiefly to the affairs of France, and though he had succeeded in maintaining some

degree of order in England, his early death was the signal for an outbreak with which the council and subsequently the young king proved unable to cope. Continual disaster in France still further discredited the government. Taking advantage of the claim of hereditary right, the Duke of York came forward as the champion of order. The nobility ranged themselves on one side or the other of the contending parties, and the country became the seat of a cruel dynastic war. The Yorkists were victorious in the struggle. The death of their old and moderate leader placed at their head his son Edward, a man of great ability imbued with the morality and principles of an Italian despot, and as the long regency had inevitably replaced in the hands of the council much of its independent power, Edward IV. found little difficulty in employing it for his own purposes. Parliament ceased to have much importance except to register the sovereign's will or to grant submissively the taxes he required. In the earlier struggles for national liberty the king had found his chief opponent in the baronage, and subsequently as leaders of the nation the nobles had exercised a great restraining influence. But in the internecine struggle of the Wars of the Roses they had committed political suicide, and Edward IV., surrounded by a nobility of his own creation, and armed with the powers of prerogative, which had never been formally abrogated, found himself able to establish a practical absolutism. The family dispute had not, however, reached its last act; Edward's successor, Richard III., rendered himself odious to all classes of the people, and the battle of Bosworth placed upon the throne a prince who claimed to be a representative of the Lancastrian House, and whose position was so far less absolute than his predecessors that he acknowledged that he was king by the will of the people.

The accession of Henry VII. and the Tudor House opens the second act of the drama of English history. The great principles of the middle ages had passed away; it was the age of the rebirth of learning; printing had been invented; firearms were superseding the lance and bow; the discovery of the western world was soon to excite the spirit of nautical enterprise; capital was taking the place of the restricted guild system; the inclosure of commons was changing the face of the country, depopulating the fields and filling the cities; the church had begun to be shaken from its foundations. In the midst of this changed society the new dynasty had ascended the throne, claiming to rest upon the popular will, but invested with all the absolute authority with which the late reigns had surrounded the crown. It is not perhaps going too far to say that the king was endowed with a temporary dictatorship. The typical representative of this phase of government is Henry VIII., a man in whom gross passion and unscrupulous determination to gratify his own will were curiously blended with a certain amount of culture and a real desire for the well-being of his people. Charged as it were with the duty of re-establishing an orderly national life upon a strong monarchical basis, he plunged into war as a ready means of asserting national power. France and Spain were already on the threshold of their great struggle for the supremacy of Europe, and it was in strict accordance with the tradition of English policy that Henry allied himself with the Spanish house. But a change was speedily to pass over the foreign relations of England. Instigated by his passion for Anne Boleyn, Henry demanded a divorce from his Spanish wife; the opposition of the papacy precipitated the Reformation in England, and transferred the national hostility from France to Spain. The difficulties he encountered in his pursuit of the divorce brought him face to face with the one weak point in his position as absolute monarch. The possibility of the assertion of paramount authority by a foreign prince had been studiously hidden from him by his ecclesiastical minister Cardinal Wolsey, who, himself master of the church, had thought to avoid all contest of authorities by devoting his power to the service of the crown. Such a possibility was now suddenly revealed to him. The fall of Wolsey and the substitution in his place of Thomas Cromwell supplied the king with a very able instrument for a high-handed assertion of the independence of the English Church. The movement found support in the excited animosity to the doctrines and practice of Rome which was filling Europe. Led by the energy of Cromwell, Henry proceeded beyond mere separation to the destruction of much of the apparatus of the old church. Reformed liturgies, an English Bible, the dissolution of the monasteries, seemed to secure a triumph for the advanced reformers. But the minister had overshot the desire of his master, and the reign closed amid Henry's efforts by even-handed severity to establish the supremacy of the crown without allowing the predominance of either party. So delicate an equilibrium could not be maintained. A burst of reforming zeal, supported by ministers of questionable character and still more questionable prudence, went far to destroy the position of England; and it was not without a very general consensus in her favour that Mary, the champion of the old faith, ascended the throne. Unfortunately, her birth and natural prejudices led her to ally herself closely with Spain. A great reaction in favour of Roman Catholicism throughout Europe had begun; Spain was at the head of the movement, and there seemed every probability that England would lose its national independence and be bound not only to the ecclesiastical supremacy of Rome, but to the temporal supremacy of Spain. Religious persecutions of a severity unknown in England added strength to the angry feelings then excited. Protestantism and national independence were forced into connection, and it became the inevitable duty of Elizabeth on her accession to play her part as the supporter of this twofold cause. With the aid of her great minister Lord Burghley, she acted with consummate ability. Far too weak to oppose at once the powerful forces of united Catholicism, she contrived by a temporising policy to avoid the dangers which would have attended an open defiance. She took advantage abroad of every opening for indirect support of the Protestant cause; at home, skilfully mingling politics and religion, without direct religious persecution she treated her opponents as traitors. She encouraged with all her woman's wit the feeling for nautical enterprise which was rife in the country; and at length, with the obstacles which had met her early course removed, firmly seated on her throne, and regarded both at home and abroad as the champion of Protestantism, she was able to bid defiance to the power of Spain and establish the supremacy of the English navy in the repulse of the Spanish Armada.

In carrying out the sweeping changes of his reign, Henry VIII. had found the support of his people necessary. Even the settlement of the succession, though intrusted to Henry and carried out according to his wish, was arranged with parliamentary sanction. The co-operation of the people was still more necessary for Elizabeth. Throughout her reign the influence of parliament had been rising. Social changes had still further tended in this direction; if the old nobility had chiefly disappeared, a new nobility had taken its place, and the gentlemen of England, with property often increased from the monastic spoils, had become an important class. Though Elizabeth constantly

ENGLAND AND WALES
English Miles
Kilometres
SCOTLAND
IRELAND
NORTH CHANNEL
FIRTH OF CLYDE
SOLWAY FIRTH
IRISH SEA
NORTH SEA
ST GEORGE'S CHANNEL
BRISTOL CHANNEL
ENGLISH CHANNEL
STRAIT OF DOVER
CHANNEL ISLANDS
FRANCE
NORTHUMBERLAND
CUMBERLAND
DURHAM
WESTMORLAND
NORTH RIDING
YORK
EAST RIDING
WEST RIDING
LANCASHIRE
CHESHIRE
LINCOLN
LINDSEY
KESTEVEN
DERBY
NOTTINGHAM
STAFFORD
SHROPSHIRE
LEICESTER
RUTLAND
NORFOLK
SUFFOLK
EAST
WEST
ISLE OF ELY
HUNTINGDON
CAMBRIDGE
NORTHAMPTON
WARWICK
WORCESTER
HEREFORD
RADNOR
MONTGOMERY
MERIONETH
CARNARVON
DENBIGH
FLINT
ANGLESEY
CARDIGAN
CARMARTHEN
PEMBROKE
BRECKNOCK
GLAMORGAN
MONMOUTH
GLOUCESTER
OXFORD
BUCKINGHAM
BEDFORD
HERTFORD
ESSEX
MIDDLESEX
LONDON
BERKSHIRE
WILTSHIRE
SOMERSET
DORSET
DEVON
CORNWALL
HAMPSHIRE
SURREY
KENT
SUSSEX
EAST
WEST
ISLE OF WIGHT
ISLE OF MAN
Douglas
Dublin
Belfast
Cardiff
Bristol
Plymouth
Portsmouth
Southampton
Brighton
Dover
Calais
Boulogne
Dieppe
Le Havre
Cherbourg
Alderney
Guernsey
Jersey
Longitude West & of Greenwich

assumed a masterful position with regard to her parliaments, she none the less listened to them and at times yielded to their remonstrances. It remained for the House of Stuart to force by unwise opposition this rising power into a position of supremacy. The death of the Virgin Queen seemed likely to open the question of the succession, but the crown passed without difficulty to the Scottish king, and the long-delayed union of the two kingdoms under one ruler was accomplished. The parliamentary settlement of Henry VIII. had set aside the Scottish line; it was therefore by strict law of inheritance only that James found himself called to the throne. Trained in a different school of politics, and apparently succeeding by what it was the fashion of the time to speak of as 'divine right,' he failed entirely to understand the position of his predecessors. This miscomprehension of his historical position handed on to his descendants was the cause of the disasters which attended their dynasty. Conceiving themselves possessed of the powers inherent in the old English crown, and determined to make them good, they forced the nation to fight over again the battle which had already been decided in the time of the Lancastrians. The contest between personal monarchy and constitutional government was terminated only by the removal of the Stuarts from the throne. A battlefield was found in nearly every department of government. James I. himself ran counter to many of the national prejudices. Thoroughly Protestant at heart, he favoured the new High Church party, who looked for support in a powerful crown; easily influenced by favourites, he fell in with the fashion of the monarchies abroad, and ruled through the hands of a great minister; in disregard of the wishes of the nation, he contracted a friendship for Spain, which was now regarded as the hereditary foe. But his weaknesses were not untempered by sagacity, and he succeeded in avoiding any overt breach with his people. His more obstinate son was less fortunate. From the beginning of his reign he found his parliament arrayed against him; it succeeded even in wringing from him the great Petition of Right. Weary of the struggle in which he seemed to be worsted, he believed himself strong enough to stand alone, and for some years ruled without a parliament and in disregard of the most important liberties of his subjects. Financial difficulties, caused in part by his ill-advised efforts to establish the Episcopalian form of worship in his northern kingdom, compelled him at length to seek parliamentary aid. The long-repressed discontent of the nation thus found a means of expression, and the edifice of personal government fell before it. A grudging consent to hotly pressed reforms, an unfortunate laxity in observing his promises, and unwise efforts at resuming his power drove Charles into open hostility with the people, and the country was plunged into the horrors of civil war. Revolution ran its inevitable course; the constitutional leaders of the early movement gave place to men who dreamed of much more radical changes, and whose politics were deeply tinged with religious fervour. The war brought to the surface successful generals, and in one of them was found a man who united vast practical ability with the subversive views and religious enthusiasm of the advanced party.

The parliamentary enemies of Charles, having completed their work by the execution of the king, found themselves mastered by the overwhelming ability of Oliver Cromwell. Raised to what was practically the throne, he set himself to reconstitute upon a new basis the constitutional structure which had been swept away. His large and tolerant views, and his determination to produce order, excited the hostility of the narrow sectarians who had formed the majority of the Long Parliament. By all men of conservative mind, or who shared in the loyal sentiment so prevalent among Englishmen, he was regarded with aversion. His efforts to bring well-ordered liberty out of the jarring elements with which he was surrounded failed; he was forced throughout his tenure of power to rely upon his own iron will. He succeeded in raising England to a high place among nations; it again assumed the position of leader of the Protestant interest, and again sought its allies among the enemies of Spain. But on the death of the great Protector, and at the prospect of a succession of military tyrannies, a wave of reaction swept over the country. Enthusiasm had died out, and that majority which at all times loves the old ways and prefers the easy paths of habit to the strenuous effort necessary to complete reforms insisted on the restoration of the banished house. With general acclamation, though not without some attempts to restrain his power within legitimate limits, Charles II. was brought back to Whitehall. Less arbitrary than his father, and far more capable of bending to the storm, he proved no less determined to maintain in his own way the fullness of the power he had inherited. He had to contend with much more formidable opponents. Though the full restoration of the church and crown had followed upon his accession, the Rebellion had not been without permanent results. It was impossible that the parliament which had for years been regarded as the source of government should sink back into the position it had occupied in the reign of Charles I.; the king could no longer hope to rule without it or to raise the revenue from illegitimate sources. The reign was one long dispute. The character of Charles, licentious, extravagant, and ready to waste the national resources upon his own pleasures, afforded ample ground of complaint. Surrounded by advisers as unscrupulous as himself, he sold himself to the French king to supply his financial wants. At the instigation of his paymaster, he plunged the country into a disastrous war with its Protestant neighbour Holland, and by his mismanagement allowed the enemy's fleet to ride undisturbed at the very threshold of the capital. He tampered with the national credit, and attempted by an exercise of high prerogative to set aside the laws against the Catholics. The enthusiastic parliament elected upon his return became before the close of its long life his bitter opponent.

The assaults of the opposition, Whigs as they were now called, were directed against the Duke of York, the king's Roman Catholic brother. Nothing would satisfy them but his absolute exclusion from the throne. To bring discredit upon the Catholics they were not ashamed to lend themselves to the infamous perjuries of Titus Oates. They thought of placing the king's illegitimate son, the Duke of Monmouth, upon the throne; but their insolence defeated itself. Charles, never deficient in political insight, understood the national love for the rights of legitimacy, the dread of a disputed succession, and the sympathy with which his efforts to support his brother were regarded. He dissolved his refractory parliament, and even thought of vengeance. He drove Shaftesbury, the leader of the opposition, from the country, and assaulted the strongholds of his enemies by finding excuses to confiscate the charters of London and other great cities. The Whigs, who saw that such a step by changing the constituencies might easily change the character of future parliaments, were driven to despair. The more statesmanlike among them began to think of seeking for the assistance of the king's nephew, the Prince of Orange. Some of the wilder spirits sought for a speedier remedy in assassination. The discovery

and punishment of the Rye-house Plot, and the skilful mingling of the aspirations of patriots with the atrocious schemes of vulgar murderers, for a while discredited the Whigs, and Charles died to all appearance triumphant. It remained for his brother to bring into action the deep-seated discontent which underlay the seeming success of the crown. With a want of judgment little short of judicial blindness, he proceeded in a few years to alienate every class in England. The open insurrections of Monmouth and Argyll were punished with reckless and bloody severity. The Test Acts were set at defiance, and Catholics filled the army. He maintained the shameful attitude his brother had adopted towards France. He laid his hand upon the freehold offices of the universities and the church, asserted the power of the crown to dispense with statutes, re-established the court of High Commission, called upon the clergy to read publicly his illegal declaration of religious indulgence, and established a standing army to overawe the capital. Such a series of tyrannical actions brought about the crisis. The Whig leaders betook themselves to William of Orange. This great statesman, who had devoted his life to restrain within due limits the power of Louis XIV., at once accepted with joy the opportunity of adding the strength of England to his great combinations. Protestant in religion, tolerant both by nature and by political necessity, the powerful chief of a republican government, he was well fitted to rule a kingdom torn by religious and political faction. The heads of all the English parties had sought his aid; his mere appearance was sufficient to close the Stuart dynasty and drive James a fugitive from the country.

The nation had again entered upon the full exercise of its powers. Taught by experience, before it deposited them in the hands of the king, it formulated the liberties of the country in a great and binding charter which should at once and for ever put an end to those efforts at personal rule which had rendered its previous history so stormy. The victory of parliament was thus completed. The reign of the first parliamentary king was indeed disturbed throughout by conspiracies, and rendered unrestful by the efforts of the exiled house, and at the close of the reign of Queen Anne for one critical moment there was a possibility that the Tories under Bolingbroke would succeed in re-establishing the Stuarts; but the rapid action of the great Whig nobles thwarted the attempt, and the failure of the Jacobite insurrection in 1715 secured in accordance with the settlement of parliament the Hanoverian House upon the throne. From that time onward, through the reigns of the four Georges, William IV., Victoria, Edward VII., and George V., constitutional government has constantly prevailed. The contests of parties, however severe, have been over differences of opinion of a less vital character than those involved in a change of dynasty. It has been possible, without revolution, without impeachment, to allow of the quiet and orderly change of ministers as a regular part of the working of the parliamentary machine. Such a process implies little short of the complete disappearance of the personal wishes or opinions of the monarch as a factor in the political life of the nation. It was not without resistance that the crown consented to assume this attitude. Neither William III. nor the statesmen who had secured his accession understood the full results of what had been done. Nor was William himself, bent upon using the wealth of his new dominions to aid him in his great continental schemes, inclined to resign any of the powers of the crown or to throw himself into the arms of a single party; he attempted, like his predecessors, to employ as his ministers the ablest men of all parties. It was almost by accident that what is known as 'party government,' by which the king chooses his ministers from the majority in the House of Commons, and thus puts himself in harmony with his parliament, was discovered. The lesson which the success attending the great Whig government of 1696 taught was strengthened by experience. It was not till the Duke of Marlborough, the heir of the views and objects of William, found himself supported by the homogeneous ministry of 1708, that he met with unqualified success. From that time the ministry, virtually a committee of the majority of the house, and known as the Cabinet, has formed a recognised part of the machinery of government.

But it was not only in the establishment of constitutional government that the Revolution of 1688 produced a change in the attitude of England. It introduced the country as a first-rate power into the politics of Europe; no important complications have since arisen in which it has not played its part. Throughout William's reign, as a matter of course, its strength was employed against France. The war of the Spanish Succession opened to its armies under the leading of Marlborough a glorious career of victory. The Whig leaders, who had not shrunk from impeaching the authors of the Peace of Utrecht which closed it, yet appropriated the advantages then acquired, and forced England in support of the treaty to the very head of the European powers. In the war of the Austrian Succession, the national energies, directed chiefly against France, secured British supremacy upon the ocean, which ripened under the great Pitt in his alliance with Frederick of Prussia into the unquestioned command of the colonial world both in the east and west. Though paralysed for a moment by the disasters of the American rebellion, the military enterprise of the country revived under the younger Pitt. Forced into opposition to the French Revolution, he was the soul of the great coalitions by which the proselytising vehemence of the Jacobins was held in check. The appearance of Napoleon upon the scene, and the extraordinary successes which attended his arms, changed the character of the war; it became a struggle for existence. It was again English subsidies, English troops, and English successes in Spain which tended more than anything else to bring the great powers into action, and to rouse that feeling of national life which produced the overthrow of the Napoleonic empire. Once again England stood at the very head of European powers.

One cause of these vast successes, unexpected in a country under popular rule, is to be found in the character of the government which sprang from the Revolution. That event was in its essence an aristocratic rather than a popular movement. The restriction of the constituencies and the influence of the possession of land threw power into the hands of a comparatively limited class. It was more as an oligarchy than as a democracy that England was able to prove itself so powerful abroad. But great social changes were gradually working themselves out, a revolution was taking place in the industrial world. The enlarged application of steam, the invention of machinery, improved methods of agriculture, the extended use of coal, the removal of the iron trade from the south to the north, and its great increase, were all tending to bring into greater prominence the trading, manufacturing, and artisan classes. The strange anomalies of the representation became still more glaring; change of occupation was not effected without much individual hardship, and the discontent arising from suffering was joined with that engendered by a sense of political exclusion. The ideas fostered by the French Revolution played their part in the general ferment. The determined and successful

effort of the Irish Catholics to obtain religious emancipation laid bare the increasing weakness of the governing classes. And at length the leaders of the Whig party made common cause with the classes hitherto excluded from government, and, backed at once by the traders and the artisans, forced upon an unwilling parliament the great Reform Bill of 1832. From that time till the close of the century there was a marked change both in the position of England and in the character of the questions which excited public interest. Still mistress of the sea, and possessed through its colonies of a world empire, England found enough to do in the preservation and improvement of this gigantic dominion, and as far as possible abstained from interference in continental quarrels. Once and again it showed its influence. In 1848, the year of revolutions, and in the subsequent consolidation of Italy, its sympathies were not hidden, but there was no thought of active interference. It allowed the great American republic to settle its disputes uninterrupted. It adopted the same attitude of non-intervention in the Prussian wars against Denmark, against Austria, and against France. It was only in questions which seemed to touch the safety of its Eastern empire that it drew the sword. The Crimean war was avowedly for the maintenance of Turkey as a check upon Russia, which was threatening the road to India. Of the same class were the wars in Egypt and Afghanistan. Still more directly when India itself burst into insurrection was England called upon to interfere and engage in the victorious but terrible campaigns which marked the suppression of the Mutiny. The other wars, and they were not few, were all connected with mercantile and colonial interests; the principal was the war with the Transvaal and Orange Free State in 1899–1900, ending in both these republics being annexed to the crown as British colonies. As to the questions which, after the passing of the first Reform Bill, excited public interest, the chief were the extension of the political franchise, the reform of municipalities, the repeal of the Corn Laws, the establishment of Free Trade, the improvement of the condition of the working-classes, the regulation of strikes and trade-unions, an equable system of compensation for injuries, a national system of education, and the management of Ireland.

During the South African war of 1899–1900 a great impulse was given to the feeling of solidarity between the mother-country and her colonies; and in the first years of the 20th century, prior to the outbreak of the Great War, imperialistic ideas grew in strength, manifesting themselves mainly in agitation for imperial preference. In 1907 self-government was granted to the Transvaal and to the Orange River Colony, while in 1909 the union of South Africa was completed. In foreign affairs in this period the establishment of an alliance with Japan, and the negotiation of *ententes* with both France and Russia, marked a definite departure from traditional policy. At home the passing of the Parliament Act (1911), with its limitation of the veto of the Lords, was a constitutional change of first magnitude, while the carrying of a bill for the payment of members (1912) was an important measure of parliamentary reform. Educational reform had its legislation in an act of 1902, while in social reform the Old Age Pensions Act of 1908 and the National Health Insurance Act of 1912, together with the inauguration of campaigns for land reform, were the leading features. Throughout the period industrial unrest was rife, infused at many points by syndicalist doctrine from France. In 1914 Home Rule and Welsh Disestablishment acts were passed, but the same year brought the Great War (q.v.), and with it the suspension of the operation of these measures. At the conclusion of the Great War the colonies of Germany passed in effect to England; but, at the same time, the war doctrine of self-determination was made the basis of agitation against English rule in Egypt and India. In the first instance, the protectorate established in 1914 was terminated in 1922, and the country recognised as an independent sovereign state; in the second, concessions were made in the Government of India Act (1920), but the demand for complete emancipation continued. In foreign relations the peace treaties which followed the war left England embroiled as perhaps not for a century in the affairs of Europe. At home the circumstances of the war accelerated reform of various kinds. Thus the Representation of the People Act (1918) granted votes to women, and in so doing anticipated later measures for the complete removal of sex disqualification, while it also otherwise extended the suffrage and effected a redistribution of seats; by an act of 1918 the cause of education was advanced in new directions; while in a measure of the following year schemes of housing reform were embodied. In post-war years the influence of revolutionary experiment abroad, the economic derangement of the peace, and the general disillusionment of the times accentuated the social unrest which had been growing throughout the century, and so produced circumstances in which the forces of labour added greatly to their electoral and parliamentary power. In 1920 the Welsh Disestablishment Act came into operation. To the Irish question, however, a fresh turn had been given by new doctrines of nationalism thrown up by the war, and the emergence of an Irish Free State came eventually to end the controversies of half a century. (See IRELAND.) The first Labour Government took office in 1924.

SOVEREIGNS OF ENGLAND.

	Began to reign.
ANGLO-SAXON LINE—	
Egbert	800
Ethelwulf	836
Ethelbald	857
Ethelbert	860
Ethelred	866
Alfred	871
Edward the Elder	901
Athelstan	925
Edmund	940
Edred	946
Edwy	955
Edgar	957
Edward the Martyr	975
Ethelred the Unready	978
Edmund Ironside	1016
DANISH LINE—	
Canute	1017
Harold I.	1036
Hardicanute	1039
SAXON LINE—	
Edward the Confessor	1041
Harold II.	1066
NORMAN LINE—	
William I.	1066
William II.	1087
Henry I.	1100
HOUSE OF BLOIS—	
Stephen	1135
PLANTAGENET LINE—	
Henry II.	1154
Richard I.	1189
John	1199
Henry III.	1216
Edward I.	1272
Edward II.	1307
Edward III.	1327
Richard II.	1377
HOUSE OF LANCASTER—	
Henry IV.	1399
Henry V.	1413
Henry VI.	1422
HOUSE OF YORK—	
Edward IV.	1461
Edward V.	1483
Richard III.	1483
HOUSE OF TUDOR—	
Henry VII.	1485
Henry VIII.	1509
Edward VI.	1547
Mary	1553
Elizabeth	1558
STUART LINE—	
James I.	1603
Charles I.	1625
COMMONWEALTH	1649
STUART LINE—	
Charles II.	1660
James II.	1685
HOUSE OF ORANGE—	
William and Mary	1688
STUART LINE—	
Anne	1702
BRUNSWICK LINE—	
George I.	1714
George II.	1727
George III.	1760
George IV.	1820
William IV.	1830
Victoria	1837
SAXE-COBURG OR WINDSOR LINE.	
Edward VII.	1901
George V.	1910

The history of Scotland, Ireland, and Wales is treated under those heads. For the several kings and their reigns, and the great statesmen, see the special articles. See the *Introduction to the Study of English History* (1881), by S. R. Gardiner and J. B. Mullinger, the second part containing a list of authorities. For special periods the following books will be found useful.

Before the Conquest.—Guest's *Origines Celticæ* (1883);

Pearson's *Early and Middle Ages*, vol. i. (1867); Kemble's *Saxons in England* (1849; new ed. 1876); Sharon Turner's *History of the Anglo-Saxons from the earliest period to the Conquest* (1852); Lappenberg's *History of England under the Anglo-Saxon Kings* (1845; new ed. 1880); Green's *Making of England, 449–829* (1881); Green's *Conquest of England, 758–1071* (1883); Stubbs's *Constitutional History*, vol. i. (1874); Hook's *Lives of the Archbishops of Canterbury*, vol. i. (1860); Elton's *Origins of English History* (1882); Chadwick, *Origin of the English Nation* (1907).

1066–1485.—Stubbs's *Constitutional History*, vols. ii. iii. (1875–78); Lingard's *History of England*, vols. i.–v. (1819); Freeman's *Norman Conquest* (1867–70); Freeman's *William Rufus* (1882); Bright's *Medieval Monarchy* (1875); Gairdner's *Richard III.* (1878); Hook's *Lives of the Archbishops* (1860); Robinson's *History of England to 1485* (1920).

1485–1688.—Froude's *History of England, 1527–88* (1856–69; new ed. 1881–82); Lingard's *History of England*, vols. vi.–xiv. (1819–31); Mackintosh's *History of England* (1834); Bright's *Personal Monarchy* (1876); Ranke's *History of England in the 17th Century* (1875–76); Gardiner's *History of England, 1603–42* (1869–82), and *History of the Great Civil War* (1886 *et seq.*); Carlyle's *Letters and Speeches of Cromwell* (1845); Macaulay's *History of England, 1660–1702* (1849–55); Hallam's *Constitutional History, 1485–1760* (1827).

1688–1837.—Lecky's *History of England in the 18th Century* (1878–87); Stanhope's *Queen Anne* (1870; new ed. 1880), and *History of England, 1713–83* (1836–54); Massey's *History of England, 1745–1802* (1855–63); Martineau's *History of the Peace* (1849–50); Bright's *Constitutional Monarchy* (1877); Erskine May's *Constitutional History, 1760–1860* (1861–63); Walpole's *History*, vols. i.–iii. (1878–80); Justin McCarthy's *Four Georges* (1889 *et seq.*); W. Mathieson, *England in Transition, 1789–1832* (1920).

1837– .—McCarthy's (1879–97), Walpole's (1886, vols. iv. v.), Molesworth's (1866–73), Robinson's (1922), and Trevelyan's (1923) histories; also Paul's *Modern England* (from 1846; vols. i. to iv. 1904–5); Marriott's *England since Waterloo* (1913), and Farrer's *England under Edward VII.* (1922).

See also compendious general histories by J. R. Green (1874; illust. ed. 1892–94), J. F. Bright (1877–88), S. R. Gardiner (1890–92), and A. D. Innes (4 vols. 1913–22), and larger works like *Social England*, edited by Trail (5 vols. 1893–96), and the histories edited by Hunt and Poole (12 vols. 1905 *et seq.*), and Professor Oman (1905 *et seq.*), and the *Cambridge Modern History*.

England, CHURCH OF. There is no trustworthy information as to the original preaching of the gospel in the British Isles; all that is forthcoming is either conjecture or legend. To the former category belongs the theory that St Paul was the first missionary thither—an opinion which rests only upon the apostle's own mention of his intended journey into Spain (Rom. xv. 24, 28) and the statement made by his convert and friend, Clement of Rome, that in his missionary travels he proceeded as far as 'the limit of the west' (*Epist. ad Corinth.* i. 5), words which have been construed as signifying Britain, because the farthest western boundary of the Roman empire. But that they do not in fact denote anything except the Spanish peninsula (much of which lies farther west than Britain) is made all but certain by the latter alone finding mention in the reference to St Paul in the Muratorian Canon, a document of the 2d century. To the class of mere legend belong no fewer than nine distinct accounts, specifying other apostles and saints as having evangelised Britain, one only of which—that which brings St Joseph of Arimathea to Glastonbury, and makes him shrine the Sangreal there—found popular acceptance. The most tenable theory which a consideration of all the factors of the problem suggests is that Britain was evangelised from Gaul, and that rather by sporadic and intermittent action than by means of an organised mission from Lyons or any other of the Gallic churches. Gildas, the earliest extant British historian (*circa* 516–570), acknowledges that he has no information to give upon the subject, since all the documents which might have cleared the matter up had either been destroyed by the Saxon invaders, or carried out of the country by the exiles who fled before them. And this testimony serves as specific disproof of one of the legends—that which ascribes the conversion of Britain to missionaries sent by Pope Eleutherius (177–193), at the request of Lucius, king of Britain; for this story is based solely on an interpolation made in 530 into the record of the pontificate of Eleutherius in the *Catalogus Pontificum Romanorum*, a date too near that of Gildas's history for him to have been ignorant of the fact if then credibly attested. The story of the martyrdom of St Alban, said to be the protomartyr of Britain in the persecution under Diocletian, though incrusted with mythical details, may probably contain a germ of fact, as the scene of his death was a place of pilgrimage at the beginning of the 5th century: but the first tangible historical item in the annals of British Christianity is the record of the presence of three British bishops (Eborius of York, Restitutus of London, and Adelfius of Caerleon) at the Council of Arles in 314. Others attended the Council of Sardica in 347, and that of Ariminum in 360. And from this time forward we find definite allusions to a settled church in Britain made by writers such as St Chrysostom, St Jerome, and Sozomen.

At the beginning of the 5th century, Pelagius (Morgan?), a native of Britain, originated the heresy which bears his name, and it spread so rapidly in his own country that his opponents were obliged to invoke the assistance of the Gallican Church against it. Accordingly, Germanus, Bishop of Auxerre, and Lupus, Bishop of Troyes, were sent in 429 to combat the new heresy, and Germanus paid a second visit with the same object in 447.

This controversy exactly synchronises with the earliest Saxon invasions, which, though carried on unsystematically by detached bands of adventurers, met with no effective resistance, and gradually overthrew the Romano-British civilisation, forcing the native population steadily, if slowly, back into the western parts of the island, apparently extirpating the church and Christianity itself in the process of conquest. Thus England forms the sole exception to the rule visible in all other parts of the Roman empire, that the Teuton invaders submitted to the creed of the conquered, and adopted as much of their civilisation and polity as they were capable of assimilating.

But what the British Church failed to effect, perhaps even to attempt, was achieved by external agencies. Kent, the oldest kingdom of the Heptarchy or Octarchy, was also the earliest to receive the gospel; and Bede's picturesque narrative tells how Gregory, Archdeacon of Rome, was attracted by the appearance of some fair-haired Saxon slave-children exposed for sale in the forum, and on inquiry into their race and country was seized with a desire to become a missionary thither. He could not obtain the necessary sanction, because his services at home were too valuable to be dispensed with; but when he was elected pope he determined to take effectual steps for carrying out his original plan with other instruments. He chose Augustine, prior of St Andrew's monastery on the Cœlian Hill, a foundation of his own, as head of the mission he projected, and sent him, accompanied by forty monks of the community, with supplies and with letters of recommendation to the bishops and sovereigns of Gaul. This policy directed the course which the mission was to take, for Charibert, king of Paris, had given his daughter

Bertha in marriage to Ethelbert, king of Kent, though a heathen, on condition that she should be permitted the free exercise of her religion, and be attended by a body of domestic chaplains. Ethelbert accepted the conditions, and repaired a ruined Christian church just outside Canterbury for their use, and was thus likely to receive Christian missionaries more readily than any other of the Anglo-Saxon kings. Moreover, he held the honorary precedence amongst them denoted by the title of Bretwalda, so that his example, if he could be induced to encourage the strangers, would be exceptionally influential throughout the country.

Augustine and his companions landed in Thanet on August 7, 596, and were granted an audience by the king in a few days under a great oak, to which they advanced in procession, preceded by a silver cross, bearing a picture of Christ, and singing the Litany. They were favourably received, and given permission to preach and make converts of such as chose to listen to them, while Ethelbert himself, about a year after the arrival of the mission, accepted their teaching, informed the Witan of his proposed change of religion, and obtained its sanction, besides inducing several of its members to follow his example, as did also great numbers of the commons. Hereupon Augustine, in compliance with directions given him by Pope Gregory before his departure from Rome, went to Gaul to obtain episcopal consecration as Archbishop of the English, which he obtained at the hands of Virgilius, Archbishop of Arles (November 16, 597). He sent news of his success to Rome, asking for additional men and supplies, which were promptly sent, together with the distinction of the archiepiscopal pall for Augustine himself, and a commission empowering him not only to erect twelve suffragan sees in southern England, but to do the same in the north, and appoint any one he pleased as metropolitan over them at York. But in fact little solid advance was made outside Kent for a considerable time, since a conference between Augustine and representatives of the British Church broke down through prejudice and misapprehension on both sides; and the apparent success which attended the missions in the kingdoms of Essex, Mercia, East Anglia, and Northumbria proved unsubstantial, for even those of them which had been most unanimous in accepting the gospel relapsed into heathenism after the death of the convert kings.

The recovery of these regions is due to the Celtic missionaries from their headquarters at Iona, an Irish colony, and notably to Aidan and his successor Finan. All northern and central England was evangelised by their agency, and also Essex, so that about two-thirds of the whole area of the country owes its Christianity to this source. The remainder is thus accounted for: East Anglia was converted by Felix, a priest from Burgundy, whom Augustine then raised to the episcopate; Wessex, by Birinus, an Italian, who obtained a mission from Pope Honorius, independently of St Augustine's, in 634; and Sussex, the last part of England to receive the gospel, by Wilfrid, Bishop of York, then exiled from his own diocese (681–685), the Isle of Wight being actually the latest scene of conversion. No difficulty was raised by the Scoto-Celtic missionaries in accepting the primacy of Canterbury, and in fact the several missions were welded into a single church during the life of Theodore, seventh Archbishop of Canterbury, who sat from 668 to 693. He it was who at the Synod of Hertford in 673 broke up the existing dioceses, each of which was conterminous with one of the Saxon kingdoms, into sixteen more manageable areas, all of them suffragan to Canterbury. In 735 York was made an archbishopric and metropole of the northern part of the island, though with precedence after Canterbury; but this distinction was not given formal expression until 1093, when the title 'Primate of All England' was attached to the holder of the latter see. The Welsh Church remained separate for a much longer time than that of Northumbria. It is not till 875 that there is proof of the intervention of Canterbury within its limits, for which the lack of any Welsh metropolitanate gave the occasion, and not till 1188 was the union with the Church of England fully effected.

Save for the sufferings inflicted during about a century by the piratical invasions of the pagan Danes, who treated the Saxon Christians much as the British Christians had been treated by the forefathers of those Saxons, the Anglo-Saxon Church remained peaceful and undisturbed till the Norman Conquest, living a life of its own, having scarcely any intercourse or relations with the continental churches, and ministered to by an episcopate and clergy with slender claims to learning, culture, or activity.

The Conquest, albeit attended with much hardship and oppression of the subjugated nation, and with some extrusion of Saxon prelates the moment William felt himself firm on his new throne, proved almost an unmixed benefit to the church of the country. The Norman clergy, while no less devout than the most pious Saxons, were far their superiors in learning and intellectual gifts, and the men whom William intruded into the places of the deprived Saxons, whether as bishops or abbots, were for the most part of high mark, in proof of which it will suffice to name Lanfranc, Archbishop of Canterbury, Osmund, Bishop of Sarum, and Anselm, Lanfranc's successor, though his accession to the primacy was under William II. in 1093. The great Norman nobles as a rule exercised their patronage with similar discernment; they founded abbeys and churches, cathedral and parochial, larger and statelier than had been known in England; they invited over monks from the most celebrated foreign monasteries to occupy the new foundations, and they brought the English Church, after several centuries of virtual isolation, again into touch with the rest of Latin Christendom. One factor in this last change, however, had results which no one could then forecast, for it was the Conqueror himself who availed himself of the opportunity given by the abortive Saxon revolt of 1069 to depose the Saxon primate Stigand. For this purpose he invoked the assistance of the pope, who sent two cardinals as legates. Under their presidency a synod was held at Winchester in 1070, wherein the deprivation of Stigand was effected, and the first precedent established for the internal jurisdiction of the papal authority in England. When William's own strong personality was removed, difficulties at once arose from this cause, as in the disputes concerning the investiture of bishops between William II. and Henry I. on the temporal side, and St Anselm upon the ecclesiastical part, which ended in a compromise whereby the king abandoned the claim to invest bishops by the delivery of the pastoral staff and the episcopal ring, and the church agreed not to treat the act of homage on the part of a bishop-elect as disqualifying him for consecration. This was a practical victory for the civil power, and the beginning of that mode of its nominating English bishops by uniting a letter-missive in favour of a specified person to the *congé d'élire*, or license for election, which still prevails.

Graver troubles arose when Henry II. endeavoured to abolish the privilege of clergy, which exempted

all members of the clerical body from the jurisdiction of the civil courts, even for the most serious offences against the laws. He availed himself of a vacancy in the see of Canterbury to nominate his chancellor, Thomas Becket, to the primacy, in the expectation that he would assist in bringing about this desired change. At first the new archbishop gave some support to the plan, but at the Council of Clarendon, where the new laws were synodically voted, he refused to validate the acts of the council by affixing his official seal to them, to the great anger of Henry, who was present, and who immediately took action which drove Becket into exile for six years. On his return to England, he excommunicated the Archbishop of York, the Bishop of London, and the Bishop of Salisbury for usurping his functions during his absence, and they at once proceeded to Normandy to complain of him to the king. The hasty words which the news drew from him were caught up by four knights of the court, who hurried over to England, and murdered the archbishop in his own cathedral. The crime proved fatal to the proposed measures, which Henry was compelled to abandon; and though some limitation of the privilege of clergy took place in the reign of Edward III., and again in that of Henry VII., it was not till the Reformation statutes of 1536 and 1541 that it was finally abolished.

The Papacy was even more successful in the reign of John than in that of his father. The pope then was Innocent III., one of the ablest and most ambitious of the Roman pontiffs, who set aside a disputed election to the see of Canterbury, and appointed Cardinal Stephen Langton instead of either claimant. The king refused to accept the nomination of Langton, and the pope at once put the kingdom under an interdict, which involved the cessation of the offices of religion throughout the country. But as John proceeded to retaliate by acts of violence against the clergy, a sentence of excommunication was fulminated against himself, quickly followed by one of deposition, whereby his subjects were released from their allegiance, and the kingdom was granted to Philip, king of France, who was enjoined to invade England with an army. Although John called out a military force to resist the threatened invasion, he was afraid to trust himself to his alienated subjects, and made secret terms with Pandulf, the papal legate at the French court, in accordance with which John signed a deed of resignation of his insular dominions into the hands of the pope, to be held from him as his feudal vassal on payment of a thousand marks yearly, and actually executed this undertaking in the church of the Templars at Ewell, near Dover, in 1213, kneeling before the seated legate, laying the crown at his feet, and taking the oath of homage to the pope as his lord paramount. The exiled prelates hereupon returned, and Cardinal Langton gave absolution to the king. But although Langton was thus forced upon the country by external influence, he at once identified himself with the popular party, headed the confederacy of the barons formed to extort reforms from John, disregarded the pope's attempt to protect his vassal, and compelled the signature of the Great Charter at Runnymede in 1215, refusing to publish the bull with which Innocent III. attempted to quash it. Nevertheless, the vassalage of the kingdom was not suffered to remain a mere dead letter of titular dependence on the Papacy; it continued as a very potent fact during the long reign of Henry III., when the church patronage was almost monopolised by the popes, in virtue of 'mandates' and 'provisions,' and exercised chiefly in favour of Italians; while the revenues drawn to Rome from England, as vouched by a complaint lodged at the Council of Lyons in 1274, largely exceeded those of the crown. This policy, which at once affected the people generally in their religious relations throughout the parishes all over England, and the state in its corporate character, did much to beget a temper of revolt against the Roman claims, as those of an alien and even hostile power, and had much to do with the spread of Lollardism at a somewhat later period, and even with the permanent success of the Reformation.

There was, however, an event of a very different kind which also marked the 13th century: the introduction of the new institute of friars, then but lately founded by Francis of Assisi and Dominic Guzman on a basis differing in several important particulars from the older monasticism which had played so great a part in church history. The Dominicans, or Friars-preachers, reached England about 1219, the Franciscans about 1224, being soon followed by the Carmelites and Augustinians. For a time they worked as marked a revival as they had already brought about in religion on the Continent, and the Franciscans became in addition famous for their learning, not only furnishing the ablest teachers to the universities, but producing men of such exceptional eminence as Roger Bacon, Duns Scotus, and William of Ockham. For a time the influence of the friars was wholly healthful and stimulating, but the very popularity which they enjoyed crowded their ranks with unworthy members, and the greed which they soon evinced, as well as the anti-national attitude they assumed in consequence of their exemption from local jurisdiction, as holding directly from the pope, so that they viewed themselves as his liege-men and acted as papal garrisons in England, marred the fair promise of their advent, and made them additional factors in the growing alienation from Rome. This change of attitude towards the friars appears as early as the episcopate of Robert Grosseteste, Bishop of Lincoln (1235–53), who had been one of the first to welcome their arrival, but became their steady opponent towards the close of his life, as he also was of the papal usurpation of English church patronage.

Edward I. renounced that fealty to the Papacy which his father and grandfather had accepted, besides checking the transfer of land by the Statute of Mortmain in 1279; and his own grandson, Edward III., carried resistance much further—in 1350, by the Statute of Provisors, which put an end to the pope's encroachments on the rights of patrons; in 1353, by forbidding appeals to Rome under pain of outlawry; in 1367, by refusing to continue payment of the tribute with which John had saddled the kingdom; and in 1374–75, by an inquiry into the number and value of the benefices occupied by aliens, succeeded by an embassy to the pope to complain of the abuses. One member of that embassy, John Wyclif, Master of Balliol, Oxford, had a powerful, if temporary, influence in fostering opinions adverse to the current system, and the popularity of his translation of the Bible contributed much to the same end. His teaching, though officially condemned both by the university and the church, found many supporters both amongst the educated and the masses, and probably helped the enactment of the Statute of Premunire in 1393, as it certainly did the spread of Lollardism after his death in 1384. Active measures were taken for its repression under Richard II. and Henry IV., and the first execution by burning for heresy in England was that of William Sawtré, a London rector, in 1401. He was the earliest of many victims (including Sir John Oldcastle, Lord Cobham) during a persecution which lasted with little intermission till the

outbreak of the Wars of the Roses; but meantime the reaction against Rome was holding its course both in church and state, and was much increased by the high-handed action of Pope Martin V., who endeavoured to revive the abuses which successive kings and parliaments had abated or removed.

Some recovery of Roman influence, however, took place in the weak reign of Henry VI., and Cardinal Kemp, Archbishop of Canterbury, was not only nominated by the pope to the primacy, but avowedly governed the church as papal legate; a policy wherein he was followed by his successors Cardinals Bouchier and Morton, under the last of whom (1487–1501) the long struggle of the nation against papal encroachments seemed to end in final defeat, and in the reduction of England to a mere appanage of Rome. With the accession of William Warham, a patron of learning, to the primacy in 1502, some abatement of this subjection becomes visible; but the time for a far wider and deeper revolt was near at hand, seeing that the Lutheran movement, destined to influence the whole Western Church, took place during Warham's primacy, and rapidly affected even those who were most opposed to its principles. In particular, the widespread anger it aroused against practical abuses strengthened the hands of Cardinal Wolsey in undertaking the reform of the monastic houses in England, by purging the greater monasteries of their scandals, and suppressing small and useless foundations, drafting their inmates into the larger societies, and applying their revenues to educational purposes. But rougher hands were to carry on the work in a very different fashion from his temperate measures. The failure of Henry VIII. in obtaining a divorce at the pope's hands from his queen, Catharine of Aragon, since her nephew, the Emperor Charles V., was too powerful to be thus braved, led to his determination to break with Rome; and though Wolsey declined to assist his plans, and was disgraced in consequence, yet in Thomas Cranmer, whom, on Warham's death in 1532, he raised to the primacy, he found a ready instrument for his purpose. Cranmer declared the marriage with Catharine void, and the king's private marriage to Anne Boleyn valid; while Henry retorted upon the pope's verdict of 1534 against this union by hastening on the proceedings of the famous 'Reformation Parliament,' which continued from 1529 to 1536. Herein papal licenses and bulls were prohibited, the king's ecclesiastical supremacy declared the law of the land, and its impugnment punishable with death; the submission of the clergy, compelling them to accept a revision of the canons by a royal commission and to assemble in their convocations only when summoned by the king's writ, was extorted; the payment of annates to Rome was forbidden; and the statute in 'Restraint of Appeals,' terminating all ecclesiastical suits within the kingdom by prohibiting the carriage of any suit before the pope, was enacted.

These changes seem to have been received, not only without resistance, but with real ap roval, even by the clergy as a whole; and, except for the breach with Rome, little alteration was made in the ordinary routine of church teaching nd discipline, though some slight advance was made in the reforming direction by the issue of the Ten Articles in 1536 and the *Institution of a Christian Man*, or *The Bishops' Book*, in 1537, recast and re-issued in 1542 as the *Necessary Erudition of a Christian Man*, or *The King's Book*. A greater practical change was carried out by the wholesale spoliation and suppression of the monasteries, mainly by the agency of Thomas Cromwell between 1536 and 1539, and the devolution of their great revenues, including the impropriated tithes of parish churches, into the hands of the king and the secular landlords. The Act of the Six Articles in 1539 was aimed at the more advanced Reformers, and made several of their favourite tenets heresy at statute law, so that it was no longer possible for the accused to save his life by abjuration, as it had been under the previous system. Some modification of its severity was made in 1543 and in 1544, and the beginnings of vernacular services appear in the publication of the Litany in English, in addition to an earlier permission for the private use of the Psalter, Creed, Lord's Prayer, and Hail Mary. Such was the posture of affairs at the death of Henry VIII. in 1547.

Under the child-king Edward VI., the reforming movement was pushed on much more rapidly, and is sharply divisible into two distinct periods: an earlier one, whose landmarks are the Order of Communion of 1548, and the First Book of Common Prayer in 1549, both of them the work of the native clergy, and drafted on mainly conservative lines; and a later one, when the influence of the foreign Reformers domiciled in England, and notably Bucer and Peter Martyr, became dominant with the king's advisers, and resulted in the destruction of the altars of the churches in 1550, the issue of the Second Prayer-book in 1552, by royal and parliamentary authority only, and without the assent of the church, and the compilation of the Forty-two Articles, the first draft of the present Thirty-nine, in 1553. So much wanton havoc had been wrought under colour of reformation in the closing years of Edward's short reign that Mary's accession was received without alarm, and even with welcome, and that by the clergy no less than by the laity, with the exception of those who felt themselves imperilled. But though she immediately set herself to undo all the work of the preceding quarter of a century, aided by her husband Philip II. and her kinsman Cardinal Pole, so that she was enabled with the assent of parliament to bring the church and nation back into the relations with the see of Rome which had prevailed up to 1529, yet her impolitic cruelties and the fierce persecution of which Cranmer, Ridley, Latimer, and Hooper were the most conspicuous victims, alienated the national sympathies from her, and led to a fresh reaction, which at once took shape under her successor Elizabeth. In 1559 the Act of Uniformity re-establishing the Common Prayer-book, and also a statute reviving the royal supremacy, were enacted; the Thirty-nine Articles were published in 1563, and the Church of England placed in a position midway between the attitudes in the two periods of Edward VI.'s reign already referred to. The Marian bishops, who refused to accept the changes, were deprived, but not otherwise harshly treated, and only 189 of the whole clerical body, inclusive of these fourteen prelates and six abbots, out of a total of 9400, declined to conform; while there was no separatist Roman Catholic body in England till after Pius V. issued his Bull of Excommunication against Elizabeth in 1570, nor were they organised in anywise till 1598. See ARCHPRIEST.

The Puritan section in the country, however, was far from content with the amount of reform achieved, and quickly came into collision with the authorities in church and state, mainly upon minor details of ceremonial. The first secession on these grounds took place in 1563, and was generally condemned by the leading foreign Reformers; but nevertheless Puritan principles spread very fast, and became powerful in parliament, though not sufficiently so to prevent the enactment of a severely repressive statute in 1593, when the Puritans' own violence and intractability had provoked a reaction against them, and they remained quiescent during the remainder of Elizabeth's reign. They revived in

activity under James I., and had high hopes of success; but the Hampton Court Conference, wherein an attempt was made to arrive at an amicable understanding between them and the church, proved abortive; and while their disciplinary proposals were checkmated by the Canons of 1604, their doctrinal aspirations were even more effectually and permanently defeated by the rise of the Anglo-Catholic school of theology, which exchanged the destructive and innovating temper which had inevitably prevailed during the crisis of the Reformation, when the removal of abuses was the main object, for a constructive and conservative one, making constant appeal to the standards of the ancient undivided church, and being especially opposed to the tenets of Calvinism and Zwinglianism. But the king's feebleness of nature made him ill able to guide the country at such a time, and his political blunders brought about an alliance between the Puritans and the patriot party, who were aggrieved by many acts of misgovernment. The authorities of the Church of England, contrariwise, both under James and his successor Charles I., lent themselves to the support of absolutist views, and thus incurred much odium, which was considerably increased by the dissatisfaction aroused by the action of Archbishop Laud, whose good intentions were not accompanied with practical discretion, but were marked with much high-handed intolerance. The reaction was swift and violent: the Westminster Assembly of Divines met in 1643, and adopted from Scotland the Solemn League and Covenant, one detail of which is the total abolition of prelacy, and which parliament made binding on all persons in England over the age of eighteen; in 1645 the Book of Common Prayer was forbidden under severe penalties, and the Directory of Public Worship substituted for it; in the same year Archbishop Laud was brought to the block, and the Church of England, as a body holding a recognised national position and free to exercise its functions, disappeared from view for the fifteen following years. The restoration of Charles II. in 1660 was attended by the return of the exiled clergy and the reinstatement of the church, while the Savoy Conference in 1661 decided the issue as to the general aspect of the revived communion in favour of the High Church or Anglo-Catholic view, by revising the Prayer-book in its present form, which was enforced by an Act of Uniformity in 1662, a measure followed by the resignation of a number of the ministers admitted to benefices under the Commonwealth, estimated variously at from 800 to 2000. This was virtually the last settlement of ecclesiastical affairs in England by the joint action of church and state, and the many events which have since occurred to condition them have not materially altered its broad features. The illegal exercise by James II. of a dispensing power in issuing the 'Declaration of Indulgence,' which, though ostensibly meant for the relief of all Nonconformists, was designed to cover the legalisation of Roman Catholicism, and the trial of the seven bishops who refused to give it circulation in their dioceses, directly caused James's deposition, and resulted hurtfully in some respects for the church.

For the Nonjuring schism under William III. deprived the church of many pious and some able men whom it could ill spare, and contributed something to the gradual cooling of zeal and the laxity of doctrine which marked the Hanoverian period and were furthered by the influence of such prelates as Hoadly and White Kennett. But socially the Church of England touched its highest point of influence just before the season of decay. At the close of Queen Anne's reign it appeared to be strong and successful everywhere, and there was practically no competitor in the field, as both Roman Catholics and Nonconformists were few and powerless. But with the silencing of Convocation under George I. in 1717 (made feasible by its impolitic surrender in 1664 of the right of the clergy to vote all taxes payable by them), and the steady encouragement given to the ultra-Broad Church section of the clergy, a blight came upon the church, and it rather vegetated than actively lived thenceforward till nearly the close of the 18th century; for the Methodist movement, begun by John and Charles Wesley in 1727 on the footing of a guild within the church, and given formal shape in 1740, began to assume the status of an external sect in 1760, and soon afterwards became the active rival of the church. The Evangelical revival towards the close of the century owed much of its success to the alarm caused by the French Revolution, since the adoption of freethinking opinions in England was thought likely to lead to results similar to those of the Terror; but though it did much for individual piety, the notion of working in and for the church at large, or as a national institution, does not seem to have so much as crossed the minds of its leaders, and it did thus nothing whatever to promote any corporate reforms, though achieving much in raising the standard of clerical devoutness.

It was reserved for the factor variously known as the Oxford or Tractarian movement, or by its advocates as the 'Catholic Revival,' to make this omission good, and to stimulate the energies of the whole Anglican communion. The movement itself was immediately occasioned by a statute enacted in 1833 suppressing ten bishoprics in the Church of Ireland, which at once prompted the question, 'If the like policy should at any time prevail in England also, and lead to the overthrow of the church as an establishment, what would it have to fall back upon for its very existence as a corporate body?' The answer to this question was given in the 'Tracts for the Times,' issued from Oxford at intervals during 1833–41, and chiefly written by Newman, Keble, Pusey, Isaac Williams, and Richard Hurrell Froude. They at once excited active controversy, seeing that they not only traversed the Low and Broad Church positions, but also that of the contemporary High Church school itself, which was content to acquiesce in a theology bearing clear marks of 18th-century influence, and differing materially from that of the great Stuart divines, which the Tract-writers aimed at reviving. Although at first the line adopted by the school as a whole may be roughly described as a *via media* between Roman Catholicism and Reformation doctrines, although at first the former system was freely criticised, yet two great waves of secession to the Roman Church, in 1845 and 1850, the earlier occasioned by the condemnation of Tract XC., written by Dr Newman, and the latter by the Gorham Judgment, drew considerable numbers of its more distinguished members with them, and not only weakened it seriously at the time, but seemed to justify all the adverse criticism it had met, and to discredit it altogether. Yet it stood the shock firmly, and proceeded on the lines originally sketched out, and that with such energy and success as entirely to change the face of the Anglican Church in the succeeding half-century and beyond. The great development of church building and restoration, the revivals of convocation and of sisterhood life, the creation of a copious and learned ecclesiastical literature, the impetus given to the foundation of colonial and missionary dioceses and to the increase of the home sees, at first merely suffragan, but later as separate dioceses, the introduction of a higher standard of clerical life and work, and the embellishment of

public worship, are the chief results of its labours; and what might have been less anticipated from its origin, it has shown itself not less ready in adapting agencies of nonconformist birth and usage to the purposes of the church. That it has in fact been the determining factor in these respects, and has rather drawn the remaining schools into the current than been anticipated or aided by them, is vouched by the date, not less than by the character, of the reforms, since they do not begin to be manifest, even in germ, till the Oxford movement became powerful, and was translated from theory into practice. As regards the alleged tendency towards Roman Catholicism, that must be judged not by the degree in which the school is in sympathy with Roman Catholics rather than with Protestants on certain issues, nor yet by counting up individual secessions in that direction, but by the broader inquiry into the growth of the Roman Church in England since the Oxford movement has affected the condition of religion in the country. And the fact is, as attested alike by the marriage returns (especially trustworthy in the case of Roman Catholics, because of their strict discipline in this matter) and by the calculations made by the Roman Catholic authorities themselves, they do not increase at the same rate as the nation at large, and constitute, despite their threefold sources of increase—births, immigrants, and conversions—a slowly but steadily diminishing factor in its ratio to the population, and chiefly dependent, even so, upon the Irish element to maintain its numbers.

In marked contrast with the torpor of the 18th century and the earlier years of the 19th, the history of the Church of England has in recent times been as crowded with events profoundly affecting it as any corresponding period of time during the Reformation era; with this notable difference, the absence of the Erastian character which the direct intervention of the crown and the civil power in general gave then to the aspect of ecclesiastical affairs. In the modern revival of the Church of England the court has had neither share nor sympathy; there has been rather more opposition than aid from parliament, owing to the temper of the large nonconformist element in the House of Commons; and the legal tribunals have been actively hostile; but no serious check or delay has been interposed to the movement by any or all of these adverse influences. It is possible to name only the most salient events of the period in the briefest fashion to complete this historical outline. The beginning of Queen Victoria's reign was marked by the enactment of the Pluralities and Non-residence Act in 1838, and of the Church Discipline Act in 1840. The development of the colonial episcopate (which, though initiated in 1787, had increased to no more than five sees down to 1836) began in 1841, and was steadily rapid in operation. The Gorham case, decided against the ruling of the Court of Arches by the Judicial Committee of Privy-council, synchronised with the establishment of a Roman Catholic hierarchy in England by Pius IX. in 1850, professedly as a restoration of the pre-Reformation episcopate. Convocation was revived in 1853, through the action of Lord Aberdeen, then premier, and has met regularly ever since. In 1860 *Essays and Reviews* was published, and was soon followed by kindred but bolder writings of Dr Colenso, Bishop of Natal; and though both the *Essays* and the bishop were condemned by the ecclesiastical authorities, these sentences were reversed, the former in 1864, the latter in 1865, by the Judicial Committee; against which findings strong protests were made (in the case of *Essays and Reviews* by 11,000 clergymen), and the Convocation of Canterbury affirmed synodically the contrary condemnations. The Church Congresses, which have done so much to make the outer public familiar with the working of the English Church, began in 1861; the Pan-Anglican Conferences, equally powerful in welding together the separated parts of the vast Anglican communion, in 1867. Contrasting with the license allowed to the Low and Broad Church schools by the Privy-council decisions, the judgment in the suit of Liddell *v.* Westerton (1857), was largely, and those in the suits of Martin *v.* Mackonochie (1869), Hebbert *v.* Purchas (1871), and Clifton *v.* Ridsdale (1877), were entirely, hostile to the High Church litigants, condemning various ceremonial adjuncts of public worship which they held to be permitted or enjoined by the formularies. But these findings have been so riddled with destructive criticism by eminent jurists and other experts as miscarriages of justice that they have never commanded respect or obedience. The restoration of the long dormant class of suffragan bishops took place in 1870, and they now form a considerable factor in the home episcopate; while the increase in the number of English dioceses, originating with the foundation of the sees of Manchester and Ripon in 1836, was followed by the re-erection of the sees of Bristol and Coventry, and the erection of Liverpool, Newcastle, St Albans, Southwell, Truro, Wakefield, Birmingham, Southwark, St Edmundsbury and Ipswich, Chelmsford, Sheffield, Bradford, &c. In 1920 the first meeting took place of the National Assembly of the Church of England. This body, a creation of the Enabling Act, or properly the Church of England Assembly (Powers) Act, 1919, was the outcome of a claim by the Church for lessened state control and for greater powers of self-government. The Assembly, a representative body consisting of a House of Bishops, a House of Clergy, and a House of Laity, has power to legislate regarding church affairs, but no measure passed by it becomes law till, following the approval of an ecclesiastical committee established by the act, and consisting of fifteen members of the House of Lords and fifteen members of the House of Commons, each House of Parliament has passed a resolution to that effect.

The polity of the Church of England is episcopal, and the area is territorially distributed into two provinces, Canterbury and York, each presided over by an archbishop. The Church of England claims that its bishops are the legitimate and canonical successors of the pre-Reformation hierarchy, and has carefully fenced the episcopal office with safeguards to insure its regular continuance. But Roman Catholic controversialists allege that there was a complete solution of continuity at the accession of Elizabeth, when Matthew Parker was appointed Archbishop of Canterbury in the room of the recently deceased Cardinal Pole. Yet not only has the regularity of the English succession been acknowledged by such eminent authorities as Bossuet in earlier and Döllinger in more recent times, but there is decisive proof that the objections now alleged are merely factitious afterthoughts. The question of the necessity of papal confirmation to validate the status of bishops was debated in the Council of Trent, 30th November 1562, and objections were adduced against its obligation. But it was argued on the other side that to rule against it would be dangerous, because the only argument adducible against the orders of the English bishops was that they had not papal confirmation, since they proved that they had due call, election, mission, and consecration; and the whole council accepted this view of the situation (Le Plat, *Monum. Conc. Trident.* dcclxxi.).

The doctrinal standards of the Church of England are primarily the Book of Common Prayer, including the three Creeds occurring therein; and

secondly, the Thirty-nine Articles. The first four general councils are also part of her legal system, and there is a general appeal to Holy Scripture as interpreted by 'the Catholic Fathers and ancient bishops.' She differs from the Roman Catholic Church by the rejection of the distinctively Roman tenets embodied in the modern articles of the Creed of Pope Pius IV., and from the Eastern Church in a less degree, and chiefly in respect of the invocation of saints and the cultus of images, as not warranted either by Scripture or by the church of the first five centuries. On the other hand, she differs from the societies which have sprung up since the Reformation by requiring episcopal ordination for all her clerical members; by the structure and tone of her Liturgy, which is simply a translated and abridged revision of the pre-Reformation Missal, Breviary, and other office-books; and by her refusal to admit into her formularies any tenets which have not the warrant of antiquity, whatever plausible arguments may be adduced for them from the letter of Scripture. She has always exercised strong attraction upon the educated classes, and has probably a larger proportion of cultured laymen actively interested in and working for her than any other communion of the day, and in England she has also retained the agricultural class. The lower middle class and the town artisans constitute the strength of English Nonconformity, though the revival born of the Oxford movement told strongly upon this class also. The advance of the daughter-churches in the United States and the Dominions has been very great.

See Hunt's *History of the English Church*, and his *English Church in the Middle Ages;* Ollard and Crosse's *Dictionary of English Church History* (1913); Perry, *Student's English Church History* (1878); Dixon, *History of the Church of England from the Abolition of the Roman Jurisdiction* (1877–1902); Abbey and Overton, *The English Church in the Eighteenth Century* (1878); Sadler, *Church Doctrine, Bible Truth* (1872); Bishop Christopher Wordsworth, *Theophilus Anglicanus* (1865); Curteis, *Bampton Lectures on Dissent* (1872); Howard, *The Church of England* (1885); Moore, *The Englishman's Brief* (S.P.C.K.); Forbes, *Explanation of the Thirty-nine Articles* (1878); Overton, *The English Church in the Nineteenth Century* (1894); Makower, *The Constitution of the Church of England* (trans. 1895); Shakespeare and Carlyle, *Towards Reunion* (1919).

English Channel. See CHANNEL (ENGLISH).

English Harbour, a port of Antigua (q.v.).

English Language. GENERAL INTRODUCTORY SKETCH.—The development of the English language can be traced in a series of written documents extending back to the beginning of the 8th century. It is convenient and necessary to distinguish several well-marked periods or stages of development during this long space of time, and it is usual to divide the life-history of English into three main periods, respectively designated Old English (also called Anglo-Saxon), Middle English, and Modern English. These divisions are often further subdivided into Early and Late Old English, First Transition English, Early Middle English, Late Middle English, Second Transition, Early Modern, and so on. The approximate dates generally assigned to the various main periods are: Old English, down to 1050; Transition, from 1050 to 1150; Early Middle English, from 1150 to 1250 or 1300; Late Middle English, from 1300 to 1400. After this date (that of Chaucer's death) some scholars, including the present writer, would place Early Modern, while others prefer to regard the 15th century as Second Transition, making Early Modern begin about 1500.

It is very doubtful whether this minute division is desirable; indeed, it is more important to have a sense of continuity, and to realise that the process of change and development is continuous, and that every age is, in fact, one of transition. Just as the generations of men pass one into the other, and overlap, so does the language which they speak pass, by imperceptible stages, from what we call Old English into Middle English, and thence into Early Modern, and so on. It appears that many sound changes, which all agree are characteristic of the Modern period, were at least well begun by the first quarter of the 15th century (see *English Sounds*). This is proved by the spellings and rhymes found in documents written at that time. If this is so, we must suppose that the 'new' pronunciation was probably in existence, in some districts at least, already before the end of the 14th century. If that was so, then Chaucer, whom every one agrees to consider a Middle English writer, must have heard the beginnings of Modern English; indeed, he may himself have shared some of its characteristics. In spite of this unbroken continuity, however, this absence of leaps and bounds in development, and of clear-cut periods in the history of English, we can undoubtedly trace well-defined characteristics which distinguish the language of one age from that of another. These differences involve the language as a whole, not only those features which can be analysed and easily described, such as changes in pronunciation, in vocabulary, in accidence, and in syntax, but those subtler shades which defy analysis and can only be grasped by means of long and sympathetic study of the sources, namely, the spirit and atmosphere of the style, what is rather vaguely called the *genius of the language*, which naturally changes with the general ideas and state of culture prevalent in a given age. It is not merely the linguistic means whereby men express themselves—the external and audible part of language—which is modified from age to age, but that which is expressed—that is, the outlook on life, the wishes, hopes, and fears, the characteristic kind of spirit and consciousness of each generation. The student who patiently makes himself acquainted with the variegated and ever-changing drama of English speech throughout several centuries is, indeed, sensible of this unfolding of the human spirit made manifest in verbal expression, but he finds it difficult to delimit the beginning and end of the several phases with rigid chronological exactitude. The most striking general fact in the history of English is the emergence, during the 15th century, of one from among the many dialectal types, as the chief vehicle of literary expression, a form of speech which in course of time attains so great a prestige and dominance that before the end of the 15th century it has become practically the sole written type—though still slightly modified by local influence in districts remote from the metropolis—which is used to the exclusion of others, not only in works of real literature, but in official documents of all sorts, and even in private letters. Of these latter large numbers are preserved, written in English during the 15th century, by persons of nearly all classes, from kings and queens, bishops and great noblemen, from country gentlemen and merchants, from officials, and the humbler sorts of domestic servants. This common dialect was, as we shall see, originally that of London and its neighbourhood; it was the dialect in which Chaucer wrote, which Caxton and the other early printers used, to the best of their ability, and it was destined to become the language of literature, and gradually, and much later, the dialect which all educated people, no matter from what part of the country they came, found it convenient to speak. This is the dialect which every one means at the present time when he speaks of *English*, and it is the history of this dialect

with which all 'histories' of English are mainly concerned.

But the emergence of standard and literary English, its adoption as the only written form, was a slow process, and the spread of a spoken standard was slower still, and we are bound to take a general survey, however slight, of English as a whole, so far as the sources at our disposal permit, down to the end of the 14th century. Soon after that date we can confine our narrative to the fate, throughout the succeeding centuries, of the one main type.

On its first introduction into these islands English was a very pure representative of the West Germanic group of languages of which it was a member, and it bears a particularly close resemblance to Old Frisian and Old Saxon. The vocabulary of Old English was at first very pure West Germanic. It contained certain elements borrowed from Latin; some, which for the most part are found in the vocabularies of other West Germanic tongues, incorporated already in the continental period, others acquired from speakers of Latin in Britain, and yet a later group of words derived through the influence of the Roman Church after the conversion of the English to Christianity. Later on Scandinavian words pass into the language. The inflexional system of Old English was typically West Germanic. We find the whole group of verbs known as 'strong' verbs which express the past tense and past participle by an alteration of the 'root' vowel—*rīsan—rās—risen*, &c., which survives in *rise—rose—risen*; the 'weak' verbs, which form their past and past participle with the suffixes, *-ede, -ed, -ode, -od*; the case endings of nouns and adjectives, though somewhat dilapidated compared with those of Gothic, and the distinction between strong and weak declensions in these two categories are common to all Germanic languages; the pronouns, prepositions, and numerals, the word order and general principles of syntax are essentially Germanic in character.

The most characteristic feature of Old English, if we compare it with the other languages of the West Germanic group, is the changes which have occurred in the vowel sounds. These are far-reaching and very remarkable. Some of them must have taken place already in the continental period, others, and by far the larger portion, seem to have developed on British soil (see section *English Sounds*). The effects of these changes, while perhaps hardly sufficient in the oldest period to make English unintelligible to the speakers of such closely related languages as Old Saxon and Old Frisian, were nevertheless the starting-point whence the external form of our language has gone on diverging from Continental Germanic speech, so that the identity of words in English and the dialects of Low German has long been generally unrecognisable without special study.

But English, even in the oldest period, was not quite undifferentiated. The various tribes—Angles, Saxons, and Jutes—had, as we must suppose, severally, from the beginning, certain slight differences in their mode of speech (see *English Dialects*).

When all is said and done, the differences, mainly phonological, between the various dialects in the O.E. period, so far as these can be distinguished in the written records, are comparatively trifling, and apparently could have offered no obstacle to social intercourse between speakers of the different types.

Under King Alfred, Wessex obtained a dominant position among the English kingdoms and provinces; her kings were kings of all England, and the West Saxon dialect became the current and standard form in official and literary documents. Hence nearly all records in English, written after King Alfred's time down to the Conquest, are either in pure W. Saxon, or in a form in which W. Saxon is the principal element and basis. The deviations from this type are very few, so that our knowledge of the precise character of the other dialects is comparatively imperfect. This dominance of W. Saxon as the common literary dialect was not destined long to survive the Norman Conquest.

By the side of the ordinary dialect of prose, there existed, in the old period, a poetical language, differentiated from the former, more by certain archaisms and tricks of diction than by actual differences of dialect. Practically all the metrical compositions in O.E. have come down to us in what is virtually fairly pure and characteristic W. Saxon, with a mixture of certain occasional forms which are apparently chiefly Mercian in character. Whether this is due to the existence of a traditional poetic dialect in which these different elements were conventionally blended, or whether it should be ascribed to the lapses of copyists, is not yet satisfactorily settled.

The most characteristic feature of O.E. poetical diction is its extreme use of metaphorical expressions for common things. Thus a king or prince is the 'protector of heroes, or warriors,' the 'ring,' or 'treasure giver'; a sword is a 'battle friend,' a 'war,' or 'battle ray,' a 'sharp edge,' &c.; a ship is a 'sea stallion,' a 'sea mare,' a 'bird,' a 'sea-bird,' &c.; the sea is the 'whale's country,' 'whale's bath,' the 'path of the whale,' the 'bath of the gannet,' and so on. The ordinary prose style of the O.E. period, while rather awkward at times, especially in the 9th century, when King Alfred himself, though often eloquent, frequently gives the impression of not being a perfect master of his instrument, in the later portions of the period reaches a remarkable degree of polish, and is capable of great clarity and point, as well as of ease of movement, and a simplicity combined with loftiness of expression. The prose of Ælfric's *Homilies* exhibits these qualities to the greatest perfection. After the Conquest the amount of English prose composition is naturally very much reduced, and the tradition is gradually lost. Seventy or eighty years after the Conquest we have a very remarkable record of English speech, as well as an interesting picture of life and feeling, in the latter portions of the Peterborough Chronicle, which begins about 1137 and ends in 1154. Here we find a great simplification of inflexions, a spelling which indicates here and there that certain most important sound changes have occurred, a not inconsiderable number of Norman-French words, and a general structure and style of sentences which appear strikingly modern compared with the latest pre-Conquest writing.

It is evident, however, that these changes, apart from those in the vocabulary, are not the suddenly-wrought effects of the Conquest, but merely the first expression in writing of what had long been coming about in actual speech. From a careful examination of the phenomena which occur sporadically in documents written during the century preceding the Norman invasion, we gain the impression that the old order was passing away. The writers are anxious to adhere to the traditional literary models, but they betray here and there the fact that many changes in pronunciation have already taken place (see *English Sounds*).

This is what we should expect, but it is important to realise that the Conquest did not of itself produce the great changes in the inflexions, pronunciation, and general structure of the language which are sometimes attributed to it, and that the characteristic modifications which we think of as

characteristic of the M.E. period had begun long before the Conquest, and would have led to the same results if that great historical event had never happened.

It is noteworthy of English documents after the 12th century that they reveal a far greater degree of dialectal differentiation than is found in those of the O.E. period. This does not correspond to a new process of dialect creation, but is simply due to the fact that no single dialect type is any longer dominant, as was W. Saxon before the Conquest. The richly differentiated English speech now finds expression in all its variegated regional forms in the written documents. Another rather remarkable fact concerning the English of the 12th and 13th centuries is that in the documents of that period, especially in those written in the eastern areas covered by the old Danelagh, Scandinavian words in considerable numbers make their appearance for the first time. The number of these even in the latest O.E. writings is very small, though it is certain that they must have been current in many local dialects, and equally so that after the last of the Danish kings, no fresh Scandinavian influence was exerted upon English speech. Words and expressions of this origin must therefore have existed in the spoken language before the Conquest, although they do not find their way into literature.

Of all the various M.E. dialect types, the most important for the student of the history of the language is that of the S.E. Midland and S. Eastern areas, since it is the speech of a portion of that area which subsequently became the prevailing type, as has been said, in literature and in spoken English. Although the narrower area of London, the actual home of court speech, is but poorly represented by written records before the time of Chaucer, we possess a large number of writings representing the dialects of the S.E. and S.E. Midlands written before the end of the 13th century.

The dialects of M.E. are doubtless capable of being more exactly and minutely classified than has been done up to the present, and the precise distribution of the various characteristic features, in respect both of phonology and accidence, might, even with the material at present available, be ascertained with much greater certainty. Much remains to be done in these directions, but we are in a position to state that there are no clear-cut divisions between the different dialect areas. These pass by gradual and almost imperceptible stages one into another. Thus the dialect of Suffolk, which is S.E. Midland, has much in common with that of North Essex, which may be regarded as intermediate between S.E. Midland and the S. Eastern of the southerly areas of this county and of Kent, which latter is regarded as typically South-Eastern. Again, the dialect of E. Surrey has much in common with Kentish, but in the westerly area, near the Hants border, shows important affinities with the S. Western type of English.

In the west also there is no hard and fast line between Midland and Southern. The speech of Worcestershire, Oxfordshire, and South Shropshire, which is to be regarded as S.W. Midland, had many Southern characteristics. Passing northwards, the Midland dialects, both east and west, become more and more northern in type, until we get into areas where the full Northern type obtains.

The dialect of London can be traced in a rather unsatisfactory series of documents from the Conqueror's English Charter (1066) down to the poems of Davy (*c.* 1327), and thereafter much more fully in the works of Chaucer, and in official records. From a chronological survey it appears that while even the earliest London documents show a dialect of rather a mixed type—that is, with a large proportion of the Saxon elements of Middlesex, alongside of traces of a more easterly type of Essex character—in the course of time the influence of a more Midland type gains ground, until in Chaucer's time the speech of the metropolis seems to have been very largely S.E. Midland in character. The Midland element is even more predominant after the close of the 14th century. This blending of dialect types was a perfectly natural process, and resulted from the peculiar geographical position of London and the tendency of the great city to draw ever-widening areas into its social and political orbit.

The influence of Norman-French upon the English vocabulary, which began to some extent under Edward the Confessor (d. 1066), who had a Norman mother, and had Norman officials about his court, increased after the Conquest, until it reached its culminating point in the 14th century. By that time not only was French the official speech, and that of the governing classes generally, but even humbler persons who had nothing to do with the court, and who were probably of pure English blood, often abandoned the use of English and spoke French, apparently from a kind of snobbery, as we learn from Trevisa's account (1385) of the languages of Britain. This state of bi-lingualism resulted in that intimate blending of the vocabularies of French and English which is so characteristic of our language. In 1362, however, English was introduced into the law courts, and in 1385 English was substituted for French in grammar schools, and even gentlemen, we are told, were giving up having the latter taught to their children.

It cannot be said that the dialect of London had become anything like the universal literary medium by the end of the 14th century. It was, however, tending that way, and it is worthy of note that John Gower (*c.* 1325–1408), although a Kentishman, used, in his lengthy poem *Confessio Amantis*, a type of English which, while containing a certain number of typical Kenticisms, is on the whole but little removed from the court English of Chaucer, and very different indeed from the broad Kentish of the *Ayenbite*, written about 1340. John Wycliffe also, a native of Yorkshire (d. 1384), left large numbers of tracts and sermons written approximately in the dialect of London, with, it is true, certain occasional Northernisms, and tinged also with more westerly features, derived presumably from his residence in Oxford.

During the 14th century the writers, or at any rate the scribes, adhere for the most part to a conventional and more or less rigid system of spelling which, while it expresses differences of dialect —e.g. E. Midland *lerning* compared with Western *lurning*, &c.—tells us next to nothing of the actual sound changes which the course of time was bringing about in the several dialects. Thus from the MSS. of Chaucer, for instance, we cannot discover that the vowel sounds have undergone any remarkable change in pronunciation since the Conquest, although it is certain that pronunciation did not remain fixed for 300 years. There is, however, good reason for believing that during this period pronunciation had also altered considerably, and that the long vowels especially were gradually moving towards their present sounds. (See *English Sounds.*)

In the following century, however, the art of writing was extended far beyond the circle of the professional scribes, and many of the writers, while observing generally the rules of spelling which they had been taught, make numerous occasional lapses in the direction of unconscious phonetic spelling. The result of a careful study of these 'mistakes' is that a pronunciation very different from that

usually assumed for M.E. is shown to have existed before the middle of the 15th century, and it further becomes very doubtful whether we are justified in believing, as all scholars did until quite recently, that the so-called 'Continental' values of the vowels had survived practically unmodified as late as the end of the 14th century itself.

If we compare the spelling of many of the writers of the *Paston Letters* (1422–1509), that of the *Chronicle* of William Gregory (d. 1467), or of the *Cely Papers* (1473–88), with that of Chaucer, we might suppose that a very remarkable and rapid change in the character of the language had taken place since the beginning of the century. On the other hand, the spelling of Caxton (d. 1491) is to all intents and purposes still that of Chaucer, and reveals practically nothing concerning the changes which are established by the evidence of the less 'carefully' written private documents written earlier in the century. Caxton and the other early printers simply followed the habits of the professional scribes of the late 14th century, and thereby fixed permanently the main features of traditional English orthography, in a form which was no longer a mirror of pronunciation even in Chaucer's day.

An important event in the linguistic history of the 15th century is the dying out of Regional Dialect in written English, and the increasing currency of the London type, not only in literary works, but even in private letters, and that before the establishment of printing in this country (1476). (See *English Dialects.*) There are some traces of this process before the end of the 14th century. We find Sir John Fortescue in his *Governance of England* (1471–76) writing not in his native dialect of Devonshire, but in English as free from Regional influence as that of Caxton. John Shillingford, another Devonian, mayor of Exeter 1447–50, writes excellent London English in his private letters, with very few lapses into Westernisms. The city and guild records of such places as Exeter, Worcester, and Coventry, even those which are prior to Caxton, show but small traces of provincialisms.

With the appearance of printed books, which as Caxton himself tells us he produced in the speech of London, the knowledge of this form of English was rapidly extended, and the death-blow was given to Regional Dialect in literature. By the end of the century it may be said that, except in the North, and in Scotland, London English had become the universally employed form in writings of all kinds, published and private.

The general substitution of London English for the innumerable Regional types as a spoken language was a much slower process, and is not complete, in spite of the efforts of the schools, in the present day.

There are certain indications that towards the end of the 15th century the existence of an upper-class dialect as distinct from the speech of the humbler sort of people, in London itself, was recognised, but it is impossible to say for certain that this was so. It is not to be doubted, however, that such a differentiation, owing to social factors, had actually occurred.

It is certain that two types of London English can be distinguished in the writings of this time—one more definitely Midland in character, and the other containing more Southern features. It seems probable that the latter type was that of the court. In the following century the *Diary of Henry Machyn* (1550–53), a London tradesman, is a valuable record of middle-class English, and in its forms and general style offers a marked contrast to the speech of the more courtly and scholarly writers of the period. In Puttenham's *Arte of English Poesie* (1586), p. 157, there is a definite reference to the speech of 'the inferiour sort' as distinct from that of 'men ciuil and graciously behauoured and bred.' The history of spoken standard English during the last three centuries shows very little influence from Regional Dialect, but that exerted by various Class Dialects, or forms of standard English differentiated by the force of social factors, has been very considerable. It is convenient to distinguish between *Received Standard*, or upper-class English, and *Modified Standard*, or those varieties which have grown up among the other sections of society which do not speak a Regional Dialect.

The influence of the different forms of *Modified Standard* has resulted in the substitution of other types of pronunciation from those formerly prevalent in *Received Standard*, sometimes in whole groups of words, sometimes in isolated words, in certain grammatical forms being discarded, and others adopted, and, in general, in a gradual shifting, from age to age, of the standard or 'correctness' in English speech.

It is plain, from the study of spoken English from the 15th century to the middle of the 18th, in the various sources of knowledge available, that the *Received Standard* down to about 1755 (the date of the first edition of Johnson's *Dictionary*), after which a reaction set in, was far less 'careful' in pronunciation and grammar than at present. The natural tendencies of articulation, such as the omission of consonants in certain combinations, and, finally, the pronunciation of old *er* as *ar* (sarvent, farvent, &c.) in a very large number of words, the slurring or reduction of vowels in unstressed syllables, to a far greater extent than at present (as *fortin* for *fortune*, *faggit*, *flaggin* for *fagot*, *flagon*, &c. &c.), were admitted without question in the normal speech of good society. There was far less desire for that kind of 'correct' pronunciation which is based on the traditional spelling. This is proved from the familiar correspondence of the *Paston Letters*, of Queen Elizabeth, of Gabriel Harvey, of the letter-writers in the *Verney Memoirs* (1639–96), of Lady Wentworth and her children (1705–39), as well as from the accounts given of English pronunciation by the more reliable grammarians of the 17th and 18th centuries. The occasional spellings even in literary works by writers of repute during the 16th century, and the rhymes of poets down to far into the 18th century, all point in the same direction. The reaction came from the highly educated middle-class in the time of Johnson, and the personal influence and prestige of this great man and his circle probably contributed largely to the gradual realisation of those ideals of correctness which he sets forth in the preface to his *Dictionary*.

Two points remain to be briefly touched on in this general survey—the relation of the Spoken Language to the English of Literature, and the survival of Regional Dialect among the upper classes.

As regards the first point, it may be affirmed that allowing for the inevitable differences between what is rapidly uttered without preparation, in familiar conversation, and that which is written at leisure, with every opportunity for deliberation, care, and design, the best literary style of any age is identical, in structure, diction, and general cadence and atmosphere, with the best spoken English of that age. This is noticeable in a remarkable degree in the age of Elizabeth, when the very habits of pronunciation are frequently betrayed by the lapses of the writer from the conventional 'correct' spelling, even in such literary works as *Euphues*.

The style of English literature renews its vitality each generation from the colloquial English of everyday life in which, far more than in any outworn purely literary tradition, it has its roots, and from which it draws its nutriment.

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Further and fuller lists of recent works on the history of English in all its stages, including special monographs on O. and M.E., are to be found in H. C. Wyld's *Short History of English;* lists of sources, grammars, and special investigations will be found in the works of Luick, Jespersen, and Zachrisson quoted above, and in Wyld's *History of Modern Colloquial English.*

As it is sometimes quite impossible to give an account of the history of sound change without using a phonetic alphabet, the following symbols are used, when necessary, for greater accuracy. Phonetic spellings are always included in [ ]. The normal spelling of O. and M.E. may on the whole be regarded as phonetic, so that transcription is only needed occasionally to distinguish, for example, between the two sounds represented by *ē* and by *ō*. In the Mod. Period, where the orthodox spelling hardly changes, although the sounds have changed and are changing, transcription is essential. It must be understood that in O. and M.E. the vowel symbols have approximately the 'Continental' values.

Vowels.—*a* = *a* as in Ger. *mann*; *ā* = *a* as in *father*; æ = vowel in Engl. *hat*, &c.; *ē* = Fr. *é*; *ɛ̄* = Fr. *è*; ī = Fr. *i* in *si*; *i* as in present spelling; *ȳ* = Fr. *u* in *dure, su*; *ø* = Fr. *eu* as in *peu*; *ō* = Ger. *o* in *schon*; *ɔ̄* = *aw* as in *saw*; *ɔ* = *o* in *not*; ū = *oo* as in *moon*; *u* = Engl. *u* in *put*; a = *u* in Engl. *but*; *ɝ* = sound in *curl, bird*, &c.; ə = common Engl. unstressed vowel in *butter*, &c.

Consonants.—j = *j* in Ger. *jahr*, Engl. *y* in *young*; ŋ = *ng* as in *sing*; ʃ = *sh* as in *ship*, &c.; ž = *j* in Fr. *jour*; þ = *th* as in *think*; ð = *th* as in *this*; s = always *s*, never *z*; z = *z*; g = *g* in *go*. (f, l, m, n, p, k, t, r, d, b, w, have same values as in ordinary spelling.) Length marked by ¯ over the vowel; stress by ′ over the vowel; nasalisation by ˜ over the vowel, *ã*, &c.

Diphthongs are merely combinations of above symbols: *ai* as in *sight*, *au* as in *house*, &c. Note Consonant combinations, e.g. dž = *dge* in *bridge*, tʃ = *ch* in *cheap*, &c.

HISTORY OF THE SOUNDS OF ENGLISH.—§ 1. The external form, that is, the sounds of O.E., underwent certain characteristic changes which wrought considerable differences in the oldest form of our language compared with the parent West Germanic, or with the other, nearest cognate tongues of this group. It is necessary to assume an intermediate stage—W. Gmc.—between Primitive Gmc. and O.E., because, although the phonological differences between W. Gmc. and Gmc. were not very great, there are certain sounds in O.E. which cannot be derived direct from parent Gmc. without the assumption of this intermediate stage which we find preserved in the other W. Gmc. languages. In some ways, especially as regards the vowels, the Old High German dialects are more primitive than the other W. Gmc. languages, though in respect of the consonantal sounds High German is much less primitive. Old English preserves on the whole the original consonant sounds of W. Gmc., which are also found in Continental Old Saxon. The consonant system of W. Gmc. does not greatly differ from that of Germanic.

The treatment of the W. Gmc. vowels in O.E.—We distinguish between *Isolative* and *Combinative* sound changes. The former are the result of normal development, and are not determined by the influence of other sounds in the same word. By the period of the earliest O.E. documents the characteristic phonological differences are fully developed. Some of the changes may have begun during the Continental period. The complete isolation of English from other types of Germanic speech produced more far-reaching changes in the original sound system than is found in any of the languages of the same family on the Continent, widely as these have diverged from each other in some respects.

§ 2. *Isolative Treatment.*—1. W. Gmc. *ā* becomes *ǣ*: O.E. *sǣd* 'seed,' O.H.G. *sāt*; O.E. *dǣd* 'deed,' O. Sax. *dād*. W. Gmc. *ā* remains in O.E. when followed by *w*, or *g*, + a back vowel: *lāgon* 'they lay,' *sāwon* 'they saw.'

2. W. Gmc. *ă* becomes *æ*: O.E. *dæġ* 'day,' O.H.G. *tac*; O.E. *æcer* 'field,' O.H.G. *acchar*, &c. When, however, *ă* is followed in the next syllable by *a*, *u*, it remains unaltered if only a single consonant intervenes; thus *dæġ* has nom. pl. *dagas*, dat. pl. *dagum*, &c. The *æ* develops, however, in the pl. of *cræft* 'strength,' &c., pl. *cræftas*, and so on.

Before nasals also *a* does not change to *æ*, thus *land*, *nama* 'name,' &c.

3. W. Gmc. *ai* becomes *ā* in O.E.; O.E. *ān* 'one,' O.H.G. *ain*, *ein*; *bān* 'bone,' O.H.G. *bain*, *bein*.

4. Gmc. and W. Gmc. *au* becomes *ēā* in O.E. through the stages *æu*, *æo*, the latter of which still survives, in some Old Northumbr. sources: *ċēās* 'chose,' Gothic *kaus*, O.H.G. *kous* (= *kaus*); O.E. *dēāþ*, Gothic *daupus* 'death,' O.H.G. *tōt* (with change of *au* to *ō* before *t*); O.E. *hlēāpan* 'leap,' O.H.G. *loufan*.

5. Gmc. and W. Gmc. *eu* becomes O.E. *ēo*; O.E. *ċēosan* 'choose,' Goth. *kiusan*; O.E. *lēof* 'dear,' Goth. *liubs*, O.H.G. *liuf*. The diphthong still retains its primitive form occasionally in some of the earlier Glosses, e.g. *steupfæder* 'stepfather' in Épinal Gl., later *stēop*.

6. The vowels *e*, *i*, *u*, *o*, whether long or short, remain in O.E. unless altered by Combinative change.

7. There was a vowel in Gmc. and W. Gmc. which was originally a nasalised *a* [*ą*]. It had arisen in Gmc. in the combination *-anh-*. The vowel in this position became nasalised (a sound somewhat resembling French *an*), then the *n* disappeared. Thus there was an old past tense of the verb *to bring*—**branhta*, this became **brą̄hta*. In O.E this nasalised *ą* became *ō*, and the nasalisation disappeared, the vowel being lengthened. In O.H.G. we find *brachta* 'brought,' and *dachta* 'thought,' but in O.E. *brōhte*, *pōhte*. The nasalisation disappeared in time in the other W. Gmc. languages; in O.E. alone the vowel was previously rounded to *ō*. Part of the process, as we see, was Combinative, but the main part, that we are concerned with here, namely, the rounding of the nasalised *ą*, is Isolative.

§ 3. *Combinative Changes.*—1. *Fracture.*—This is the name given to a process whereby, at a very early period, the vowels *i*, *e*, *æ* and *ǣ* were diphthongised when they occurred before certain consonants or combinations of consonants. The sounds which produced the diphthongs were *h*, alone, or followed by another consonant; *ll*, and *l* followed by another consonant; *rr*, and *r* followed by another consonant. *i* became *iu* and then *eo* in the Merc. dialects (cf. § 88, 3); *e* became *eu* and then *eo*, so that in these dialects there is no difference between the result of the fracture of *i* and *e*. *æ* became *æu* and then *ea*; *ǣ* became *ǣu* and then *ēā*. *i* and *e* undergo no fracture before *ll* and other *l*-combinations except those with *c* and *h*.

(*a*) Fracture of *i*: *meox* and *miox*, from **mihs-* 'dung'; *meolcum* and *miolcum* 'milk,' dat. pl. from **milk-*; *iorre* 'angry,' W. Sax. *ierre*, Merc. *eorre* (cf. § 88, 3, below).

(*b*) Fracture of *e*: *feohtan* 'to fight,' O.H.G. *fechtan*; *seoh*, imperat. 'see,' from **seh*; *seolh* 'seal,' from *selh*; *heorte* 'heart,' O.H.G. *herz*, O. Sax. *herto*; *weorðan* 'become,' O.H.G. *werdan*; *eorþe* 'earth,' O.H.G. *erda*.

(*c*) Fracture of *æ*: *seah* 'saw,' from *sæh*, cf. O.H.G. *sah*; *feaht* 'fought,' *feallan* 'to fall,' O.H.G. *fallen*; *eald* 'old,' O.H.G. *alt*, O. Sax. *ald*; *healf* 'half,' O.H.G. *halb*; *earm* 'poor,' O.H.G., O. Sax. *arm*; *wearþ* 'became,' O.H.G. *warth*; *earn* 'eagle,' O.H.G. *arn*. (*N.B.* this *æ* is always from an earlier *a* which survives in other Gmc. languages.)

(*d*) Fracture of *ǣ*: the only example is O.E. *nēāh* 'near,' from *nǣh*, O.H.G. *nāh*.

2. W. Gmc. *ą̄* becomes *ō* before a nasal consonant in O.E.: O.E. *mōna* 'moon,' O.H.G. *mānō*; *nōmon*, pret. pl., 'they, &c., took,' O.H.G. *nāmum*. This is the vowel which, as we saw in § 2, 1, normally became *ǣ* in O.E.

3. W. Gmc. *ą̆* before a nasal consonant is rounded to *o* in Early O.E., especially in W. Sax., but this rounding is not universal, and *a*-forms occur in all dialects; thus *monn* and *mann*, *hond* and *hand*, *long* and *lang*. In later W. Sax. the *a*-forms preponderate.

4. Primitive O.E. *ą̄* becomes *ō*. This process is exactly similar to that described in § 2, 7, but part at least of it is of a later date, and the whole process must be considered as typically English. The loss of the nasal consonant before *h* is a Gmc. change, and the *ą̄* arose in the most primitive Gmc. period. The *ą̄* we are now considering arose in the earliest English period in the combinations *-ans-*, *-amf-*, *-anþ-*. The actual rounding of *ą̄* of both origins may have been synchronous. Thus an original *gans* 'goose' (as in O.H.G.) became *gās*, and this, before the earliest documents, became *gōs*. Other examples are: *sōfte* 'soft,' O.H.G. *samfto*; *nōþ* 'courage,' from **nanþ*, cf. Goth. *nanþ-jan* 'to venture'; *tōþ* 'tooth,' from **tanþ-*, cf. O.H.G. *zand*.

5. Lengthening of *ĩ*, *ũ* (nasalised *i* and *u*) on loss of nasalisation. These vowels arose under the same conditions as *ą̄* discussed in § 2, 7, and § 3, 4, but they undergo no qualitative change.

Examples: *sīþ* 'time, journey'; cf. Goth. *sinþ-s*; *cūþ*, 'known,' O.H.G. *kund*, Goth. *kunþ-s*; *mūþ*, 'mouth,' from **munþ-*; cf. O.H.G. *mund*.

6. Diphthonging of Primitive O.E. *e*, *æ*, *ǣ* after front ('palatal') consonants. (For origin of *æ* and *ǣ* cf. § 2, 1 and 2.) This process is typical of the W. Sax. dialect, and occurs after the consonants *ċ*, *ġ*, *sċ*, where the above vowels become *ie*, *ea*, *ēā* respectively. The non-W. Sax. dialects preserve the vowels unchanged. The diphthonging occurs in W. Sax. before the period of the earliest documents. Thus Prim. O.E. *ċæf*, non-W. Sax. *ċæf* (*ċef*), becomes W. Sax. *ċeaf* 'chaff'; W. Sax. *ġeaf*, pret. sing. 'gave,' non-W. Sax. *ġæf* (*ġef*); W. Sax. *ġēāfon*, non-W. Sax. *ġæfon* (*ġefon*), pret. pl. 'gave'; *ġiefan* 'to give,' non-W. Sax. *gefan*, O.H.G. *geban*; *ġielpan* 'boast,' non-W. Sax. *ġelpan*, O.H.G. *gelfan*; *sċeal* 'shall,' non-W. Sax. *sċæl* (*sċel*); *sċield* 'shield,' non-W. Sax. *sċeld*; *sċēāp* 'sheep,' non-W. Sax. *sċæp*, became *sċēp*, O.H.G. *schāf*.

7. *-i-* and *-j-mutation.*—This process, which is one of the latest of the important Combinative changes in Early O.E.—later than all those hitherto mentioned—consists in the fronting, or, as some prefer to call it, 'palatalising,' of back vowels, *a*, *ā*, *u*, *ū*, *o*, *ō*, when the front vowel *i* or the front open consonant ('spirant') *j* (as in German *j*ahr, or English *y*ear) follows in the next syllable. The intervening consonant is first modified by shifting the place of articulation forward in the direction of the front *i* or *j*, and this in its turn 'fronts' the preceding vowel. The process is essentially a 'fronting' process, except in one case, that of *æ*, which, as we shall see, being a front vowel, is merely 'raised' to *e*. The results of this process are found in the oldest documents. In addition to the simple vowels, *i*-mutation affects also the diphthongs, especially in W. Sax. *ēā* and *ēō*, both becoming *īe*. We know that *i*-mutation is later than the other Combinative changes hitherto dealt with, because vowels which result from these earlier processes are affected by this one. The process is perhaps the most important and far-reaching of all the O.E. Combinative changes, since its results remain at the present time, and there are innumerable cases of variants in the same 'root' which cannot be understood without a knowledge of it. Examples:

(*a*) of *ă*: *slæġen*, p.p. 'struck,' from **slaġin*.

(*b*) of *ā*: (cf. § 2, 3) *dǣl* 'part,' from **dāli*, cf. *dāl*, from **dāla*; also *dǣlan* 'to divide,' from **dāl-jan*; *tǣċan* 'point out, teach,' from **tāk-jan*, cf. *tāc-n* 'sign, token.'

(*c*) of *ĕ*: *settan*, vb. 'set, place,' from **sætt-jan*, cf. *sæt* 'sat,' pret. of *sittan*.

(*d*) of *ō*: *dēman* 'to judge,' cf. *dōm* 'judgment,' and O. Sax. *dōmian*; *cwēn* 'woman, queen,' from **cwōni*, W. Gmc. **kwāni* (cf. § 3, 2); *tēþ* 'teeth,' from **tōþi*, cf. *tōþ* 'tooth'; *gēs* 'geese,' from **gōsi* (for this *ō* cf. § 3, 4).

(*e*) of *ŏ*: *exen*, pl. of *oxa* 'ox' from **ox-in-*.

(*f*) of *ū*: *brȳd* 'bride,' cf. Goth. *brūþi-*; *cȳ* 'cows,' from **kū-i*, pl. of *cū*, cf. Provincial *kye*; *cȳþan* 'to make known,' from **cūþ-jan*, from *kunþ-jan*, which survives in Gothic, cf. § 3, 5.

(*g*) of *ŭ*: *fyllan* 'to fill,' cf. O.E. *full* 'full'; *pytt* 'pit,' from **puttjo*, early loan-word from Lat. *puteus*.

(*h*) of *ēā*: *hīeran* 'hear,' from **hēar-jan*; *flīeman* 'put to flight,' from **flēām-jan*; *ierm̄pu* 'misery,' from **earmipu*, cf. *earm* 'poor'; *bieldan* 'to encourage,' from **beald-jan*, cf. *beald* 'bold.' The diphthongs *īē* only occur in W. Sax., cf. § 85, 2. For forms in other dialects, cf. § 86, 1. In Late W. Sax. *īē* becomes either *ȳ* or, in other areas, *ī*.

The Middle English Period (*c.* 1100–*c.* 1400). —§ 4. The vowel system by the end of the O.E. period was approximately the following: *Long vowels*, *ā*, *ǣ*, *ē*, *ī*, *ō*, *ū*, *ȳ*; *short vowels*, *a*, *æ*, *e*, *i*, *o*, *u*, *y*; *long diphthongs*, *ēā*, *ēō*, (*īē*); *short diphthongs*, *ea*, *eo*, (*ie*).

§ 5. *Spelling.*—This was at first unaffected by Norman influence, but it was beginning to reflect, sporadically, the gradual sound changes that were overtaking English, such as the simplification of the old diphthongs, and the weakening of the vowels of unstressed syllables to a single sound, generally written *e* later on. In the Late O.E. period, however, we find that *a*, *e*, *u* in unstressed syllables were often confused, and one written where, historically, another belonged.

During the 12th century increasing signs are seen in the MSS. of Norman orthography, notably the writing of *u* (or *v*) for O.E. *ȳ*, on the model of the French spelling for a sound which was presumably identical, and the writing *ou* for the [ū] sound as still in French; the purely graphic substitution of *o* for O.E. *u* (*sone* for O.E. *sunu* 'son,' &c.), especially in the neighbourhood of *n*, *m*, *w*. The new diphthongs, whether in English or French words, were written *ai*, *ei*, *au*, *ou*, symbols which are unknown in O.E., except *ei*, which occurs sometimes in Kentish texts. It may be assumed that, on the whole, the vowel symbols still had their so-called Continental values: *e*=[e], *i*=[i], &c. Length is sometimes expressed by doubling the letters, *saaf* 'safe,' *good* 'good,' but is generally unmarked. When necessary for clearness, the phonetic symbols will be used in the following, placed in [ ].

§ 6. The consonants underwent comparatively little change. O.E. *ċ*, *sċ* are written *ch*, or, medially, *tch*; *sch*, *sh*, *ssh*, *ss* respectively, and no doubt had their present-day sounds. O.E. *ġ* initially is often written *ȝ*, a modification of the O.E. symbol *ȝ*, and, later, more commonly *y*. O.E. *g* between back vowels was an open consonant ('spirant'), and in this position it was weakened to *w* in M.E., e.g. *lawe* 'law,' O.E. *lagu*. O.E. *ċġ* in *bryċġ*, *byċġan* 'bridge, buy,' &c., attained the present sound, and was written *gg*: *brigge*, *biggen*, &c. The Continental symbol *g*, unknown in Engl. MSS. before the Conquest, was used for the stop consonant as at present: *gōd* 'good,' &c. The back open voiceless consonant, as in Scots *loch*, is written either *h* or, later, *gh*, as in *ruh* 'rough.' The O.E. symbol *þ* is generally replaced by *w* or *uu*. The symbol *ƿ* survives alongside of *th* well into the 15th century.

Early in the M.E. period the back voiceless stop is increasingly expressed by *k*, especially before front vowels, *king*, *kēpen* 'keep,' &c.; later also *ck* when final, in which position *c* would express [s] to a Norman. *c* for *s* is sometimes used in English words, cf. *mice*. *c*, however, is retained initially before back vowels where no ambiguity could occur; thus we still write *cold*, *cot*, *come*, &c. The early printers did not cut a special type for ȝ, but used *z*, which is also found in some late 15th-century documents instead of ȝ or *y*. This explains why we still write *Capercailzie*, *Dalziel*, *Monzie* [kəipəkeili, diél, mənī], &c. *Mackenzie* owes its present pronunciation to the spelling, which undoubtedly was intended to express [məkénjī].

§ 7. The above vowels underwent important changes in the M.E. period, involving both quantity and the actual quality of the sounds.

Changes in Quantity.—M.E. Vowel Lengthenings. —(*a*) Late in the O.E. period short vowels were lengthened before the combinations *ld*, *nd*, *mb*, *rd*; thus *ald* (§ 87, 4) became *āld* 'old,' *æld* (the result of the fractured form) became *æld*, *ċild* 'child' became *ċīld*, *cămb* 'comb' became *cāmb*, *wŏrd* became *wōrd*, &c.

(*b*) During the 13th century the short vowels *e*, *a*, *o* were lengthened in words of two syllables where only one consonant intervenes, as in *tăkan* 'take,' which became *tāken*, *hŏpa* 'hope' became *hōpe*, *mĕte* 'meat' became *mēte*, &c. The lengthened

syllables in these cases ended in a vowel, the division originally being *me-te*, &c. These are called open syllables, and the process is known as *lengthening in open syllables*. At a later date *ĭ* and *ŭ* are lengthened under the same conditions in some dialects, and by the 14th century undergo a further change to tense *ē* and *ō* respectively. They then share the subsequent fate of ordinary M.E. *ē*, *ō*, for which see §§ 31, 33, below. Examples: Late M.E. *wēke* 'week,' O.E. *wĭcu*, *wōde* 'wood,' O.E. *wŭdu*.

§ 8. *M.E. Vowel Shortenings.*—(*a*) *Shortening before groups of consonants.*—O.E. long vowels were shortened in M.E. before doubled (long) consonants, before most combinations of consonants other than those mentioned in 7 (*a*). Before these also, when another consonant follows, long vowels were shortened, and those originally short were not lengthened: *hĭdde*, pret. of *hīdan* 'hide,' O.E. *hȳdde*; *fĕdde* 'fed,' pret. of *fēden*, O.E. *fēdde*; *wĕpte*, pret. of *wēpen*, O.E. *wēpte*; *sŏfte* 'soft,' O.E. *sōfte*; *dĕpthe* 'depth' cpd. with *dēpe* 'deep'; *găstliche* 'spiritual,' O.E. *gāstlīċe*; *gŏsling* cpd. with *gōs* 'goose'; *hălwien* 'hallow' cpd. with *hōli* 'holy'; pl. *childre* cpd. with *chīld*; pl. *lămbre* cpd. with *lōmb* 'lamb,' &c. It will be seen that many differences in quantity in forms of the same root in Mod. Engl. can be explained by this principle.

(*b*) *Shortening of first of three syllables.*—*Hŏlidai* cpd. with *hōli*; cf. pl. n. *Whitaker*, where the first element is O.E. *hwīta* 'white.' The vowel in an open syllable (§ 7 (*b*)) where this is the first of three is not lengthened: cf. *Beverley* by the side of uncompounded *beaver*, O.E. *beofor*, M.E. *bēver*.

(*c*) *Long vowels shortened in unstressed syllables.*—There are innumerable examples of this in place-names compounded with O.E. *tūn* 'town,' where we now get [tən] (written *-ton*), Bamp-*ton*, &c.; cf. old *Kingston* with Mod. *Kingstown* in Ireland; those in *-ham*, O.E. *hām*, as in Birming*ham*, &c. cpd. with uncompounded *home*. Cf. also *hussif*, O.E. *hūs-wīf* 'house-wife.'

Qualitative Treatment of the Vowels in M.E.—§ 9. O.E. *æ*, *a*. To judge by sporadic spellings with *e* it seems probable that before the end of the O.E. period *æ* had in several dialects, including W. Sax., been raised to *e*—*set* for O.E. *sæt* 'set,' *pet* for *pæt*, *wes* for *wæs*, &c. (On the earlier O.E. change to *e* in the dialects cf. §§ 87, 5; 88, 1.) In another area, however, in the Midlands, and perhaps first of all in the East, *æ* instead of becoming *e* is retracted to *a*, and in the first half of the 12th century we find *was*, *bar*, O.E. *bær*, 'bore,' *spac*, O.E. *spræc* 'spoke,' side by side with the old spelling *æ* and a few *e* spellings. The *a*-forms speedily become the most widespread in practically all dialects, including that of London. Chaucer knows no others. The *a* of this origin is lengthened according to § 7 (*b*), e.g. O.E. *læt* 'slow,' M.E. *lāte*, 'late.' O.E. *a* undergoes no change in Early M.E., and therefore differs in no respect from the new *a* from *æ*, O.E. *fæt* 'vessel,' pl. *fatu*, M.E. *fat*—*fătten*. This *ă* in so far as it remained short was gradually fronted during the M.E. period in the direction of the Mod. sound (cf. § 25).

§ 10. O.E. *ā* (cf. § 2, 3, above) became *ō*=[ɔ] in the Sthn. and Midland. The change, in the way of some slight rounding, must have begun very early, and before the introduction of the earliest French loan-words with *ā*, *fāme*, &c., since none of them ever have *ō*. The 12th-century texts still write *a* as a rule, but Peterb. Chron. writes *mor(e)*, O.E. *mār(a)* 'more' several times. During the 13th century the archaic spelling *a* is often used, sometimes alongside of, sometimes instead of, *o*, even in those dialects where *ō* had certainly developed; but by the beginning of the next century *o* is practically the universal spelling in all areas where the rounding took place. Examples: *hōm*, O.E. *hām*; *bōt(e)*, M.E. *bāt* 'boat'; *rōd*, O.E. *rād* 'rode'; *tōlde*, O.E. *tālde* 'told'; *gōst* 'spirit,' O.E. *gāst*. The shortenings mentioned § 8 (*a*) are earlier than this rounding, as is seen from *Stăn*-lei cpd. with *stōn*, O.E. *stān*, &c., *ăn*, indef. art. (unstressed), cpd. with *ōne* 'one,' O.E. *ān*, and the suffix *-hăm* by the side of *hōm*, &c. This *ō* had the same sound as O.E. *ŏ*, lengthened according to § 7 (*b*), and must be kept distinct from the other O.E. and M.E. *ō* below. It is sometimes written *oa*, *loaf*, O.E. *hlāf* 'loaf,' &c. For Nthn. fronting of O.E. *ā* cf. § 91, below.

§ 11. O.E. *ǣ*. This sound in O.E. had two distinct sources, which it is necessary to distinguish, as their fates are in some cases different. (*a*) What we may call Prim. O.E. *ǣ* or *ǣ*[1], from W. Gmc. *ā* (cf. § 2, 1, above) becomes [ē], written *ē* in O.E. in a very large area of the country before the earliest written documents, but remains as *ǣ* so written in Wessex and part of the S.E. Midl. (For dialectal distribution of *ǣ*, *ē*, cf. §§ 85, 3; 86, 3; 95 (*b*); 96 (*b*) and (*c*); 97 (*b*) and (*c*), below.) In M.E. those dialects which preserved this *ǣ* raised it to [ɛ̄], the other dialects had [ē] instead. Chaucer's rhymes show that the London dialect used the [ɛ̄] type in a preponderating number of words, although the other type was by no means unknown.

It may be noted that the sound [ɛ̄] is sometimes, but not at all systematically, written *ea*, otherwise it is impossible to distinguish between the types except by examining the rhymes in poetry. Examples of words containing *ǣ*[1] are: *rēde* 'council,' O.E. *rǣd*; *spēche*, O.E. *sprǣc*; *wēren* 'were,' O.E. *wǣron*; *brēth(e)* 'breath,' O.E. *brǣþ*, &c.

§ 12.—(*b*) The other O.E. *ǣ*, which we may call *ǣ*[2], was the result of *i*- *j*-mutation of O.E. *ā* (cf. § 3, 7 (*b*)). This sound is far more constant in O.E. than *ǣ*[1], and, apart from Kent and certain areas in the extreme East, it survived during the O.E. period. In Late O.E. and Early M.E. this *ǣ* was also raised to [ɛ̄], while the other type remained [ē] as it had been in O.E. The treatment of *ǣ*[1] and *ǣ*[2] becomes an important dialect test in M.E. (cf. §§ 93 and 96). In the dialect of Chaucer *ǣ*[2] the slack type [ɛ̄] is usual, though the rhymes show that the Kentish or Essex type [ē] also existed. On the whole, it may generally be assumed that words containing *ǣ*[2] in M.E. will have the [ɛ̄] sound, the area where the tense type obtains being comparatively small. The vowel of this origin is also written *ea*. This symbol is an indication of the slack sound. Examples are: *tēche* 'teach,' O.E. *tǣċan*; *ĕvre* 'ever,' O.E. *ǣfre*; *ēni* 'any,' O.E. *ǣnig*; *hēth* 'heath,' O.E. *hǣþ*. Note that Chaucer rhymes *brēp*—*hēp* in lines 5 and 6 of the Prol. Gower, a Kentishman, writes *ie* for *ǣ*[2] in *diel*, 'part,' showing his typical tense form, compared with Chaucer's *dēl* [*dɛ̄l*]. It is very important to make the distinction in pronunciation between the two sounds [ē, ɛ̄] in M.E. The subsequent history of the two sounds is different up to a point. They are both [ī] now, but the tense [ē] changed into its present sound perhaps a century earlier than the slack, and the present type of the latter did not come into use in Received Standard till much later still. (For other sources of M.E. [ē, ɛ̄] cf. § 7 (*b*); §§ 13, 20, 22, 23.)

§ 13. O.E. *ē*.—This sound, which may arise from the *i*-mutation of *ō* (cf. § 3, 7 (*d*)), from either *ǣ*[1] or *ǣ*[2] in certain dialects, as just described, from *i*-mutation of *ēa* in non-W. Sax. (cf. § 23), as a special S.E. treatment of O.E. *ȳ* (cf. § 96), or from the lengthening of *i*-, remains unaltered during the greater part of the M.E. period, towards the end of which it tends towards the present sound [ī]. As early as the 12th century sporadic spellings, such as *siche* (Brut) for O.E. *sēċan*, tend to show that the sound, in some areas at any rate, was beginning to change

very early. Tense *ē* of any of the above origins is occasionally written *ie* in M.E., a spelling which always indicates the tense vowel. See examples under references to various sources of the sound.

§ 14. O.E. *ī*, as in *wīf*, 'wife, woman,' *wrītan* 'write,' *mīld*, *blīnd*, &c. survives late into the M.E. period unaltered so far as we know. In the first third of the 15th century spellings like *bleynd* 'blind' point at least to the beginning of diphthongisation.

§ 15. O.E. *i*, *e*, *o*, and *u*, unless lengthened according to § 7 (*b*), above, remain unaltered in M.E.

§ 16. O.E. *ō* in *bōc*, *tōp*, *fōda*, *gōd*, *mōna*, *lōcian*, &c. was a tense vowel, and during the M.E. period gradually developed towards [ū]. The above words are normally written *bōk*, *book*, *tooth*, *good*(*e*), *mone*, *moon*(*e*), *loke* 'look' in M.E., where the *oo* implies no more than length. From the 14th century onwards, however, as very occasionally even earlier, we find the spellings *bouk*, *goud*, *louke*, &c., where *ou* is the normal M.E. spelling of the sound [ū]. Although it might be rash to assume that the present-day vowel, as in *moon*, &c., was fully developed as early as the first half of the 14th century, these spellings undoubtedly point to a movement in that direction. It is probable that by the end of the century the new vowel was established over a wide area. This tense *ō* is never rhymed by good poets in M.E. with the other *ō* of §§ 7 (*b*) and 10. These sounds were different in O.E., they are different now, and they were certainly quite different in M.E. For the Nthn. development of O.E. *ō* cf. § 91.

§ 17. O.E. *ū*, as in *mūþ* 'mouth,' *hūs* 'house,' *hū* 'how,' &c., is generally written *ou* or *ow* after the middle of the 13th century, and in some texts earlier. Thus *hous*, *south*, &c., imply no change in sound. This old *ū* was never caught up by the new *ū* from *ō*—that is, there never was a time when old *mōna* 'moon' had the same vowel as old *tūn* 'town.' Before the new *ū* was fully developed old *ū* had begun to change, and the beginnings of the subsequent diphthongisation must have started. We have no graphic evidence of this, however, during the M.E. period.

§ 18. O.E. *ȳ*.—This original vowel, whose chief source in native English words was the *i*-mutation of *ū* (cf. § 3, 7 (*f*)) already in O.E., appeared in three forms (cf. §§ 87; 92 to 97), *ī*, *e*, *ȳ*. The London dialect prefers the *ī*-type—*brīd* from O.E. *brȳd* 'bride,' *hīden*, O.E. *hȳdan* 'hide,' *mīs* 'mice,' O.E. *mȳs*. The history of this *ī* is precisely that of original *ī* (§ 14). The S.E. types *hēden*, *mēs*, come under M.E. *ē* (§ 13); the surviving O.E. *ȳ*-type is preserved chiefly in the S. and S.W. and W. Midl. It gradually disappears in native words nearly everywhere in favour of the *ī*-type. In those areas where it survives it is written *u*, or *ui*, *uy* in M.E.

The sound occurs also in N. French loan-words such as *sūre*, *pūre*, *fortūne*, *aventūre*, &c. The sound survives in these words well into the Mod. period (§ 40).

§ 19. O.E. *ў*.—In those dialects where it survives in native Engl. words this sound is written *u* in M.E. Its main source was the *i*-mutation of *ŭ* (§ 3, 7 (*g*)). The same three types of the short are found in M.E. as of the long, with approximately the same distribution, except that more *e* and *u* forms of the former are found in the London dialect than of the long. The *i* and *e* types, of which the former are the prevailing forms in London, undergo no further change, being treated like original *ĭ* and *ĕ* respectively. The vowel of the *u*-type is retracted in the early Mod. period, and became identical with M.E. *ŭ*, whose fate it therefore shares. The subsequent history of this sound belongs to the Mod. period (cf. § 39). In M.E. the same word may occur (in Chaucer) in more than one form. Examples of *u*-type in M.E. are *russche* 'a rush,' *muche* 'much,' *bundel* 'bundle,' *hull* 'hill,' *bury*, old dat. sing. of *burg* 'town,' O.E. dat. *byriġ*; *e*-forms are *knell*, *fulfelle* 'fulfil,' O.E. (W.S.) *fyllan*, *kesse* 'kiss,' vb., O.E. (W. Sax.) *cyssan*, &c.; *i*-forms: *mille* 'mill,' W. Sax. *mylen*, *thinne* 'thin,' W. Sax. *þynne*, *bisie*, W. Sax. *bysiġ*, *pitte* (also *putte* in Chaucer), W. Sax. *pytt*, 'pit.' The *ŭ* [ў] sound is common also in Norm. Fr. words: M.E. *jugge* 'judge,' *juste*, &c. This vowel has precisely the same history as the native Engl. sound.

Simplification of O.E. diphthongs in M.E.—§ 20. O.E. *ēā* became *ǣ*, and is so written, occasionally, in Late O.E. This spelling still survives in Early M.E., but *e*, together with the traditional *ea*, is more frequent. In later M.E. *e* is the normal spelling. There is no doubt that the sound very early became [ɛ̄], and was thus identical with that derived from the lengthening of O.E. *ĕ* (§ 7 (*b*)) and that derived from O.E. *ǣ*[1] and *ǣ*[2] (§§ 11 and 12). Examples in M.E. are *dēthe* 'death,' O.E. *dēāþ*, *dēfe* 'deaf,' O.E. *dēāf*, *chēs* 'chose,' O.E. *cēās*, pret. sing. It would be quite accurate to say that the vowel in these and similar words was derived from Late O.E. *ǣ*.

§ 21. O.E. *ēă*.—The only source we need consider here is that derived from the O.E. fracture diphthong *ea* (§ 3, 1 (*c*)). This was also monophthongised to *æ* in Late O.E., and shares the fate of original O.E. *æ̆* (§ 9). Thus O.E. *hearm* becomes *hærm*, whence M.E. *herm* and *harm*; *ġeard* 'yard' becomes *yærd*, whence M.E. *yerd* and *yard*. The London dialect usually has the *ă*-type, but Chaucer still uses *yerd*. In the combination *ea* + *ld*, O.E. *eald* 'old,' *beald* 'bold,' the same change to *æld*, *bæld*, takes place and this vowel undergoes lengthening, so that we get Late O.E. *ǣld*, *bǣld*, whence M.E. *ēld*, *bēld*, with [ɛ̄] from *ǣ*[2] as in § 12.

The distribution of this fractured type is a dialect problem (cf. §§ 95 and 96). In the greater part of the Midland area, however, the fracture of *æ* before *l*-combinations does not take place, and instead of *eald*, &c., we get Late O.E. *āld*, *bāld*, *cāld* 'cold.' This early became the prevailing London type, and indeed it had spread over nearly the whole country by the end of the 14th century. This *ā* is treated in M.E. exactly like the other O.E. *ā* (§ 10), and is rounded to *ō*, so that we get very widely *ōld*, *bōld*, *cōld*, in M.E.

§ 22. O.E. *ēŏ*.—The history of these diphthongs, both long and short, may be treated together. (1) In some areas, especially in the extreme East, *eo* and *ēō* were monophthongised as early as the 10th century to *e* and *ē* respectively. (2) In others farther West and South the diphthongs were retained as such, and went apparently through the following stages [eo < eo < ĕ̄]. This last stage is probably reached in the early 12th century, and the rounded vowel is very soon unrounded to [ɛ̄], thus arriving by a different process at the same result as the first-mentioned type. The *ē* of this origin is invariably tense [ē]. This is the London type, derived perhaps by process (2). (3) In the more Westerly areas of the Sth. and Midl. the process followed is (2) above, but on reaching the [ĕ̄] stage, instead of becoming [ɛ̄] the vowel is raised to [ў̄], thus retaining its rounding. For this sound the symbol *u* is often used, as for the other similar sounds discussed in §§ 18 and 19. (For the distribution of the types see §§ 92 and 95.) Examples of the London type are, for the long, *dēre* 'dear,' O.E. *dēōr*, *chēsen* 'to choose,' O.E. *cēōsan*, *hēld*, pret. 'held,' O.E. *hēōld*; for the short, *erthe* 'earth,' O.E. *eorþe*, *herte* 'heart,' O.E. *heorte*, *nether*, O.E. *neoþor*.

§ 23. O.E. *tĕ*.—These diphthongs only occur in W. Sax. (§§ 3, 6; 3, 7 (*h*); 85, 2). In those M.E.

dialects where they exist they are expressed by the spelling *u*, which stands for the Late W. Sax. *y*, e.g. W. Sax. *hyrde* 'shepherd,' M.E. *hurde*; W. Sax. *ieldu, yldu* 'age,' S.W. M.E. *ulde*; W. Sax. *hīeran, hȳran*, S.W. M.E. *huiren*, &c.

The mutation of O.E. *ēā* in the non-W. Sax. dialects is *ǣ*, and this survives, so written in M.E., e.g. *hēren* 'hear,' from O.E. *hēran, ēlde* 'age,' O.E. *ēldu, herde* 'shepherd.'

§ 24. In the Late M.E. period the following vowels were in use in the Sth. and Midlands: [*ă, ā, ĕ, ē, ō, ŏ, o, ŭ, ĭ- ў*], and the diphthongs [*ai, oi, au, ou, ɛu, iu*].

THE MODERN PERIOD.—§ 25. *Changes in Stressed Vowel Sounds since c. 1400.—M.E. ă.*—This sound has been fronted to [æ] by an Isolative change. There is no doubt of the fact; the only question is, When did the present sound develop? It is not till 1653 that Wallis, and in 1685 Cooper, describe a vowel which can only be the present sound in *bat, cap, dash, grand, hat*, &c. On the other hand, we get spellings such as *sedness c.* 1420, *thenking* 'thank-' 1442, *wetch* 'watch' 1469, *jesper c.* 1465, and so on, which seem to show that the full M.E. sound was no longer pronounced, at least in some circles. Shakespeare in *Ven. and Ad.* rhymes *scratch—wretch*, which would hardly have been possible had the old sound still existed. It would probably be safe to say that in the best London English the new sound came into use rather later than in some provincial dialects, but that it was established in the former by the end of the 16th century.

§ 26. *The combination -al-.*—This first became [*au*], and then was gradually monophthongised to the present [ɔ]. The latter process will be dealt with under the treatment of M.E. *au*, § 36. During the 15th century such spellings as *Saulysbury, Tawbot, cawlyd* 'called,' *schawl* 'shall,' show at least that the diphthong had already developed.

§ 27. *M.E. ă after w, wh, qu.*—In words like *was* (when stressed), *wash, what, quality*, &c., the vowel is rounded to [ɔ]. The process is one of rounding, and presumably took place when the vowel was still in the [ă] stage. *Wosse* is written in the third quarter of the 15th century for *was*, and the same spelling for *wash, c.* 1550. Watson, 1593, rhymes *songs—swans*. The *o*-spellings do not become very frequent till the middle of the 17th century. The words *quality, quantity*, were long pronounced by some speakers with [æ], and this persisted into the first third of the 19th century among old-fashioned persons. On the other hand, *quollity* occurs as early as 1683 in the Verney Memoirs.

§ 28. *M.E. ă before s, f, th (þ), and r.*—In these positions *ă* normally became [æ], according to § 25, but was subsequently lengthened. Thus *path, bath; pass, last; laugh* (Late M.E. *lăf*), *chaff; are, hard*, &c., were pronounced in later 16th-century English and down to well on in the 18th century among some speakers as [pǣþ, pǣs; lǣf, tʃæf, ǣr, hǣrd], &c., as in the S.W. of England and in many parts of America to-day. This long front vowel was subsequently retracted to [ā], the present sound in Received Standard English. The lengthening probably took place during the first part of the 16th century; the later retraction, at varying dates among different classes of speakers. There are indications that among some speakers [ā] existed already in the late 17th century. This is the chief source of present-day [ā].

§ 29. *M.E. ā.*—This sound was first fronted and then diphthongised to the present sound. The process was probably [ā-ǣ-ɛ̄-ē-eĭ]. As early as *c.* 1430 Bokenam writes *credyll* for M.E. *crādel* 'cradle,' and in 1420 the rhyme *cāre—wēre* occurs. Other 15th-century spellings are *ceme* 'came,' *teke* 'take,' &c. It is clear that some sort of fronted vowel is indicated, but it is impossible to say which precise stage in the series was reached at a given time. In the 16th century Ld. Buckhurst rhymes *speake—make*, and Spenser *states—seates*, which almost certainly points to [ē]; cf. § 31. The present-day diphthong is first definitely described by Batchelor in 1809. If a front vowel had already arisen as early as the first third of the 15th century, it seems probable that in Chaucer's day the old M.E. *ā* could no longer have been pronounced. The shift towards the present sound had at least begun.

§ 30. *M.E. ē*=[ē].—This vowel, no matter what its origin (cf. §§ 11, 13, 22, 23), has been merely raised to [ī]. There are plenty of 15th-century spellings with *i, y*: *hyre* 'hear,' *myte* 'meet,' *dyme* 'deem,' *symed* 'seemed,' *spyde* 'speed,' &c. These spellings are very frequent in the 16th century, Q. Eliz. being especially prone to them in her letters. From the moment that these spellings occur it can hardly be doubted that the new sound has developed, or at least one which hardly differs from it.

§ 31. *M.E. ē*=[ɛ̄].—We have seen that this vowel had numerous sources, and that it was kept distinct from the other *ē* in M.E. rhymes. It has now caught up the tense *ē*, and there is no difference in sound between *meet*, M.E. *mēten*, always tense, and *meat*, M.E. *mēte* (with lengthened vowel), originally slack. The first change was that when [ē] became [ī], the other *ē* became tense. The rhymes as late as Pope, and even as Cowper, show that in a large number of words this type, with [ē], remained in use in such words as *sea, seat, cheat, heat*, &c., for a long time. On the other hand, there is evidence, rather doubtful for the 15th, quite positive for the 16th and 17th centuries, that among some groups of speakers the [ī] sound had already developed. In 1528 *clean* (M.E. [ɛ̄]) rhymes with *been*; in 1550 the spellings *brykyng, spykyng*, occur in Machyn; *birive* (O.E. *rēāfian*) in Gabr. Harvey's letters 1573–80; and Q. Eliz. writes *bequived* 'bequeathed.' These forms make it certain that the new type already existed, but it was not yet widespread. There is plenty of evidence for the existence, side by side, of both forms in the 17th and 18th centuries, though during the latter the new type was gradually taking the place of the old more and more among a wider circle and in an increasing number of words. What has happened since Pope is not that his pronunciation of *heat* to rhyme with *mate* has changed by natural development into ours, but that his type has been abandoned and another substituted. Our pronunciations of *great, break, steak*, are probably survivals of the older type. Note that before *-r* the vowel did not become tense, e.g. in *bear*, M.E. *bēren, tear*, vb., M.E. *tēren*, &c. The vowel in *spear* is anomalous.

§ 32. *M.E. ĭ.*—The diphthonging of this vowel probably began in the 15th century at latest. The new sound was soon levelled with that of M.E *oi*, and we find *anynted* in 1430, *defoyled* 'defiled,' *pyson* 'poison,' later in the century. In 17th century we get *gine* 'join,' *byled* for 'boiled,' &c. Pope rhymes *line—join*, &c. The normal development of this diphthong was [*aĭ*], whether from *ĭ* or *oi*, but the spelling has affected the pronunciation of the latter, so that 'ile' for 'oil,' 'bile' for 'boil,' &c., are now vulgar, though very common in the dialects.

§ 33. *M.E. ŏ*^{2} (*slack*=[ɔ]), cf. §§ 7 (*b*), 10.—This vowel, which occurred in *hŏm, lŏp, gŏt*; *hōpe, thrōte*, &c., became [ō] after old tense *ō* had become or was about to become [ū], and this sound lasted at any rate till late 18th century. The present diphthongal pronunciation is first noticed by Batchelor, 1809.

§ 34. *Un-rounding of M.E. ŏ.*—This was apparently a West-country change. A form *starme*

'storm' occurs in a Wilts text *c.* 1420. This type of pronunciation is still heard in the West, and in American English. The un-rounded forms are found sporadically in the letters of all classes in London English from 16th century onwards: the vulgar Machyn (1550) has *Dasset* 'Dorset,' *harse* 'horse,' *caffen* 'coffin'; Lady Hungerford 1569 writes *swarn* 'sworn'; and Q. Eliz. has *stap*. Note that Shakespeare rhymes *folly* with *dally* in *R. of Lucr.*, 554–556. The pronunciation became fashionable during the 17th and early 18th centuries, as may be seen from Vanbrugh's burlesque of it in the character of Ld. Foppington. The 17th-century Verney Memoirs have *fally* 'folly,' *sassages*; and Mrs Basire writes *Gearge* 1655. The forms *strap*, *Gad*, survive to-day, and *plat* for *plot* (of ground) occurs in the Authorised Version.

§ 35. *M.E.* $\bar{o}^1$ (*tense*).—This developed into something like the present sound already in M.E. (§ 16). Spellings with *ou*, *goud*, *houk*, &c., and with *u*, *gud*, &c., are quite common in the 15th and 16th centuries. We have three groups of words at the present time whose vowels all go back to this M.E. $\bar{o}$: *moon*, *spoon*, *rood*, where the new [ū] remains unchanged; *hook*, *book*, *good*, &c., where the vowel has been shortened, perhaps during the last 150 years; *blood*, *month*, *flood*, *glove*, *mother*, &c., where the new vowel was first shortened in the Early Mod. period, and then treated like old *ŭ* (§ 39, below). This differentiation is apparently the result of dialect mingling in Received Standard. The age of the first shortening was clearly prior to that in which M.E. *ŭ* was altered, and on this see evidence in § 39. The spellings *fludde*, *bludde*, in 16th century probably represent the early shortened forms, which by this time had undergone a further change in the direction of our present sound in those words.

§ 36. *M.E. and Early Mod. au; also M.E. ou.*—This includes words like *law*, *saw*; *cause*, *haunt*, *caught*; and the later group *all*, *stalk*, *tall*, &c. (§ 26); further, *thought*, *daughter*, &c. The process of change to the present sound was probably [*au–ɔu–ɔ̄*]. M.E. *ou* in *pouhte*, *doughter*, &c., was caught up by old *au* at the first stage above indicated. Surrey (in Tottel) spells *tought*, M.E. *taughte*, rhyming with *ywrought*, M.E. *wroughte*; and Ld. Buckhurst rhymes *wrought—caught*, showing that the two sounds had become identical. The 16th century also saw the simplification of the diphthong, as is shown by such spellings as *olso* 1535, *onnt* 'aunt,' *a nobe* 'an alb' *c.* 1550. The above is the main source of our present [ɔ̄] sound.

§ 37. *M.E. ai, ei.*—These two original diphthongs were identical in sound in Late M.E., and = [*ai*]. The first element was fronted, and then the second was dropped, so that the sound became identical with that from M.E. *ā* and *ē* [ɛ̄]. Thus the process was [*ai–æi–ǣ–ɛ̄–ē*]. The sounds were probably united at the [ǣ] stage in the 15th century, where they are both often written alike—*a* for old *ai*: *sa*, 'say,' *feth* 'faith,' M.E. *feith c.* 1442, &c.; and conversely, *ai* for *ā*: *maid* for M.E. *māde* 1421, *spayke* for M.E. *spāke* 1539, and so on. Henceforth the history of *ai* is that of M.E. *ā*, which has already been outlined.

§ 38. *M.E. ū.*—The words *how*, *cow*, *house*, &c., all contained this sound. We have retained the old spelling (explained § 5), but have diphthongised the vowel. Spellings such as *abaught*, M.E. *aboute*, *faunde*, M.E. *found*, *aur*, M.E. *our*, &c., occur in the Paston Letters of the 15th century, and *sauth*, M.E. *south*, in the Godstow Register of the same century. There is no doubt that a diphthong is intended, but we cannot be sure how far it has gone towards the present sound. The 16th-century orthoëpists describe the diphthong as made up of *o+u*; in 1625 a French writer transcribes *how* as *haow*, which must mean something very like our own sound. In any case the starting-point of diphthongisation was earlier than the development of the new *ū* (§ 35), and we have seen that this, for various reasons, must be placed probably not later than the third quarter of the 14th century at latest.

§ 39. *M.E. ŭ* (*including Engl. and Fr. u* [y]).—This vowel has undergone un-rounding, and has passed into the characteristic sound heard in *but*, *cut*, *run*, *hunt*, &c. The old sound still survives in some words, after lip-consonants: *put*, *pull*, *bush*, *bull*, &c. At the moment when the un-rounding started there were four classes of words which had all the same *ŭ* sound: (1) M.E. *ŭ* in above examples; (2) those containing M.E. [y], written *u*: *bundle*, *thrush*, *cudgel* (§ 19); (3) French words containing Fr. *u*=[y]: *judge*, *public*, *study*, &c.—classes (2) and (3) must have altered their vowel, by retraction, to the *ŭ* sound; (4) words containing M.E. tense *ō*, which had become the new [ū] and been shortened: *flood*, *glove*, *done*, &c. (§ 35). Thus sounds of four different origins had all become identical, and their common sound underwent in all cases the same change. There are 15th-century spellings which at least suggest that un-rounding has already taken place: *gannes* 'guns,' *sadanly* 'suddenly,' *camyth* 'cometh' (M.E. *cŭm-*), &c. It does not follow that this implies a sound identical with that of to-day.

§ 40. M.E. *ū* (=French *ū* [ȳ]; and M.E. *ēu*; *eu* =[ɛ̄*u*]; *iu*).—These sounds appear to have been all levelled under a single form [jȳ] in Late M.E. Examples of the several groups are: *ūse*, *dūke*, *dūe*, *issue*; *knēw*, *grēw*; *dēw*, *fēw*; *Tuesday*, *steward*, &c. &c. We find these once various sounds expressed by the same symbols in the 15th century—that is, all the above symbols are used for any of them. They also rhyme together. Fifteenth-century examples are: *knywe*, M.E. *knēw*; *hue*, M.E. *hēw*, pret. 'hewed,' O.E. *hēow*; Bokenam rhymes *greu*, pret., with *vertú*; *sewer* 'sure,' *dewke* 'duke,' *dew* 'due,' *indewer*. In 16th century we find *blue* 'blew,' *nu* 'new,' &c. Opinions differ as to when [jȳ] developed into the present sound [jū]. The 17th century orthoëpists differ in their statements; many assert that 'long *u*,' as they call it, meaning the sound in *tune*, *duke*, &c., still had the French sound, while others state that the English sound is different from the French. It seems certain that all the above words had the same sound. In 15th century at least the only question is, What was it? How soon did the present sound arise? The fact probably is that some speakers retained [jȳ] far into the 17th century, while others already pronounced [jū] as at present.

The spelling *youes*='use,' vb., which occurs in 1569 (Lady Hungerford), seems to make it certain that that lady pronounced as at present, and the spelling *youst* 'used,' *young* 1647, *youmore* early 18th century, all point in the same direction. On the other hand, to quote an authority not generally cited in this connection, Voltaire in the *Dictionnaire Philosophique*, in the article 'Langage,' says: 'Les Anglais qui ont corrompu toutes les voyelles . . . n'ont point abandonné *u* . . . il disent *vertu* et *true* et non *vertou*, *troue*.' This as clearly points to [ȳ], and Voltaire spoke and wrote English fluently. We thus cannot be sure whether Shakespeare and Milton pronounced *duke*, *dew*, as we do at present, or whether they said [djȳk, djȳ], but we can be sure that both pronunciations were in vogue in the English of their times.

§ 41. The Vowels in Unaccented Syllables.—The habit of 'slurring,' shortening, or 'obscuring' vowels in unstressed syllables is not of recent origin. On the contrary it has been characteristic of English speech at every period of its history. To this habit

it is due that an inflexional system of O.E. crumbled almost to nothing in M.E. During the latter period a new series of vowels often appeared in unstressed syllables; some due to new compounds, some to the adoption of foreign words, others again which for some reason had escaped an earlier reduction, experienced the process in the later M.E. period. In many French words of two syllables the accent was formerly on the second syllable; later, according to English habits of speech, the stress was shifted to the first, and the second was shortened or obscured. The following brief list of occasional spellings drawn from documents ranging from the 15th to the 18th century tends to show that the present-day pronunciation of unstressed syllables, or something very like it, must have been established certainly before the end of the 15th century. In some cases the examples are found in each of the four centuries; in others, they have been found in writings from later periods. The earliest available only are given, as a rule, for economy of space.

It will be noted that in some instances, owing to the influence of the traditional spelling, a new pronunciation is now current which is supposed to correspond more exactly to this. The examples are arranged under the different vowels before various consonants. They are mostly, though not always, drawn from private letters and diaries. *-ed*: *belovid* 1420, *wrechid* 1451; *-eth*: *-ith* and *yth* very common in London and other Engl. in 15th century; *-es*: mass*is* 1450, charg*is* 1455, vers*is* ib.; *-est*, eld*yste* 1450–70, fair*yst* (superl.) 1490; *-en*: oft*yn* 1430, kech*yn* 1451; *el*: unk*yl* 'uncle' 1451, app*yl*-tre 1430; *-less*: harm*lys* 1465; *-ness*: kind*nis*, happi*nis* Q. Eliz.; *-ess*: dutch*iss* 1705; *-ledge*: know*liche* 1447; *-et*: mark*yt* 1473, bull*its* 1708; *-ac-*, stom*e*chere 1478, stom*i*chers 1645, stom*ick*, *Izic* 1724; *-age* (*-ange*), mess*y*ngere 1450–70; *-ave*: St Ol*e*ffes (St Olave) 1462, Olive 1701; *-age*: marr*ige*s 1556, vicar*ige* 1605, cor*ige* 'courage' 1641; *-mas*: cryustyn*mus* 1550, cris*mus* 1634; *-on*: ses*yn* 'season' 1451, reas*yn* 1512, mutt*en* 1529; *-o-*: dys*a*bey 1451; *-of-*, men *a* warre 1531, tenne *a* clocke 1573–80; *-ot*: fag*e*ts 1661, som'*at* 1701; French *-ure*: past*er* 'pasture' 1420, moist*er* 'moisture' ib., unscript*er*lye Bp. Latimer, mann*e*ring 'manure' 1535, tort*e*ring Shakespeare 1st fol., joint*er* 'jointure' 1570, fut*er* 1664; French *-une*: com*y*ned together 1447, mysseforte*n* 1550, misfort*in*, fort*in* 1642, 1645, 1663, &c., fort*ing* 1663—said also by Tony Lumpkin; French *-ute*: cond*y*tte 'conduit,' bysk*itt*, min*ite* (a note) 1473–88; French *-u-*: repetation 1469, mon*i*mentary, mirac*i*lous 1677, vert*i*ous 1708; French *-u*: new*ys* (=nevys) 1550, val*y* 'value' 1642, nev*ie* 1655; *-aw*, *ow*: fel*as* 'fellows' 1430, fell*y*schyp 1470–80—Pope rh. fell*ow*—prunell*a*; *-night*: s*e*net 'se'nnight' 1656, fort*net* 'fortnight' 1654; *-ain*: cert*yn* 1447, cert*yne* Anne Boleyn, capt*in* 1642, vil*in* 1655; *-day*: Mun*dy* 1573–80, 1647: Frid*y* 1642. These few examples are enough to show how old are the habits which some now condemn. The examples are nearly all taken from persons of the upper class. A full discussion of the subject and numerous examples will be found in Wyld's *History of Mod. Colloquial Engl.*, ch. vii.

CONSONANT CHANGES IN MODERN PERIOD.—§ 42. The various modifications of consonantal sounds which can be traced, some from 14th century, some from 15th, fall generally under the following heads: (1) Isolative Changes without loss or addition; (2) Combinative Changes involving neither loss nor addition; (3) Loss of Consonants; (4) Addition of Consonants. The results of some of these processes still survive in ordinary speech, others have disappeared in Received Standard owing to the recent tendency to assimilate pronunciation to the supposed 'correct' forms suggested by the traditional spelling. This tendency is comparatively recent, and far on into the 18th century the best speakers were unaffected by it. There are many other categories of which space forbids mention, and the following are only a few from many examples. The writers of the following nearly all belong to the upper classes, some are well-known authors.

§ 43. *Isolative Changes without loss or addition.*—(*a*) M.E. *-gh* becomes *f* (spelling still retained): *thorf* 'through' 1465, *troff* 'trough' 1553; to *laffe* 1553. (*b*) M.E. *-ht* becomes *-ft*: *unsoffethe* 'unsought' 1450–70 (=[ansɔft]), *daughter* rh. *after* 1604, *dafter* very common in 17th century. (*c*) Substitution of *-in* for -ing: *holdyn*, *drinkyn* 1389; *wrytyn*, noun, 1443, *hangyn*, *walkyn* 1450, *hangyns* 1520; *syttyn*, *rydyn* 1550, *besichen*, Q. Eliz., *seein*, *bein*, *comin* 1642, *shillins* 1657, *disoblegin* 1664, *takin*, *dynin*-room, *approchin*, *mornin*, *writins*, &c. Lady Wentworth 1705. Pope rhymes *gardens—farthings*, and so on. The reaction against this pronunciation seems to have started *c.* 1830, but has by no means completely triumphed.

§ 44. *Combinative Changes without loss or addition.*—(*a*) *-si-*, *-ti-*=[sj, tj] become [ʃ], also *-su* [-sjū] becomes [ʃu]: *conschens* 1469, *derecschons* 1470–80, *instrocshens* 1544, *commyshin* 'commission' 1539, *suspishiously* 1649, *mentshoned* 1650, *pashens* 1664, *Prushee* 'Prussia' Lady Wentworth 1705; *ishu* 'issue' Gabr. Harvey's Letters 1573–80. (*b*) Initial *su-* becomes *'shu'*: *sheute* 'suit' 1593, *shur* 'sure' 1642, *shuite* (of clothes) 1653, *ashoure* 'assure' 1653. (*c*) *-di-* becomes [dž]: *sawgears* 'soldiers' 1550, *teges* 'tedious' 1647, *contages*, *Injan* 1701, *edjucate* 1801.

§ 45. *Loss of Consonants.*—(*a*) *of initial aspirate*: *alf* 'half' 1389, *alpeny* ib., *astely* 1463, *oulde* 'hold' 1503 (Mary, daughter of Hen. VII.); *ede*, *alff*, *ard*, *elmet* 1550. (*b*) *swo-* becomes *so*: *sor* 'swore' 1451, *sord* 'sword' 1593, *sowlen* 'swollen' 1593, *sord*, *solen*, *sorn* given as proper pronunciation for *sword*, &c. 1701; *ku* (qu) become *k-*, *coting*=quoting in *Euphues*. (*c*) Loss of *l* before lip and back consonants and some others: *behaf* 'half' 1442, *Fakonbrige* 1465, *Mamsey* 'Malmsey' 1570–80, *stauke* Q. Eliz., *swolne* rh. *bemoan* E. of Surrey in Tottel, *swone* written by Machyn 1550, *shudd* Elyot's *Governour* 1531 and Gabr. Harvey, *wood* 1665. (*d*) Loss of *r*. The earliest examples are before *-s*: *wurst* rh. *adust* 1441, *wosted* 1450, *passell* 1470–80, *mosselle c.* 1460, *church* rh. *such* 1528, *skasely* 1544 and 1556, *furst* rh. *dust* E. of Surrey in Tottel, *Fotescue*, *Fottescue* 1635–36, *quater* 'quarter' 1642, *Gath* for *Garth* Lady Wentworth 1705–11, *Dotchester*, *Molbery* 'Marlborough' ib. 18th-century writers affirm that *nurse*, *purse*, are pronounced like 'nuss,' 'pus,' &c. (*e*) Loss of *d* before and after other consonants, medially and finally: *freendy* 'friendly' Hoccleve, *Wensday*, *myssomer* 1450, *Wostrett* 'Wood St.' 1550, *stannestill* 1593, *Lonan* 'London' 1654, *Lunnon* 1757, 1765, 1787, *blyn* 'blind' 1389, *husbon* 1440, *my Lor* 1470–80, *rebowne* 1528, *blyne*, *cole* harbour 1550, *friten*, p.p., 1642, *thousan*, *Sunderlin*, *own* 'owned,' *Richmon*, &c. Lady Wentworth. (*f*) Loss of *t* in same positions: *fonstone* 1420, *morgage* 1448, *offen* 'often' Q. Eliz., *wascote* 1593, *Chrismas* 1639, *busling* 1701, Seynt Johan þe babt*is* 1389, *nex* 1462, *excep* 1470, *uprigh* 1503, *Egype* 1550, *respecks* 1629, *Papeses* 1655, *pagin* 'pageant' 1701, *prospeck*, *strick*, *tex* 'text' Lady, and P. Wentworth 1705–11; Pope rhymes *neglects—sex*. (*g*) Loss of *b*: *Lameth* 'Lambeth' Archbp. Cranmer 1534, *tremlyng* 1557, *nimlest* Q. Eliz., *Cammerwell* 1607, to *clyme* 1580.

§ 46. *Addition of Consonants.*—(*a*) Of *w* initially before *one* and *ho-*: *won* 'one' 1420, 1426, 1466, 1549,

1593, &c. &c.; *wholle* 'whole,' earlier *hole*, 1420, *whome* 'home' 1442, *wolde* 'old' 1479, *whot* 'hot' ib. and 1550, &c. (*b*) Addition of consonants finally: *Jaylardes* 1420, *lynand* 'linen' 1470, *wyld* 'will' 1449, *synst* 'since,' *downed* 'down' 1528, *varment* 'vermin' 1539, *sermont* ib., *surgiant* 1573–80, *mush-rompe* (*Euphues* 1586), *orphant* 1582, *vilde* 'vile' common in Shakespeare 1st fol., Donne rh. *vilde —child, schollards* 1641, *micklemust* 1642, night-*gownd* 1683, Swift rh. ferment—vermin, *sarment* 'sermon,' *laught*, inf., *saft* 'safe,' *lost* of time, *gownds* Lady and P. Wentw. 1711–13.

(For more information on the Consonants see ch. viii. of Wyld's *Colloquial English*.)

English Inflexions.—§ 47. *Definite Article.*—The full inflexion of this in all genders and numbers must have been considerably impaired in most areas, in the spoken language, before the end of the O.E. period. In Midl. by the middle of 12th century the indeclinable *þe* is a word in frequent use in written English. In the more southerly areas the old *þer*, gen. and dat. fem. sing., *þen(e)*, acc. sing. m., and *þon*, &c., dat. sing. m., occur as late as the 13th century. The old neut. sing. *þet*, *þat* is used first as the article; but more and more with a demonstrative force as at present. It survives, however, into the Mod. period in *the tōne = that ōne*. The old M.E. acc. or dat. survives in *for the nonce = for then ōnes*. In the place-name *Atterbury* the dat. fem. survives, = *at þer*, whence *atter-bury*. The pl. *þō* is used as late as 15th, and, rarely, as the 16th century. With disuse of the fem. and neut. forms of the article, grammatical gender disappeared and was replaced by natural gender.

§ 48. *Nouns.*—After the O.E. period, owing to the weakening of *-a*, *-u*, to *-e* in unstressed syllables, and the tendency to level all declensional types under one of two types, the chief questions are what is the poss. sing. and what is the pl. form of nouns. Speaking generally, nouns either form their poss. in *-es*, according to the old chief masc. and neut. type, or, less commonly, in *-e*, which may represent either an old *-a* of a masc. decl., the *-e* of a fem., or, possibly a weakening of *-an*, the old weak gen. In the middle of 12th century *þes cuēnes* 'the queen's' occurs in Midl., but in the south the *-e* poss. occurs fairly often in the 14th century, and, sporadically, much later. In E. Midl. *steore nāme* (13th century) we have presumably a survival of the O.E. weak gen. *steorran* 'star's,' and also in *huerte loue* 'heart's love,' South-west. Chaucer writes *-es* for poss. in all genders, but has occasional *-e* in old fem, *widewe, churche, ladye*. He has one example of an old *-u* stem—*sune* 'son.' Phrases like *oure lady matins* occur in Caxton, and as late as 1567; throughout the 16th century isolated examples of these fem. poss. are found, and *our Lady Day last* in 1688; *Lady Chapel, Lady Day* are the last survivals. The *-s* is omitted after nouns in *-r, father*, &c. as late as the end of 16th century —*the father good will*, 1593; after group-combinations—*the bishop of London palles*, 1550; before words beginning with *-s—the younge kinge stomacke*, 1588; sometimes in other cases, as late as early 18th century—*a parson widdoe*, 1705.

Such groups as *the King of England's daughter*, &c., are thus inflected occasionally already in Late M.E. In the 15th and following centuries these constructions become increasingly frequent. The normal M.E. construction is *þe kinges suster of France*, cf. the *bailiff's daughter of Islington*. This survives in the 16th century, cf. Lord Berners's *the kynges daughter of Englande*. Where we now say *King Stephen's brother*, &c. the M.E. construction was *þe kinges brother Stephnes*. In 1460 we find the *Lordys wyffe Nevyle*, the noun in apposition not being inflected. During the 16th century quite long groups take the inflexion on the last word of the group—e.g. *our holye father of Romes eares* (Bishop Latimer).

§ 49. *Plural of Nouns.*—The commonest type in O.E. is the masc. class, which has nom. and acc. pl. in *-as*. This becomes *-es* in M.E., and is by far the commonest type, being extended to most other classes. The only type which at all competes with it in M.E., and that only in some areas of the South, is that derived from the O.E. weak decl. which has *-an* in nom. and acc. pl., M.E. *-en*. This suffix is found, especially in Kentish, attached to old strong (*-as*) nouns: *applen, honden, dēden* 'deeds,' *bruggen* 'bridges,' as well as the old weak words—*hunten* 'hunters,' *herten* 'hearts,' &c. In Early Mod. Engl. occasional weak pls. are used by good writers—*All sowllen college* 1535, *Alhalowentyde* 1483, *Allhalonday* 1567, *howsyn* 'houses' (Ascham), *Peason* (Gabriel Harvey), &c. In Kent. texts of M.E. the old weak gen. pl. *-ena* survives occasionally as *-ene—kingene*, &c.

Such invariable plurals as *deer, sheep*, are survivals of old long-syllabled neuters, which have no suffix in nom. and acc. in O.E. The type still survived in 15th and 16th century English to a far greater extent than at present. Words expressing weight, distance, measure and number, and words used collectively are the chief words affected, but there are others as well, which are more truly survivals of the old type. Of the former—*three thousand pounde* (Bishop Latimer), *three hundred thousand pound, xv foote thyke* (Life of Wolsey), 2 *yeere* (Verney Mem. 1641), *iiij fethem* (Gregory, 1460), *ij lambe* 1533, *to bring forth apple* (*Euphues* 1586); of the latter—*all thinge* (Lord Berners), *I trust I shall receve your thanke* (Q. Eliz.).

§ 50. Of minor classes the mutation-pls., of which *teeth, geese, lice, mice*, &c. are examples, may be mentioned. Originally these were more numerous, and included words of all genders. O.E. *bēċ* 'books' survives as *bēch* in a 12th-century Kent. text; *geet* O.E. *gāt* 'goats,' and *kēne*, a South-eastern form for *kine* 'cows,' are found in Caxton.

§ 51. *Irregular Plurals.*—*Children* is from M.E. *childre*, O.E. *ċildru*, with the additional weak pl. suffix; *brethren* has both mutation and the weak suffix; in Early Mod. we get this form, also *brotheryn* (1480). In M.E. all the relationship words except father often occur with *-en* in the pl.: *sustren, modren, douȝtren*, &c. On the analogy of *children* and *ēiren* 'eggs,' O.E. *ǣgru* with *-en* added, we get also *lambren* 'lambs,' by the side of normal *lambre*, and *calfren* by the side of *calfre* 'calves.'

§ 52. *Survival of Old Datives.*—The forms *meadow, leasowe*, are old datives; O.E. *mǣdwe, lǣswe*; M.E. *medoue, lesoue*, &c.; *bury* in dat. from O.E. *byriġ*, nom. *burg*, which gives us *borough*.

§ 53. *Adjectives.*—In O.E. adjectives have two types of declension, the weak, which is used after the article and which resembles the *-n*-declension of nouns, and the strong, which is used in other cases. The characteristic suffixes of the str. adj. are those of the pers. prons.—*-ne* acc. sing. masc.; *-re*, dat. sing. fem.; *-ra*, gen. pl. In M.E. the weak declen. disappears after the end of the 12th century, unless indeed the final *-e*, commonly used as an attributive suffix in the 14th century as the sole inflexion, without deduction of gender, number, or case, be a weakening of *-an*. The typical strong adjectival endings survive sporadically in the South as late as the 14th century, but on the whole they are rarities after the 12th century. A few cases of *-ne* occur in Worcs. in the 13th century, and rather more in the South and in Kent. A dat. sing. *godere* appears in the S.W. Midl. text of Ancren Riwle (early 13th); as a gen. pl. *-re* is rather commoner in the 13th century both in E. Midl. and in the South. Even Chaucer still has

such phrases as *youre aller cost*, and fossils like *alderbest*, where *alder* = O.E. *allra* 'all' are used by him, while a belated *God our aller Creatour* ('of us all') survives in the 15th century (Letter of Richard III. to James III. of Scotland).

§ 54. A curious usage, derived from French, is the addition of the pl. suffix *-s* to adjectives. This is found occasionally in Chaucer when the adj. is used attributively and stands after the noun—*places delitables, goodes temporeles*; it is rarer when the adjective precedes the noun—*in the sovereyns devynes substances*, or when the adj. is used predicatively—*romances that ben royales*. In the 15th and 16th centuries these forms are occasionally used in technical phrases—*Lordes spirituelx and temporelx, lettres missives*, &c.; still more remarkable are such constructions as *demures and wise sustris*, &c. (15th century).

§ 55. *Comparison of Adjectives.*—The suffixes *-er, -est*, are derived from O.E.; they may represent Prim. O.E. *-ir, -is*, or *-or-, -ost-*. In the former case they mutate the vowel of the adj. The forms *eldra* 'elder,' *eldest, strenġ, strenġest, lengra, lenġest*, from *ald*, M.E. *ōld, strōng, lōng*, are among the most frequent mutated comparatives and superlatives. *Lenger, strenger, lengest, strengest* are used far into the 16th century; *elder, eldest* have long had a specialised meaning, but *elder* is still used by Lily and Spenser, and even by Congreve, as late as 1700 as the ordinary comp. of *old*. The use of *more, most* with adjectives which have the comp. and superl. suffixes is fairly frequent in the 15th and 16th centuries. Caxton has *more gretter*; Latimer, *more diligenter*; Caxton, *most strengest*; Lord Berners, *moost outragoust people*, &c. So correct a writer as Lily uses the form *badder* instead of *worse*.

§ 56. *Adverbs.*—These are formed in O.E. (*a*) by the addition of *-e* (Instr.), *wīde*, 'widely'; (*b*) by addition of *-līċe* 'like,' *sōpliċe* 'truly'; (*c*) *-unga, -lunga, -linga, eallunga* 'altogether,' *grundlunga, grundlinga* 'to the foundations'; (*d*) *-mælum, styċċemælum* 'piecemeal,' &c. From (*b*) is derived the commonest adverbial suffix, *-ly*; from (*c*) *darkling* 'in the dark,' *headlong*, &c. Further, the gen. and dat. of nouns or adjectives in O.E. are often used adverbially—*ealles* 'completely,' *dæġes* 'by day,' and, on the analogy of this, *nihtes*, which corresponds to *o' nights*, where *o'* stands for M.E. *on* 'in,' and is here redundant; *micelum* 'very' (dat. sing.), *hwīlum* 'at times' (dat. pl.), whence with altered meaning 'whilom'; *seldom* is another of this class.

Once, twice, thrice, M.E. *ānes, twies, pries, always, nowadays*, are all old genitives. The last resembles the formation of *o' nights* (*a* from *on*). It is at earliest a M.E. formation, since in O.E. *on* would take a dat. after it here.

Personal Pronouns.—§ 57. *Singular, First Person.*—O.E. *iċ*, weakened to *ī* in unstressed syllables in M.E. which gradually becomes the prevailing form, except in S.W., where it survived far into the 19th century. Chaucer still uses *ich* occasionally, but generally *ī*. Acc. and dat. *mē* call for no remark, as they survive with the normal change of vowel. Generally *mīn* is used as a real genitive in O.E., and occurs after verbs governing gen.—*God helpe mīn* 'God help me,' &c. It is also used as a poss. adj., and is inflected like other strong adjectives. The inflexions *mīnne, mīnre* (or *mīre*) are still found in 13th century. In M.E. *mī* 'my' occurs before consonants, *mīn* before vowels.

§ 58. *Second Person.*—O.E. *þu, þē(c), þīn* survive in M.E. and later with the normal vowel changes.

§ 59. *Third Person Masculine.*—O.E. *hē, hine, him, his*. The nom. dat. gen. (poss.) survive to present day. Acc. *hine* survives in S.E. Midl., and is used still more frequently in the South during the 13th century. Gradually *him* is more and more used indifferently for acc. and dat. Many rustic dialects still retain *hine* in form of *'un* [ən], used perhaps more of things than of persons.

§ 60. *Third Person Feminine.*—O.E. *heo*, acc. *hie, hi*, gen. dat. *hire*. Except in Nth. and occasionally in E. Midl. the old nom. survives in M.E. till the 14th century, and in the W. much longer. Peterb. Chron. (1154) has already *sċæ* 'she'; the earliest Nthn. texts have *scō, schō*, &c. In W. Midl. (14th century) *schē, shē* are used alongside of old *hue* (*hēo*) and *ȝhē*. *Schē*, &c. early becomes the regular form in London English. As late as 1420 the Wilts S. Editha has *hē, hee* as the only forms. The M.E. acc. dat. and gen. are normally *hire, hir, here, her*. The weak form *a* 'he' is used by non-dialectal writers as late as 17th century.

§ 61. *Third Person Neuter.*—O.E. nom. and acc. *hit*, other cases as in masc. *Hit*, together with all other pronouns in *h-*, often loses the aspirate already in the 13th century. Thus *it*, as well as *e, im, is* all occur, in unstressed positions, in 13th century. On the other hand, *hit* is frequently written by Q. Eliz., and this is still common in Scots dialects. The new poss. *its* is not recorded till late in 16th century.

Plural Forms of Pronouns.—§ 62. *Third Person.*—*They, their, them* are Scandinavian forms, compared with O.E. *hie, heora, heom* (*him*). In the nom. all Sthn. texts write various *h-* forms, *heo* and more frequently *hī* down to and during 14th century. The Wilts. S. Editha still has *hee, hoe* in 1420. The London poems of 1327 still use *hii*, but all later texts appear to use *þei, thei* only. The E. Midl., with the exception of Orm (1200), have *hī, hē* down to end of 13th century; after 1300 *þei* appears, at first occasionally, and then as the usual or only form. W. Midl. has *hii, heo*, and *þei* in 1350, thereafter apparently only *þey, thai*. The Nthn. texts have only *th-* *þ-* forms in M.E. Some Sthn. texts have *ha, a* as unstressed forms.

§ 63. In dat. and poss. the *th*-forms are later and slower of introduction than in nom. All Sthn. and Midl. texts, well into the 15th century, have *hem* and *here* as the usual forms; *þeȝȝm* (= *theim*) is found by the side of *hem*, and *þeȝȝre* by side of *heore* in Orm, and during 14th century *them, theim, þeyr*, &c. occur occasionally by the side of more usual *h*-forms. Nthn. texts always have the Scand. *th*-forms. The London documents invariably write *hem, her(e)* down to the end of the 14th century, and even Caxton still uses the *h*-forms more frequently than the *th-*. The weak form *em* is used in the third quarter of the 15th century. After the beginning of the 16th century the *th*-forms, *their, them*, are practically universal; and the others, during this century, may be regarded as rare curiosities. *Her* is found, however, in *Nut Brown Maid* (1500) in Surrey's poems (once), a few times in the early folios and quartos of Shakespeare. The latest known colloquial use of *her* is in Machyn's Diary. As regards *hem*, this survives to this day in the form *'em* (the apostrophe indicating the supposed derivation from *them*). *'Hem* is written in Ben Jonson's *Every Man in his Humour* (1598), and *-am* in Chapman's *All Fooles* (1605). During the later 17th and the greater part of the 18th century *'em* is used very frequently in comedies, private letters, and in serious literary works. The forms *his, is, hes, es* are used as acc. = 'them' down to first half of 14th century in Kent, and frequently during the 13th century in the S.E. Midl.

§ 64. *Second Person Plural.*—O.E. noun *ȝē*, acc. and dat. *ēōw*, gen. *ēōwer*. The M.E. *you, ȝou, youre, ȝoure*, &c., whence Mod. *you, your*, owe their initial consonant to the old nom., M.E. *yē*, the earliest

M.E. *ou* soon gives place to forms with *y-*, &c. In 14th century *yē*, *you* are already used as mark of respect in addressing a single person, and the distinction between this and the more familiar *pū*, *pē* is preserved into 16th century. Down to the middle of the 16th century writers generally distinguish between nom. *ye* and acc. dat. *you*. After that both forms are used indifferently for the nom.; Q. Eliz. seems to use only *you* for all cases. *Ye*, though more rarely, is occasionally used as an oblique case. *You* and *ye* are sometimes both used as nom. in the same sentence in 16th century for the sake of variety. *Ye* survives in *how d' ye do* [*haudidū*], and as the familiar and now obsolescent *thank ye* [þæŋki]. It should be noted that present-day *you*, *your* [*jū*, *jŭ*] are derived from the M.E. unstressed and shortened forms *yŭ*, *yŭre*. Chaucer still uses *you*, *youres*, with long vowel rhyming with *thou* 'thou,' and *oures* 'ours.' These forms have been lost.

§ 65. *First Person Plural.*—O.E. *wē*, dat. acc. *ūs*, gen. *ūre*, M.E. *wē*, *ous*, *us*, *oure*, correspond exactly to the present-day forms, except that *us* [as] is derived from the M.E. unstressed form *ŭs*, the stressed *ous* having been lost.

§ 66. VERBS.—Verbs in English, as in other Germanic languages, are distinguished into strong and weak. The former have a change of vowel in the pret. and p.p., but no suffix with *-de-*, *-d-*. The latter form the pret. in O.E. with the suffix *-ede* or *-ode*, and the p.p. with *ed* or *od*.

§ 67. *Personal Endings.*—Pres. indic. sing. O.E. *-e*, *-est*, *-(e)þ*; pl. *-aþ* for all pers. In M.E. the sing. remains on the whole unchanged in Sth. and in Midl.; the pl. has *-eþ* in Sth., *-e(n)* in Midl. In London English the third sing. usually has *-eth* almost exclusively till far into the 16th century, though *-es* appears occasionally. During the 16th century *-es* becomes increasingly common, until by the beginning of the 17th it is gradually becoming the prevailing form. The *-eth* suffix, however, survives as the only form in the Liturgy and in the Authorised Version of the Bible. It persists also in occasional use even in private letters during a great part of the 17th century. The pres. pl. is usually *-e* or *-en*, after the Midl. type in Chaucer, and *-en*, *-yn* are found frequently till the end of the 15th century. This ending is originally due to the analogy of the subj. or to the strong pret. pl. The Sthn. ending *-eth* also occurs occasionally in London English of 14th and 15th centuries, and quite sporadically in the writings of persons who do not otherwise employ Regional dialect forms in the 16th and 17th centuries. It is not uncommon to find pres. pls. in *-es* even in literary works and in private letters of the later 16th and 17th centuries. This form is probably due to the analogy of the sing. As regards the *-es* of the pres. sing. in London and literary English, this has been held to be due to Nthn. influence. It is true that *-es*, *-is*, *-s* are the typical Nthn. endings from the Late O.E. period onwards, but it is difficult to show that the Nthn. dialect exerted direct or even indirect influence on London English. The E. Midl. dialects, through which the influence might have come generally, has *-eth*, *-yth*, almost as late as London itself. On the other hand, an occasional *-es* is found in the Sthn. dialects in the 15th century, when Nthn. influence is out of the question. It therefore seems more probable that the *-s* suffix in London and the Sth. is due to the analogy of the extremely frequent *is*.

§ 68. *Infinitive.*—In O.E. *-an*, *-ian* (Prim. O.E. *-jan* and *-ōjan* respectively); M.E. *-en*, *-ien*, *-e*, *-ie*, &c. In the London dialect of the 14th century practically the only type is that in *-en*, which often drops the *-n*. In the 15th century *-e* is usual, but *-en* occurs occasionally—e.g. in Caxton, but more frequently in more or less provincial writers. An exceptionally late example is found in Sackville: *I can accusen none*. The old *-jan* suffix, which occurs principally in weak verbs, mutates the root-vowel (cf. § 3, 7), hence *tǣcan* 'teach,' from *tāk-jan*, &c.

§ 69. *Present Participle.*—O.E. *-ende*, M.E. *-end(e)* Midl., *-inde* Sthn., *and(e)* Nthn. The early London dialect has both the Sthn. and Midl. forms, but by Chaucer's time the new form *-ing* is alone used. This is derived from the verbal nouns *lern-ing*, &c. Already in late 14th century the *-ing* interchanges with *-in*, *-yn*, and it seems probable that the normal pronunciation of this ending, among educated people, at least to the end of the first third of 19th century, was almost universally *-in*. Then a tendency arose to restore *-ing*, which rapidly gained ground, though *-in* survives to the present day among wide circles of speakers of every degree of education, though less perhaps among middle-class speakers than elsewhere.

§ 70. *Past Tense and Past Participle in Weak Verbs.*—The old suffixes *-ede*, earlier *-ida*, and *-ode*, earlier *-ōda*, are kept distinct in Early O.E., but later tend to be confused, and the same is true of the p.p. endings *-ed*, *-od*. The suffixes *-ida*, *-id* mutate the vowel of the root if this is susceptible of the change. Thus original **fōd-ida* 'fed' produces in O.E. *fēd-de*, the *-i-* being lost after having wrought the change; the p.p. of this verb is *ġe-fēd-(e)d*. The suffixes are sometimes added to the root without any intervening vowel, as in O.E. *tāh-te* 'taught,' *sōhte* 'sought.' Here the root-vowels are unmutated, since neither *-i-* nor *-j-*, as in the pres. and inf., was present to produce the vowel change. The difference between the consonants in the inf. and pret. of these and other verbs ending originally in *k*, O.E. *ċ*, is due to the early pre-O.E. change of *-kt-* to *-ht-*, **sōk-ta* becomes **sōh-ta*, &c. The form *sōk-ta*, from earlier *sōk-da*, is due to the unvoicing of the *-d-* of the suffix after *k*.

§ 71. *Strong Verbs.*—The verbs which, instead of the suffixes *-ede*, *-ed*, &c., have merely a change in the vowel of the root to distinguish pres. and inf. from the pret. and p.p., fall into seven classes in O.E. They must be studied in special works, but a few points may be noted here. The types of the pres., the pret. sing., the pret. pl., are in some cases all distinct. Thus *brecan* 'break,' pret. sing. *bræc*, pret. pl. *brǣcon*, p.p. *broc-en*, &c. In M.E. a simplification gradually occurs, by abolishing distinction between sing. and pl. in pret. and either using the sing. type for both sing. and pl., or the p.p. type for both numbers of the pret. as well. In Chaucer the variety in the strong verbs is still very largely preserved; thus *fīnde* 'find,' pret. sing. *fōnd*, pret. pl. *funden*, p.p. *funden*, O.E. *fīndan*, *fānd*, *fūndon*, *funden*. M.E. gets rid of such differences as are seen in O.E. *ċēosan* 'choose,' *ċēas*, *curon*, *coren*, by eliminating the consonantal differences in the pret. and p.p., on the analogy of the type of inf. and pres.; thus inf. *chēsen*, pres. *chēse*, pret. *chēs*, *chēse(n)* or *chōse(n)*, p.p. *chōsen*. Some verbs, e.g. those of the 'write' class, show only such differences in M.E. compared with O.E. as consist in normal change in the vowels: O.E. and M.E. *wrīte*; pret. O.E. *wrāt*, M.E. *wrōt*; p.p. *writen* in O. and M.E. The pret. pl. type, O.E. *writen*, survives unchanged in M.E., but the tendency is to use either *wrōte* or *writ* for both sing. and pl. *Bite* belongs to the same class, but has long lost the pret. *bote* (O.E. *bāt*), which survived in 15th century. *Bit* is due to the p.p. type. Strong verbs may pass from their original class into another. Thus our p.p. *spoken* is formed on the analogy of *broken*, the O.E. being *sprecen*. As a matter of fact, the two verbs agree entirely in their vowels in O.E. except in the p.p. The pret. *spoke* is formed on the analogy of the new p.p.

The vagaries of the strong verbs, owing to the various possibilities arising from analogy and confusion of classes, have been so numerous since Early M.E. right down to the 17th century, that the history of each class, and indeed of each verb, must be specially studied. A single point of resemblance between two classes may produce a new form; thus, doubtless, the common *drave*, instead of *drove* in the 16th century, arose from the analogy of *gave*, the point in common between the two verbs being *driven, given* in p.p.

§ 72. In O.E. the p.p. of uncompounded verbs usually has the prefix *ge-*. In M.E. this, though lost farther Nth., survives as *y-*, *i-* in the Sth. and S. Midl. It remains in London English into the early 16th century, but exists now only in such archaic forms as *yclept* 'called.'

English Dialects.—*The Present Day.*—§ 73. At the present time the innumerable varieties of English speech may be generally grouped as *Regional Dialects* on the one hand, and *Class Dialects* on the other. The former are associated with particular geographical areas, the latter with social divisions. Among Class Dialects we must place what is often called *Standard Spoken English*, and also the various vulgar deviations from this which are heard among uncultivated speakers. It is proposed to call the best and most refined form of Standard English, as heard among the upper ranks of society, *Received Standard*, and the vulgar variants, *Modified Standard*. In origin, Received Standard was that variety of S.E. Midl. spoken in London, and more particularly at the Court. This was the dialect in which Chaucer and Caxton wrote, and it gradually became, not only the sole form of English, in which, with a few notable exceptions, literary works were composed and printed, but also, though this was a slower process, the recognised medium of speech, used by the upper classes and by persons of education, all over the country. As this form of English spread to remote areas, and among different social grades, who abandoned for it the use of their native Regional Dialects, the standard underwent modifications. It was influenced partly by the Regional speech, partly by the different speech habits which arose among the various sections of society. Thus side by side with a practically uniform upper class English (Received Standard) there developed a host of variants, often tinged with provincialisms and vulgarisms, which we call *Modified Standard*.

Turning to the Regional Dialects pure and simple, which are heard in their least corrupted form among the populations of rural areas, we find a great wealth of variety, and it should be remembered that the principal features of the several Regional Dialects are not, as some suppose, the result of faulty and imperfect attempts to reproduce Received Standard, but are traditional, in many cases of considerable antiquity, and that they have grown up and been handed down quite independently of the historical development of Received Standard and of the main stream of literary English.

English dialects, like other more important divisions of speech, are classified according to certain features which they possess in common, the existence of which in several languages or dialects is believed to show closeness of genealogical relationship and community of origin.

§ 74. These features may consist in (*a*) phonological character, (*b*) peculiarities of accidence and grammatical usage, (*c*) the nature of the vocabulary. For the present purpose the above order is probably that of relative importance. By phonological agreement is meant the identical treatment of the same original sound. This kind of agreement is closer the farther back we trace the history of dialects, though in later times fresh differentiation may occur. Thus if at the present day one dialect pronounces *stone* as 'steen' [stīn] and another as 'stane' [stēn], it is evident that in spite of the present difference they both go back to a common type in which O.E. *ā* was fronted, and belong to a large group of dialects which shared this feature, and not to another group which rounded *ā* to *ō*, to which Sthn. English belongs, and which pronounces O.E. *stān* as [stōn, stoʊn, stʊən], &c.

The least satisfactory basis for classification is vocabulary, since words, especially in the Modern period, pass easily from one district to another, through the medium of books and newspapers as readily as by word of mouth.

The classification of Modern English dialects presents extraordinary difficulties, and Wright (*Dialect Gr.*, 1905), while adopting in the main the division proposed by Ellis (*Early English Pronunciation*, pt. v., 1889), is careful to point out how difficult is the task of classification, and how unsatisfactory the results of the most careful attempt, though based upon a vast collection of facts.

§ 75. The truth is that at the present time many of the old landmarks have perished, and the old boundaries which once divided one type of English from another have been broken down. Owing to various social and political upheavals, owing also to the shifting, in many areas, of the population into widely distant parts of the country, the Regional dialects now present, in many respects, a most confused picture. Not only have some dialect forms passed far beyond their original home, but the problem is further complicated by the continuous influence of Standard English, which has been steadily exerted for centuries, both directly through the squire, the parson, and the schoolmaster, and indirectly through printed literature. Among the problems of the future, as yet hardly approached, is the task of disentangling the accretions (*a*) from other neighbouring or remote Regional dialects, and (*b*) those from various forms of spoken Standard, which have become almost inextricably intermingled with the fibre of every Regional dialect during the last three centuries at least. This can only be done by tracing the history of each modern dialect back through the intervening centuries to the nearest M.E. type of which a record survives. At the same time a comparative survey must be undertaken of geographically related groups of dialects as they now exist, with a view to discovering when and along what lines the differentiation took place of each from an earlier common ancestral type. In this way we may hope to discover, first of all, what in a given dialect is really old and original, and what is new and derived from external sources; then, but not before, it may be possible to obtain a real genealogical classification of the dialects, based upon their old and historic character, and not confused and clouded by the presence of recent and alien forms.

§ 76. Wright's classification of the existing dialects, giving his main groups and omitting the numerous subdivisions of each, is as follows:

1. *The Scotch Dialects* (of those areas where Nthn. English and not Gaelic is spoken). *N.B.*—The English spoken in the N. of Ireland has much in common with Scots.

2. *Northern English*, including all the Northern counties, the N. and E. Ridings, part of the W. Riding of Yorks., and N. Lancs.

3. *The Midland Division*, which includes S.W. and S. Yorks., Mid. and S. Lancs., right across the country from Chesh. to Notts, and including Lincs.; from Flint, Denbighshire, N.E. Shropsh. to Leic., including also N. Warwcs. and N. Worcs.

4. *The Eastern Division*, which includes Rutl., the greater part of Nthants., but excluding S. Nthants., Cambr., Norf., Suff., Essex, Beds, Bucks, Herts, and Middlesex.

5. *Western Division, N. and S.*—*Western* (*N.*) includes the greater part of Shropsh., a small portion of Montgom. *Western* (*S.*) includes E. Mon., nearly all Heref., greater portion of Radn., E. Breck., and a narrow slip of Shropsh.

6. *Southern Division* includes S.W. and S. Pembr., parts of Glam., S. Warwcs., S.W. Nthants., E. Heref., Worcs. (including N. Worcs.), Glos., Oxf., and the whole of the rest of the southern areas from E. to W. not already enumerated.

In dealing with his material, however, so as to show the distribution of the various features, Professor Wright finds it convenient to depart considerably from the classification, and to speak of Nth. Country, E. Country, W. Country, &c., of N. and S. Midl., and so on. It is noteworthy that in this more general grouping he puts the dialects of Glos., Oxf., and Bucks into S. Midl.

These attempts at classification are tentative rather than final, and it is probable that with a proper historical and comparative treatment of the existing dialects we shall get a very different grouping. Much of the work on Modern dialects so far is chiefly descriptive and statistical. Very little has been done in connecting the existing forms with their ancestral M.E. types, and the history between the M.E. period and the present day is almost a blank.

§ 77. *The Older Dialectal Divisions.*—Our knowledge of the precise areas in which many of the literary remains of O. and M.E. were written is at present far less minute than could be desired. Thus the classification usually accepted for the dialects of O.E. is at present of a very general character, and that adopted for the M.E. period, though rather more specific, is still very elementary. Thus for O.E. we distinguish a *Northern* type, a *Mercian* or W. Midl. type, *West Saxon*, which includes the speech over a large area from Hants to Devonshire, the variants of which we cannot yet assign with certainty to particular regions within this area, an intermediate type sometimes loosely referred to a *Saxon Patois* which is exhibited in the Blickling Homilies and in some other homilies and glosses, and which belongs probably to the S.W. Midl. of Worcestershire. Finally, we have examples of a *Kentish* type, preserved chiefly in charters, and, in its later forms, in some glosses and hymns, and a metrical Psalm.

We possess also a 9th-century charter in the dialect of *E. Surrey*, a form of English which closely resembles the Kentish type. Of Eastern O.E. we know next to nothing; the only E. Anglian documents so far available are two Suffolk charters of the late 10th and early 11th centuries.

§ 78. In M.E. we have at once a greater variety of dialect types preserved, and are more fortunate in being able to allocate a certain number of texts to definite areas. It is usual to adopt the following general classification of M.E. dialects: *Northern English*, including the English of Scotland, which in its earliest forms has not yet been clearly distinguished from Nthn. English; *Midland*, which we are able to divide into N.E. and N.W. Midland, S.E. and S.W. Midl. We are hardly yet in a position to distinguish the *Central Midl.* of Staffs., Derbysh., Leic., N. Worcs., and Warwick. In the *Southern* area we distinguish *S. Western*, *S. Eastern*, which includes Kent, while we have apparently a border region in Surrey, which partakes of the characteristics of East and West, an area which is clearly distinguishable from Hants on the one hand and Kent on the other, although it has some of the features of both.

§ 79. Another more important meeting-place of dialect types in the M.E. period is London. The dialect of the metropolis, at any rate in the 14th century, partakes of the character of the Sthn. (Saxon) type of Middlesex, of the S.E. Midl., and of Sth. Eastern. The latter elements are generally considered as Kentish, but it is more probable that they passed into London speech from Essex, which region was almost certainly the main channel through which S.E. Midl. features came. The features which the London dialect shares with the Sthn. dialects are most probably indigenous to Middlesex, and these are the predominant features in London documents for many centuries. The London dialect was formerly regarded, and spoken of, as a *mixed dialect*, which, owing to its geographical position and to the social and political conditions prevailing in the capital, had received many of its characteristics from without, through the influx of persons from various parts of the country. With the increase of our knowledge of the M.E. dialects, however, and the consequent widening of our views, it is becoming more and more probable that we should rather regard the London dialect as a unity, showing, it is true, some features which are characteristic of one area, and others which are found elsewhere, but a genuine product of the rather wide area over which it was spoken—that is to say, we can no longer accept the theory of 'mixture' quite in the crude way in which it was formerly stated. It is one thing to assume that a dialect feature has been introduced directly by a group of strangers, from E. Anglia, say, and that it has gradually been accepted and made current in Middlesex; it is quite another to believe that a particular tendency of change, or a specific type of speech, has gradually percolated through the population of an area, although its starting-point may have been a region more or less remote from some of the districts in which it is subsequently found. It appears more and more reasonable to distrust the older view of hard-and-fast limits for dialects, each, so to speak, with a ring-fence round it which presented an impassable boundary to the gradual spread of a speech-character from remoter areas, a boundary which required to be taken at a single bound, if crossed at all, by a specific immigration of speakers from without.

§ 80. It seems more in accordance with facts to refuse credence to the theory of rigidly fixed speech areas, shut off from the influence of immediately surrounding areas, and to regard dialects rather as shading and melting almost imperceptibly one into the other, just as geographical areas dovetail one into the other. Rivers are often regarded as forming natural barriers, and as important factors in isolating from each other the communities living on opposite sides. It is quite certain that rivers may, and often do, play such a part. On the other hand, it is equally certain that they may also serve as lines of communication, and that the traffic to and fro across the stream may be lively and continuous.

§ 81. In classifying English dialects in the earlier periods, regard must be had, less than in the past, to the occurrence or absence of *isolated* features, and more to the characteristic *group* of features exhibited by the texts of the various areas. Thus, formerly, whenever *ĕ* was found in a M.E. text for Early O.E. *ȳ* (cf. §§ 18; 19), as in *cēnde* 'nature,' &c., O.E. *ġecȳnd*, that text was assumed either to be Kentish, or to show the influence of Kentish dialect whether in the author or the scribe. It is now recognised that this particular feature existed over a wide area, in dialects quite remote from, and unconnected with, that of Kent, in those of areas as far away as S. Linc. and Norf., for instance. The

occurrence of *ĕ* for earlier *ȳ* can help us very little by itself in determining and localising minutely the dialect of a text, beyond ruling out a wide western area in the South and Midlands. We have to inquire with what other features, phonological and inflexional, this particular characteristic is associated. According to the answer to this question, we might place the origin of a given text in Surrey, or Middlesex, or Essex, in Suffolk, Norfolk, Cambridgeshire, or Lincoln.

§ 82. If the characteristic phonological and inflexional features of the London dialect in the 11th century are enumerated, it appears that there is not one which is not found in many other dialects of the same period. What is peculiarly characteristic, on the other hand, is the combination, the grouping, the association, of just such and such features together in the same dialect. It is this *characteristic combination* which is typical of London speech, and which does not occur outside a comparatively restricted area.

It was sometimes forgotten, from the older, rather narrow standpoint, that dialectal conditions do not remain the same in all parts of a wide area. Over such a comparatively vast region as that which may properly be called West Midland, we should expect to find in M.E. a not inconsiderable differentiation. Nor are we disappointed. But having decided that a given text was of W. Midl. origin, students were sometimes disconcerted to discover in it certain features which were commonly held to belong to the South. For instance, the ending *-ep, -eth* in the pres. indic. pl. of verbs is undoubtedly a feature of Sthn. dialects. If this ending appears in a text which on other grounds had been assigned to the Midland area, how is it to be explained? Must we assume that the author, if a Midlander, had lived in the South and had learnt to use this form, or that he was really a Southerner who retained this feature of his native speech, although writing for the moment in a Midl. dialect? Again, was he the victim of a Sthn. scribe, who copied his text accurately on the whole, but who betrayed himself by writing *-ep*, where a genuine Midlander would have written *-en* or *-un*?

§ 83. Any one of these explanations is legitimate and possible, but they do not exhaust the possibilities. The question arises, Was there not perhaps an area in the W. Midl. where *-ep* was the normal dialect form, and might it not be associated with other features which every student would agree are typical Midl. forms? This question cannot be answered with certainty until the regional distribution of the *-ep* plurals is precisely known. An important line of investigation then, at the present time, is the exact distribution of typical dialect features. The more tests we are able to apply, the more possible it becomes to narrow down the area within which a given text must have been written. A real difficulty exists in the elimination of features foreign to the original dialect in which a text was written, features imported into it in one of the ways suggested above. How can it be ascertained what is really an alien element introduced from without? This is the great problem that is for ever arising in the study of M.E. dialects, and it can only be solved by patient investigation of every available source of information, and by comparing text with text as minutely as possible. It is precisely in attempting to settle the question of possible scribal or other influence on the dialect of a given text that the importance of applying as many combined tests as possible is exhibited. If a particular grouping or combination of features can be shown to exist not merely in a single text, but in several, written by different scribes, then it may be taken as certain that that particular combination of dialect features is characteristic of the genuine dialect of a definite area, and that the texts in question are all written in this dialect. It is inconceivable that several scribes writing independently, and perhaps at different periods, should all hit upon precisely the same way of corrupting the original dialect. For instance, on grounds which appear from the application of the above method, it has been claimed that the Jesus text of the *Owl and Nightingale*, as we have it, is written in the genuine dialect of W. Surrey of later 13th century. There are certain features which, appearing in the same text, were formerly supposed to be discrepant, that is, some of them were thought to be imported by the scribe. It turns out, however, (*a*) that precisely the same combination of features is shown in a Surrey chartulary written at about the same date as the MS. of the *Owl and Nightingale;* (*b*) that several phonological features in the poem which were supposed to be impossible in the Surrey dialect are found not only in the chartulary, but also in forms of Surrey place-names from various sources, written down before, and after, as well as at the same period, as that in which the MS. of the poem was written. Future investigation must lie in the direction of wide yet minute comparative surveys of the features of the dialects of every area for which evidence is available in M.E. For the main tests of dialect see §§ 85–97.

§ 84. But if nearly everything is still to be done for the history of English dialects down to the end of the 14th century, still more, if possible, remains to be accomplished in relating the M.E. dialect types to those Regional dialects which still survive. The gap between M.E. and the Mod. period has to be bridged. It is only quite recently that the beginnings of a detailed knowledge have been acquired of the history of *Received Standard* (spoken) English during the 16th, 17th, and early 18th centuries. The practice of the first systematic writers on English dialects was to start with O.E. (often with W. Sax.) and to pass straight thence to the present-day local dialect, thus ignoring the intervening nine hundred years. The result was that no problem was solved, none of the vital questions which we should now ask were stated; indeed, their existence was not suspected. The study of English dialects according to the old methods has reached the end of its tether. The problems are now being stated afresh in the light of new knowledge, from hitherto unexplored sources, of the history of English at every period. The point of view from which the study is approached is changing, and there is an ever-increasing attempt to link up the facts collected about the language of the different periods, so as to present a picture of continuous development. The old view of circumscribed dialect areas with rigidly fixed boundaries is slowly disappearing, and we are beginning to realise that an ideally 'pure' dialect hardly exists, except, perhaps, in the very centre of a dialect area. As research progresses upon new lines, some of which we can already foresee, it is inevitable that much of the elaborate, but inadequate, system of the past will vanish. Our methods will be ampler, more historical, our analysis more penetrating and subtle, our classifications surer and more precise.

§ 85. PHONOLOGICAL CHARACTERISTICS WHICH DISTINGUISH THE CHIEF DIALECTIC TYPES IN O.E.—*W. Sax.* This, the most important of all the O.E. dialects, on account of its literary development, displays certain features which, so far as we know at present, are not found in any other form of O.E.

1. *Diphthonging of front vowels after front consonants.*—This very characteristic W. Sax. feature has been illustrated above, § 3, 6.

2. *Development of diphthong ĭĕ* as *i*-mutation of the old diphthongs *ĕ͡ă*, *ĕ͡ŏ*, no matter what their origin. See § 3, 7 (*h*). This *ĭĕ* becomes *ĭ* already in Early W. Sax. in King Alfred's dialect; in the more westerly area, it first remains, but appears later as *ĭ̯* (see § 95 (*g*) for M.E. developments).

3. *Survival of Prim. O.E. æ̆¹ as such.* See § 2, 1. For non-W. Sax. see § 86, 3.

4. *Un-rounding of ŭ̯ to i in part of W. Sax. area*, before *ċġ, ċ, sċ, ht, n: drihten* 'lord,' *brīċe* 'useful,' *briċġ* 'bridge,' *risċ* 'rush,' *cining*, &c., for earlier *dryhten, brȳċe, bryċġ, rysċ, cyning*, &c.

5. Combination *sel-* becomes *siel-*, later *sil-*, or *syl-*; cf. 2, above, for treatment of *ie*: *siellan, sillan, syllan* 'give, sell,' from *sellan; sielf, silf, sylf*, from *self*.

§ 86. Features shared by all non-W. Sax. Dialects.—1. *Absence of ĭĕ as i-, j-mutation of ĕ͡ă* (§ 3, 7 (*h*)): non-W. Sax. *hēran* 'hear,' *beldan* (or *bældan*) 'encourage,' *ermpu* 'misery.'

2. *Absence of diphthonging of front vowels after front consonants* (§§ 3, 6; 85, 1).

3. *Raising of Prim. O.E. æ̆¹ to ē* (§§ 2, 1; 85, 3). This is found in the earliest non-W. Sax. texts: *dēd* 'deed,' *sēton* 'they sat.' See, however, § 97 (*b*), below.

4. *Prevalence of u-mutation.* All non-W. Sax. dialects tend to diphthongise *ĭ* and *ĕ* when followed in next syllable by *-u, o, a*: *geofu*, from *ġefu, sċeopum* dat. pl. of *sċip* 'ship,' *beġeotan* from *beġetan*, &c.

§ 87. *Characteristic Features of Kentish.*—1. *Raising of O.E. æ̆² (i*-mutation of *ă*, cf. § 3, 7 (*b*)) *to ē.*—In distinction to the great majority of the O.E. dialects, Kentish texts of the 9th century habitually write *ē* in *clēnra* 'cleaner,' *dēlan* 'divide,' *mēst* 'most,' &c. This process was certainly not confined to Kent, though owing to the considerable number of texts from this area which have survived it is more generally recognised as a feature of Kentish than of any other dialect. It is found, however, in a 9th-century Surrey charter, and in two others from Suffolk. It was certainly not a feature of the more westerly dialects, nor, in the old period, of the Nthn. See § 12 on the M.E. distribution.

2. *Typical Kentish u-, o-mutation.*—This process seems to have been more unrestricted in Kentish than elsewhere, and it is characteristic of the dialect that the diphthonging takes place before back consonants, no matter what the initial consonant of the word may be: *breogo* 'prince,' from *brego*; *forespreoca* 'advocate,' from *forespreca*.

3. *Earlier O.E. ŭ̯ becomes ĕ.*—In Late O. Kentish such forms as *gelt* 'guilt,' *senn* 'sin,' &c., earlier *gylt, synn*, &c. (§ 3, 6 (*f*) and (*g*)). There is evidence that the change had occurred in the 8th-century Kt., though not expressed in the spelling till later as a rule. The *e*-spellings occur also in a 10th-century Suffolk charter, and if the early records of the S.E. and S.E. Midl. dialects were completer, it would probably be shown that the distribution of these forms was far wider in the O.E. period than can be conclusively proved at present. See §§ 18, 19 for the M.E. conditions.

4. *Absence of fracture of Prim. O.E. æ before the l-combinations* (cf. § 3, 1 (*c*)).—It seems certain from the evidence of the early charters that in parts of the Kt. area, at any rate, diphthonging did not take place, since such forms as *haldan*, W.Sax. *healdan* 'hold,' occur. The Surrey charter also has unfractured forms.

5. *Prim. O.E. ă̆ becomes ĕ: dey* 'day,' *efter* 'after,' *weter*, from *dæġ, æfter, wæter*.

§ 88. *Mercian Features.*—1. *ă̆ becomes ĕ.*—This change, as in Kentish, appears in the Sthn. Mercian area.

2. *u-mutation of Prim. O.E. ă̆* (*a*): *iċ fearu* 'I go,' W. Sax., &c., *fare*; *steaðelas* 'foundations,' from *stæðulas*. This change appears to be confined to Merc.

3. *Levelling of ĕ͡ŏ and ĭ͡ŭ.*—The latter diphthong, which in Merc. undergoes no further change from *i*-mutation, is written *eo*, and is indistinguishable from original *ĕ͡ŏ*: *weorpep* 'becomes,' from **wiurpip* (W. Sax. *wierp*); *eorre* 'angry,' from **iurri* (W. Sax. *ierre*); *ċēosep*, from **ċīusip* (W. Sax. *ċīesp*). (Cf. § 89 for Nthmb. treatment.)

4. *Absence of fracture of æ before ll, &c.: cald* 'cold,' *ald* 'old,' *all* 'all.' See also § 87, 4; and § 3 (*c*).

5. *'Smoothing' of Diphthongs before back and front consonants.*—As in Nthmb., diphthongs were monophthongised in Merc. in this position: *hēh* 'high,' from *hēah*; *bilēc* 'locked,' from *bilēac*; *ēc* 'also,' from *ēac*.

§ 89. *Northumbrian Features.*—1. O.E. *ă̆* remains in Nthmb., and is not raised to *ĕ* as in Merc.

2. O.E. *ă̆* is not diphthongised as in Merc. by *u*-mutation.

3. Distinction between *ĕ͡ŏ* and *ĭ͡ŏ* is preserved: *ġestrīona* 'to gain,' &c., Merc. *-strēonan*; *ðĭ͡ostro* 'darkness,' Merc. *ðēostro*; *hiorde* 'shepherd,' Merc. *heorde* (W. Sax. has *ĭ͡e*).

4. (*a*) *weo-* (fracture of *e*) becomes *wo-*: *wor͡ða*, from *weorþan* 'become'; *sword* 'sword,' from *sweord*. (*b*) *weo-* (*u*-mutation) becomes *wo-*: *woruld* 'world,' from *weoruld*, in *Northern Nthmb. area*.

5. In combination *we-*, the vowel is rounded and written *oe*: *woeg* 'way,' from *weġ*; *cwoeða* 'to speak,' from *cweþan*.

6. In Sthn. Nthmb., Prim. O.E. *æo*, whence later *ēa* (§ 2, 4), remains at *ēo* stage: *dēop* 'death,' elsewhere *dēaþ*; *dēof* 'deaf,' elsewhere *dēaf*.

7. Nthn. Nthmb. writes *ea* for earlier *ĕ͡ŏ* (§ 3, 1 (*b*)): *hearte* 'heart,' elsewhere *heorte*; *ear͡ðu* 'earth,' for *eor͡ðe*.

8. Sthn. Nthmb. of 10th century writes *eo* for *ea* (§ 3, 1 (*c*)): *eorm* 'poor,' instead of *earm*.

§ 90. M.E. Dialect Features.—All that can be attempted here is to enumerate some of the main characteristics which distinguish severally the great dialect groups, without entering into detail as to the more specific combinations of features found in particular localities within each area. The references to the paragraphs where the general development of M.E. is dealt with will, as a rule, make it unnecessary to add examples.

§ 91. The Northern Group.—(*a*) O.E. *ā* fronted to [ǣ-ɛ̄-ē], &c., whence Mod. Nth. Engl. and Scots [stēn, stīn] 'stone,' &c., instead of being rounded as in Midl. and Sth., § 10.

(*b*) O.E. *æ̆¹* and *æ̆²*, both levelled under [ē] by 14th century in some areas, in others distinguished as [ē (ī)] and [ɛ̄ (ē)] till later.

(*c*) O.E. *ō* was fronted to a vowel of the character of [ȳ] and rhymes with French *ü*, e.g. *fortūne—sūne* 'soon'; the vowel is variously written *u, oi, oy*.

(*d*) The *i*-mutation of O.E. *ĕ͡ă* is *ĕ*, cf. § 86, 1.

Verbal forms.—(*d*) Pres. sing. and pl. *-is* endings; (*e*) inf. without ending; (*f*) pret. pl. of strong verbs according to singular type; (*g*) p.p. of strong verbs, no *i-* prefix; ending *-en*, or none; pres. part., *-and*; pres. pl. of *Be, are, ar, bēs* (*bēn*).

Nouns.—(*h*) Strong type almost universal.

Pers. Pronouns.—(*i*) 3rd fem. sing. *scho*, &c., cf. § 60; 3rd pers. pl., Scand. *th*-type in N. G. D., cf. § 62.

§ 92. West Midland Dialect Features.—(*a*) O.E. *æ* becomes *a* (*e* in Sthn. area), § 9.

(*b*) O.E. *ā* becomes *ō* in South (§ 10).

(*c*) O.E. *æ̆¹* (§ 11) is tense [ē].

(*d*) O.E. *æ̆²* (§ 12) is [ɛ̄].

(*e*) O.E. *ȳ* (§§ 18, 19) largely preserved, and written *u*.

(*f*) O.E. *ēō* (§ 22) appears frequently as [ȳ], written *eo*, *oe*, *ue*, *u*.

(*g*) *i*-mutation of O.E. *ēā* is *ē*, cf. § 86, 1.

Verbal forms.—(*h*) Pres. sing. as Sth. or *-uþ* in 3d pers., but 2d and 3d pers. sometimes *-s* in more northerly area; (*i*) pres. pl. *-en*, *-un*, *-in*, in central area, but *-eþ*, *-iþ*, in Sth. part, and *-us*, *-is*, in Nth. of area; (*j*) pres. part. *-ing* very early in Sthn. area; *-end(e)*, *-and* further Nth.; (*k*) p.p. of strong verbs no prefix, ending *-en*, *-un*; (*l*) pres. pl. of *Be*, *arn*, *bēn*, *bēþ*.

Pers. Pronouns.—(*m*) 3d pers. fem. generally *hue*, &c., but *sche* also in 14th century; (*n*) pl. forms of 3d pers.: Engl. and Scand. forms in N., Engl. forms in G. and D.; (*o*) unstressed flexional sylls. often *-ud*, *-us*, *-un*, but also *-id*, *-is*, &c.

§ 93. East Midland Features.—(*a*) O.E. *ā* becomes *ō* as in Sth. and W. Midl.

(*b*) O.E. *æ* usually *ă*, but *e* in some early texts from southerly area.

(*c*) O.E. *æ*^{1} appears as [ē].

(*d*) O.E. *æ*^{2} generally [ē], but also [ē] in some more southerly areas.

(*e*) O.E. *ȳ* generally *ĭ*, but *ĕ* also common in most areas in the 14th century, and probably developed already in O.E. period in Sthn. parts of area.

(*f*) O.E. *ēō* appears as *ē*, which probably developed in Suffolk at any rate, in late O.E. period.

(*g*) *i*-mutation of O.E. *ēā* is *ĕ* (§ 86, 1).

Verbal forms.—(*h*) 3d pers. sing. *-eþ*, but *-es* early in Lincs.; (*i*) pres. pl. *-en*; (*j*) pres. part. *-end(e)*, *-and* in northerly area, *-ing* in early 14th century in Lincs.; (*k*) pres. pl. of *Be*, *aren*, *bēn*.

Pers. Pronouns.—(*l*) 3d pers. fem. *sċæ*, *schē*, &c., very early, also more rarely *ghē*, &c.; (*m*) pl. forms of 3d pers. *hi*, *he*, predominate, except in Lincs. in 13th century, later *thei*, &c., though not sole form; in dat. *hem* predominates except in Lincs., in gen. *here* far more common before 15th century; (*n*) note the peculiar acc. pl. *hes*, *his*, *es*, *is*, as in S., Eastern, which occurs sporadically in S.E. Midl.

§ 94. Central Midlands.—Of the special dialect features of this area, we have at present practically no knowledge for the M.E. period, beyond the important point that the sound of O.E. *ȳ* was largely retained, written *u*.

§ 95. South-Western Dialect Features.—(*a*) O.E. *æ* remains at first as a front vowel *e*, but is very early exchanged for the Midl. *a* type.

(*b*) O.E. *æ*^{1} and *æ*^{2} both survive as a slack vowel [ē].

(*c*) O.E. *ȳ* survives in part of the area, and is written *u* and *uy* respectively, but there appears to be a considerable area stretching from the extreme west to the east as far as Wilts, and gradually contracting in Glos. and Hants, in which un-rounding took place.

(*d*) O.E. *ēō* (cf. § 22) appears as [*ȳ*] written *u* as in W. Midl.; there are traces (*dure*, O.E. *dēōr* 'dear') as late as *Shillingford's Letters* (Devon, 1447–50); in early M.E. the *ū*-forms must have been current as far east as the western borders of Surrey.

(*e*) The O.E. combination *-eald* (fracture before *-ld*, § 3, 1 (*c*)) appears in early texts as [ēld], written *-æld*, *-eald*, but soon gives way to the Midland *-ōld*-type, from *-āld*, cf. § 21.

(*f*) Survivals of L. W. Sax. *ċy-* from *ċie-* (§§ 3, 7 (*h*), and 23) appear in some early texts as *chule*, O.E. *ċiele*, &c.

(*g*) W. Sax. *ĭē* late W. Sax. *ȳ* (§§ 3, 7 (*h*), and 23) survives at first, written *u*, or *ui*, *uy* when long, but by the end of the 14th century is largely ousted by the non-Sax. type *ē—ēlde* instead of W. Sax. *ielde* 'age,' *hēren* 'hear,' instead of W. Sax. *hieren*.

(*h*) Initial *f*, especially in Eng. words pronounced voiced, and written *v* or *u*.

Verbal forms.—(*i*) *Pres. sing.* 2d pers. *-est*, 3d *-eþ*; (*j*) pres. pl. *-eþ*; (*k*) pres. part. *-inde*; (*l*) p.p. strong and weak verbs, prefix *i-*, *y-*, from O.E. *ġe-*; (*m*) p.p. ending of strong verbs *-e*; (*n*) inf. *-e*, *-ie*, *-y*; (*o*) pres. pl. of *Be*, *buþ*, *bēōþ*, *bēþ*.

Pers. Pronouns.—(*p*) 3d fem. *sche*, &c. unknown before 15th century, normal forms *heo*, *hue*, *he*, *hi*; (*q*) 3d pers. pl. nom. *hi*, *heo*, *ha*, *hoe*, *pey* in 15th century; dat. *heom*, *ham*, *hom*; gen. *hor(e)*, *hare*, *here*, *hure*; (*r*) there is no trace of acc. pl. *his*, &c., as in S. Eastern (§ 96).

§ 96. Features of S.-Eastern Group, including Kentish.—(*a*) O.E. *æ* survives as a front vowel, *ĕ* longer than in other areas, especially in Kt. and Essex.

(*b*) O.E. *æ*^{1} became [ē] in Kt. early in O.E. period and remains as such in M.E.; in Essex, however, the slack type [ĕ] was also current (§ 11).

(*c*) O.E. *æ*^{2} (§ 12), the change of this to *ē*, tense, is typical of Kt. in O.E. period (§ 87, 1), and this type remains in M.E.

(*d*) O.E. *ȳ* written *e* in Kt. texts in later O.E. period (§ 87, 3), and the *ĕ*-forms remain typical of pure Kt. in M.E., with occasional *i*-forms; in Essex both *e* and *u* are written, and the same is true apparently of Sussex.

(*e*) O.E. *ēō* (§ 22) was written *ie*, *ye—hierte*, *friend*, &c., in Kt. texts as late as 14th century, and to some slight extent also in Essex texts; also O.E. *ēā* constantly written *ia*, *ya* (*dyaþ*, &c.) in Kt. It is very doubtful whether these spellings indicate diphthongal pronunciation, but they are nevertheless a mark of dialect. Cf. the very different development in S.W. (§ 95 (*d*)).

(*f*) O.E. *-eald*, *-earm*, survive as *-ēld*, *-erm*, longer in this area than elsewhere (cf. S.W. conditions in § 95 (*e*)).

(*g*) Initial *s* often written *z*, and *f* as *v* or *u*.

Verbal forms.—(*h*) Pres. sing. 2d and 3d *-est*, *-eþ*; (*i*) pres. pl. *-eþ*; (*j*) pres. part. *-inde*; (*k*) p.p. prefix *i-*, *y-* typical; (*l*) strong p.p. ending *-e*; (*m*) inf. *-ie*, *-ye*, *-y* typical; also *-e*; (*n*) pres. pl. of *Be*, *bēþ*, *bēōþ*, *bēþ*.

Pers. Pronouns Pl.—(*o*) Engl. *h*-type only; (*p*) fem. sing. *hi*, never *sche*, &c.; (*q*) *his*, *hes*, &c. very typical as acc. pl. 'them' (§§ 63, 93 (*n*), 95 (*r*)).

§ 97. Features of London Dialect in M.E.—This, the most important form of English in view of its subsequent destiny, is to be regarded primarily as a variety of S.E. Midl. It has been frequently referred to in the *General Introduction*, in the preliminary remarks on Engl. Dialects, and incidentally in the various sections dealing with *Sounds* and *Inflexions*. The following is a brief summary of the chief features presented by this dialect in the 14th century, especially as exhibited in the works of Chaucer. They should be compared especially with those of E. Midl. and S.-Eastern groups.

(*a*) O.E. *æ* represented universally by the Midl. *ă*-type.

(*b*) O.E. *æ*^{1} predominatingly [ē] so far as can be tested by the rhymes, but occasionally the [ē] type is used.

(*c*) O.E. *æ*^{2} usually appears in slack [ĕ] type, but occasionally rhymes with undoubted [ē] words.

(*d*) O.E. *-eald-*, generally *-ōld* in Davie and Chaucer (from O.E. *-āld*-type), but also slight traces of *-ēld* (from O.E. *eald*-type). The fractured forms regular in 13th century.

(*e*) O.E. *-earm* usually *-arm*, but the other type in *yerd*.

(*f*) Mutation of O.E. *ēā*, always *ĕ*, according to non-Sax. type.

(*g*) O.E. *ēō* always *ĕ*. (Note, however, the typical *fill* from O.E. *fēōll* 'fell,' perhaps shortening of [ē], which had already approached [ī] stage.

(*h*) O.E. *ȳ* appears in all three forms—*u*, *i*, *e*. The *e*-forms predominate in many words, as

Chaucer's rhymes show; the *u*-forms are well represented, but gradually give place to *i*-forms.

(*i*) O.E. *ēh*, *ēȝ* though often written *eh*, *eih*, *ey*, have become *īh*, *ī*, as is shown by Chaucer's rhymes. From this type are derived Mod. *high*, and (the pronunciation of) *eye*, O.E. *hēh*, *ēȝe*.

(*j*) Pres. sing. 2d pers. *-est*; 3d pers. *-eþ*.

(*k*) Pres. pl. *-en*, *-e*, very rarely *-eth* in Chaucer. In 13th century, however, *-eþ* seems still the normal form.

(*l*) Pres. part. *-inde* in 13th century, always *-ing* in Chaucer.

(*m*) P.p., prefix *i-*, *y-*, regular in early documents and in Chaucer, but dropped in an official late 14th-century petition.

(*n*) Strong p.p. ending *-e* before, and in Chaucer's works, but *-en* in late 14th-century petition.

(*o*) Pl. pres. of *Be*, *bēoþ*, *bēon*, *bēn*, before Chaucer; Chaucer himself usually *been*, *bee*, rarely *arn*; later documents *been*, *bup*, *arn*, *ar*.

Pers. Pronouns (see §62).—(*p*) 3d fem. sing. *she*, &c. always in Chaucer.

(*q*) Pl. 3d pers. *hi* in N. before Chaucer, who has only *they*; Engl. *h*-forms in gen. and dat. in Chaucer; *them*, *their*, unknown till early 15th century, and then but rarely used.

(*r*) Acc. pl. *his*, *hes*, occur in 13th-century Lambeth Homilies, which must represent the dialect of London area, but no trace of such forms occurs in any actual London documents.

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The above are among the most important general and special works. The publications of the English Dialect Society consist chiefly of a number of dialect glossaries representing many of the counties. They are often uncritical, and are now largely superseded by Wright's *Dialect Dictionary*.

English Literature is, in its largest sense, the mind of the English-speaking races, expressed in successive generations by the fittest representatives of each succeeding form of thought. All conflicts of opinion through which decisive action has been reached lie, with their opposing arguments and with the passions they excited, in the books that form the literature of a people; these show for each nation, in strength and weakness, all the workings of the mind that shaped its history. Such a literature must express also the slow forward movement towards higher civilisation, coloured variously by the influences of race and climate, and brought home to us by fellow-feeling with the individualities of earnest men.

Before the English came with power into Britain there was a Celtic population of the Gael and of the Cymry, each with a literature diffused chiefly by rhythmic recitation. Many traditions of later invention, with perhaps a few snatches of the oldest song, that passed with no great change from lip to lip of generations living in some secluded home among the hills, carry the mind back to a Gaelic literature that gathered much about Fionn, Oisin, and the battle of Gabhra, said to have been fought in the year 284. In like manner we have traces of a Cymric literature, strongest in the time of battle for home and country against English invasion. Tribes of the Celts in Britain gathered their forces for a last firm stand, and were overthrown at Cattraeth; Aneurin's poem, the *Gododin*, which celebrates the chiefs who fell, tells us of this battle. To the battle of Cattraeth there has been a date assigned, the year 570. If King Arthur ever lived, he lived in that 6th century, and shared its struggle.

Various Low-German tribes from the other side of the North Sea (see ENGLAND) had been finding their way over to the eastern and southern coast for many years before the time of the six settlements which Bede described (449–547). By the year 570 the settlements of English on the eastern and southern coasts had made sure their predominance. With them they brought the common lore of the Germanic peoples, the matter epic and elegiac, and no doubt lyric, of their minstrels' poetry. When this poetry was first written down is not known, but several surviving poems and fragments preserve the memory of the common Germanic world upon which the eyes of the minstrels were turned, from which they drew their subjects and their heroes with no visible tribal partiality. The poet of *Widsith* ('Far-traveller') may have lived in the 7th century; some think the 6th. *Deor's Complaint* shows us the minstrel in elegiac mood. *Beowulf* (q.v.) and the fragments of *Finnsburh* and *Waldere* are the only remains of our old epic. The Exeter Book (see below) contains, besides *Deor*, a fine group of early elegiac poems, *The Seafarer*, *The Ruin*, *The Wanderer*, *The Husband's Message*, *The Wife's Complaint*, poems in which winter landscapes and sea-pictures of great beauty are invested with an atmosphere of reflective melancholy. In all the poems yet mentioned the Christian element, where it is present at all, is easily separable. It may often be an interpolation by a duller versifier. Purely pagan literature is hardly to be found.

But there is another body of Old English poetry which is definitely Christian. Its strength was in the north. The fervour of the Celt brought to the conversion of the northern English a noble zeal and self-devotion. The abbess Hilda, who drew Cædmon into the fellowship of her monastery at Whitby, in which men and women worked together for the spreading of the gospel, was taught in the Columban school. The work of Cædmon was to spread among the people knowledge of the Bible story, in what is now called a 'paraphrase,' that took the form of poems shaped for recitation by the people to each other upon festival occasions, or by the men who made it their vocation to chant tales of battle and adventure. A hymn of Cædmon's has been preserved. Whether any part of the so-called 'Cædmonian' *Genesis*, *Exodus*, and *Daniel* be his is very doubtful (see CÆDMON). Cædmon died about the year 680; and Bede, who tells us of him, was in the year 680 a child of seven. Aldhelm, whose English songs, familiar in King Alfred's time throughout the country, are now lost, was then a young abbot of twenty-four, who had devoted his life and fortune to a work at Malmesbury like that of the abbess Hilda at Whitby. With these monasteries were associated many forms of labour for advance of civilisation, including, of course, the formation of schools. Bede in the monastery at Jarrow became the first great teacher. He shaped, in Latin, manuals for use in education, and thus his works serve as an encyclopædia of the best knowledge of his time. He gathered also, by wide inquiry, materials that were digested into the first History of England; that was his *Ecclesiastical History*, finished in 731. The history of the church in those first days was inseparable from that of

the people among whom it had laboured in its missionary work.

The 8th century, to which Bede's work belongs, was the golden time of Old English literature. To it probably belongs *Beowulf* (see above), which, like the Cædmonian paraphrase, survives only in a single MS. With few exceptions the other pieces of the oldest English literature have as narrowly escaped total destruction. We owe our knowledge of them to the preservation of two MS. collections; one known as the Exeter Book was presented by Bishop Leofric, near the time of the Norman Conquest, to Exeter Cathedral; the other is the Vercelli Book, which was discovered in 1822 in the cathedral at Vercelli. One poet's name is preserved —Cynewulf (q.v.)—interwoven by himself in runes with pieces of his verse. He wrote *Elene* and other church legends in verse of merit, but his date is doubtful. Probably he lived in the 8th century, or early in the 9th. In that time of greatest energy of thought among the Anglo-Saxons, the empire of Charlemagne drew light from a Yorkshireman, Alcuin, who was appointed to do for its monasteries and their schools what might be called the work of a great minister of public instruction. He had been born in 735, the year in which Bede died, and it was in 782 that he took up his residence at Aix-la-Chapelle.

But when Alcuin died in the year 804, the simpler question of the establishment of Christianity had passed into the more complex forms of battle against heresies, of struggle to maintain full uniformity of theological opinion. At the same time advance of thought was being checked in England. There were continued attacks of the Northmen, some of whom were trying the mettle of King Alfred, at the same time that others were following Rollo up the Seine to lay the first foundation of the Norman power. Those who followed Rollo in 876 learned in Normandy the language of the women of the country from which their descendants afterwards crossed over to England to make conquest of a kindred people. In the 9th century John Scotus Erigena, born possibly in Ireland, possibly in Ayrshire, was an acute thinker established at the court of Charles the Bald. He wrote a Latin book *On the Division of Nature*, which, by its endeavour to bring the teaching of theology into philosophical harmony with other teaching in the schools, yet without opposition to a single dogma, laid the foundation of what is called the Scholastic Philosophy.

King Alfred was then living, and working strenuously for the revival of lost learning. Ruin of a monastery meant in those days the annihilation of a school; and the ravages of the Danes had caused such decay of learning that in re-establishing the ruined schools Alfred translated the most important books of the schools into the language of the people. For Latin could no longer be the language through which studies were pursued. Orosius, whose *Universal History* had been a school-book, was thus translated, with omission of whatever was not practical, and with addition of new geographical detail. Bede's History was translated. A favourite school-book for ethical training had been Boëthius *On the Consolation of Philosophy*. That also was translated by King Alfred. For the higher training of the clergy the king, justly named Great, turned into English Pope Gregory's book on the *Pastoral Care;* and to him also is ascribed the foundation of the continuous record of the annals of the country, known as the *Saxon Chronicle*, which now and then had afterwards an entry in verse, especially, under the year 937, a poem on the battle of Brunanburh (q.v.). The noble work of Alfred, who died in October 901, filled his kingdom of Wessex with new life, and the centre of intellectual energy was thus removed from north to south. The work of Alfred's son and grandson spread this new influence, until, in 954, the grandson, Eadred, free of the last of the under-kings, ruled over all England from the Channel to the Firth of Forth. The centre of intellectual energy was then the midland region, which included the five burghs that had been strongholds of the Danes in Mercia. But after the death of Alfred, Old English literature passed into work associated with honest endeavour to restore religion by restoring strictness of monasticism. The chief interest of this period for us is in the *Homilies* of Ælfric, who wrote books also to aid his work of teacher in the school at Winchester. Ælfric's *Homilies* were upon the series of days kept holy by the church, and thus we have in them an exposition of the doctrines of the Church of England at the end of the 10th century. The first of the two sets in which they were arranged was written in the year 990. A poem on the battle of Maldon near the same date tells a victory of the Danes over Byrhtnoth, who was killed in the battle. It has much of the old spirit of the poems written, as this also was, for recitation to the people.

The Norman Conquest brought a royal court in which French was familiar, while Latin was the common language of the learned throughout Europe. Friends of the Conqueror held all the places of high trust, and of those who had money to spend few would pay it for written records of the English pieces still recited to the country-people. From 1066 till about the year 1200, except in a few religious writings of no great importance, literature speaks the thoughts of Englishmen through French or Latin. The *Chronicle*, however, went on till 1154. The literature in the language of the people had not ceased to be; but there was nobody who cared to put it upon record. Even where it was already written, it might be rubbed from the parchment to make a palimpsest in which English was replaced by French or Latin.

Of the literature written in Latin after the Norman Conquest, a very large part was monastic chronicle. Every great religious house set up its chronicle, which might begin with Adam or with Hengist and Horsa, but which, wherever it began, was a compilation of no value till its record came near to the date of writing. Then it included facts yet within living memory, and became more and more valuable as a record of the past, until it became, for the occurrences of each successive year, the testimony of a living writer. From these chronicles we have our surest knowledge of the past. They were written usually by men whose sympathies were with the church and with the people, who cared little for pomp and show, but had clear notions about duty. There was strength of England in their practical simplicity. The most important of the monastic chroniclers were Ordericus Vitalis, who wrote an *Ecclesiastical History of England and Normandy*, and William of Malmesbury, who wrote a *History of English Kings*. Each closed his chronicle and probably his life about the same time, 1141–42. In William of Malmesbury the arrangement of the narrative showed a chronicler who had the genius of a historian. Milton placed him next to Bede. About the year 1147 a stream of romance broke from among the hills in the *History of British Kings* —British as distinguished from English—by an imaginative Welsh ecclesiastic, Geoffrey of Monmouth. This Latin chronicle, enriched by its author's fancy, began with the mythical origin of Britain in Brut, a great-grandson of Æneas, and went on through tales of kings, as Gorboduc and Lear, from which our poets afterwards drew

subjects for their verse. These led to stories of King Arthur, who in this book came to life again, and became the hero of that cycle of romance in English literature which answers to the cycle of the Charlemagne romance in France and Italy. Geoffrey of Monmouth's Chronicle was abridged by Alfred of Beverley; it was turned into French verse by Geoffrey Gaimar and also by Wace, whose version supplanted Gaimar's and abides in literature as Wace's *Brut*. Romances of Arthur, Merlin, Lancelot, Tristan, were supplied abundantly as the demand for them increased. Walter Map was a man of genius, chaplain to Henry II. He (if it was he) attacked abuses of the church with witty Latin poems, setting forth a Bishop Golias as type of the fleshliness in which the spiritual life of the church was being lost. Walter Map perhaps arranged the chief Arthurian tales into a sequence, and put soul into them by uniting them inseparably with the spiritual allegory of the Holy Grail. Thus, within forty years after they had first come into our literature, the tales of King Arthur were associated, as they still are, with the spiritual life of the English people.

After the year 1200 English regained its place in literature as the language of the country, and we have an increasing number of MSS. containing works by Englishmen written in English, as well as in French and Latin. To a date near 1205 is assigned an English poem of about 56,000 lines, in which the famous story told by Wace in French was told again by Layamon, a priest living near Bewdley by the Severn. Layamon's *Brut* is the first extensive piece of literature in Early Middle English, and near to it in date is a large fragment of a work named from its author, a canon of St Austin's order, Brother Orm or Ormin, the *Ormulum*. This was a metrical arrangement of the series of gospels appointed to be read in church throughout the year, set forth in simple narrative, each of them followed by a little homily upon it, written in like manner for pleasant recitation to the people. Both are interesting to the prosodist. The old alliterative verse is in decay. Layamon wavers helplessly between alliteration and rhyme. Orm rejects both for wooden regularity. To this period belongs also the rise of the Robin Hood and other ballads, and the telling in English verse of romances, such as those of *Havelok* and of *King Horn*. To this period belongs also a much greater achievement. Dialogue literature was no new thing in English—we have an Old English *Salomon and Saturnus*, for example—but *The Owl and the Nightingale* is Chaucerian long before Chaucer, 'the most miraculous piece of writing,' as Professor W. P. Ker put it, 'among the mediæval English books.' It may be by Nicholas of Guildford or by John of Guildford, or by some other totally unknown. It is assigned to the reign of John.

The foundation of the Dominicans as preaching friars for the maintenance of orthodoxy in religion, and of the Franciscans for the spread of the religious life by brotherhood with the poor, was in the beginning of the 13th century. Books being forbidden property to the Franciscans, they escaped from bondage to their records of opinion, looked straight to nature, and advanced the knowledge of the outward world. The first rector of a Franciscan house at Oxford was Robert Grosseteste, who in 1235 became Bishop of Lincoln, and made strenuous war against abuses of the Roman government of the church. He found that three times the revenue of the king of England was being paid for the support of absentee Italians, to whom the pope gave English church livings. Roger Bacon, who settled at Oxford as a Franciscan under Grosseteste, died after the year 1294, and had produced the most advanced body of scientific knowledge, the result of independent thought and experimental research, then to be found in Europe. He set it forth in his *Opus Majus*, *Opus Minus*, and *Opus Tertium*, all poured out in fifteen months to satisfy the pope's request for an account of what he knew. Robert of Gloucester's chronicle from the siege of Troy to the death of Henry III. in 1272 put English history into verse for diffusion among the people, still chiefly by recitation. In the reign of Henry III. appeared in October 1258 the first proclamation in English since the Conquest. There was not another in that reign. At the close of the 13th century the wisdom of the people was gathered also into the metrical *Proverbs of Hendyng*.

At the beginning of the 14th century the religious spirit of the people was expressed by Robert of Brunne's metrical version—as the *Handlynge Synne*—of a *Manuel des Péchés* that had been written in French by a Yorkshireman, William of Wadington. There was in the popular poem of 'The Land of Cockaigne' a homely satire on the sensualism that had spread among the monks, who now had too much to live upon and too little to do. The miracle-plays that first came into use after the Conquest had developed greatly. Early in the 14th century long sequences of Bible story, then first set forth in the language of the people, were so dealt with by trade-guilds as to be a great means of bringing the Bible into the street, and vividly presenting to the people the events on which the forms of their religious faith were founded. Such sequences of miracle-plays have come down to us—the Chester, the Coventry, the Wakefield or Towneley, and the York. There are known to have been more than these, and they did not wholly go out of use until the reign of Elizabeth. Englishmen then had Bibles to read in their own tongue, and had learned to read them, so that there was no more need for the device of an *Ormulum* or of a sequence of miracle-plays to show what they contained. To the beginning of the 14th century belongs also an outburst of lyric of singular freshness and delicate beauty.

While English literature was in such ways the voice of the nation, the genius of Dante had raised literature in Italy to its highest artistic form, the higher for close union with all that was felt to be most real in life. The year 1300 is the assumed date of the *Divina Commedia*. Dante, who died in 1321, was followed by Petrarch (born in 1304), and by Boccaccio (born in 1313). Petrarch and Boccaccio were the great living poets of Italy when Chaucer's genius was being shaped in England. They died nearly at the same time—Petrarch in 1374, Boccaccio in 1375, when Chaucer was in ripest manhood, and the better artist for the influence these great Italians had upon his work.

But energies of thought in care about essentials were the main cause of the strength of English literature in the 14th century. There was continued provision of monastic chronicles, also of religious poems, one of them, the *Cursor Mundi*, of great length. But a new mind found utterance. Decay of spiritual life in the church, as its wealth became its weakness, and caused poets and reformers to lament 'the fatal gift of Constantine,' had given cause for earnest questionings and struggles for reform. At the university of Paris, in 1324, Marsiglio of Padua had controverted the sacerdotal limits of a church, had declared only Christ the judge of heresy, and had broken with the medieval view of papal authority. In this country William of Ockham, called the invincible doctor, argued boldly against the pope's power in temporal affairs. It was he who brought the Scholastic Philosophy to a close by reasoning upon doctrine without faith in the infallibility of dogma. The great movement of the 14th century towards reform

was prompted by visible corruption. Wyclif himself as a reformer looked at first mainly to discipline, with which questions of doctrine became gradually more involved. For seventy years, from 1309 to 1378, the popes were at Avignon under French influence, and this quickened English resistance to their claims. For the next forty years or more the influence of the papacy was further weakened by the rivalry of two popes, one in France and one in Italy. Thus, while John Wyclif, who died on the last day of the year 1384, having secured between 1360 and 1382 a complete translation of the Bible into English, represented in our literature of the 14th century a strenuous reform movement within the church, William Langland, in a great poem addressed to the people at large, the *Vision of William, concerning Piers the Plowman*, sought to animate men to the search for Christ, and battled vigorously with church corruptions. Five great pestilences in the 14th century—the greatest the Black Death of 1348–49—were regarded as signs of divine wrath against sin, and added much to the intensity of feeling. Langland, who wrote his Christian poem, which made love 'the triacle of heaven,' between 1362 and 1400, seems to have been urged to utterance by the great pestilence of 1361. Multiple authorship has sometimes been claimed for his work. *Piers the Plowman* is written in the old alliterative verse which, with a changed rhythm, but otherwise fairly well preserved, had in some obscure way lived on to emerge in the 14th century. A greater than Langland was among its practitioners, the anonymous 'Gawain poet,' the strong imaginative genius who, probably in Lancashire or Cheshire, wrote the romance of *Sir Gawain and the Green Knight*, the allegory of the *Pearl*, and the didactic *Cleanness* and *Patience*. Contemporary with him was at least one other alliterative poet of merit, 'Huchown of the Awle Reale.'

The Jack Straw rebellion of 1381 caused John Gower, a wealthy gentleman, religious, liberal, and with distrust of Wyclif's followers, to seek the source of all ills of the land by a review in his Latin poem, *Vox Clamantis*, of all orders of society. In this, although an orthodox churchman warning against heresies, and one who had no sympathy with popular violence, he wrote with emphasis of the corruption of the papacy and the gross appetites of the religious orders. Gower wrote three great books, and wrote them in what still were the three languages of English literature. His book written in French, *Speculum Meditantis*, was lost till 1896; that in Latin was the *Vox Clamantis*. In his English poem, the *Confessio Amantis*, Gower, like Chaucer, followed the lead of Boccaccio's *Decameron* in threading together upon a connecting narrative a series of tales. Like Chaucer's, they were told in verse. Gower's tales were moralised to illustrate the seven deadly sins, and one book dealt with a question pressed on the country by the gross misrule of Richard II., the duties of a king. Gower lived until 1408, blind during the last eight years of his life. Geoffrey Chaucer died in 1400. In the *Canterbury Tales*, with their Prologue and the rest of the connecting thread of narrative, as well as in other writings, Chaucer shows a genius akin to Shakespeare's. Not only is there a rare dramatic power manifested clearly, but he had also the calm sense of highest truth, and that kindly breadth of human sympathy without which a power such as Shakespeare's cannot be. In his other poems Chaucer seems in earlier life to have been influenced by the French poets fashionable at court; but he came more and more under the influence of the great Italian masters. His *Troilus and Cressida* and his *Knight's Tale* are free versions of two of the most famous poems written by Boccaccio, and the influence of Dante was upon his later work. In the north, while Chaucer wrote, the spirit of liberty maintained by the endeavours of the kings of England to extend their sovereignty beyond the Tweed produced from John Barbour, Archdeacon of Aberdeen, his poem of the *Bruce*, which was half-finished in 1375. To Barbour has been attributed also a collection of church legends which were printed in 1881–82.

In the earlier half of the 15th century there were many influences adverse to the maintenance of the high standard of English literature. There were civil wars and there was foreign war of aggression, part of the endeavour of the kings of England to maintain and extend sovereignty in France. None of these wars were inspiring to the men on the south side of the Tweed. Scots and French were driven to alliance against a common danger; and in battle for their independence the Scots bred the better poets. In England at the beginning of the 15th century there were, indeed, two poets of mark, John Lydgate and Thomas Occleve or Hoccleve, each of them about thirty years old when Chaucer died. Hoccleve was a clerk in the office of the Privy Seal, who wrote in English his chief poem *De Regimine Principum*, on the duty of kings, that it might be humbly presented to King Henry V. as a reminder to him that Hoccleve and other clerks in the government service could not get payment of their salaries. Without disloyalty Hoccleve pointed out the evil of aggressive war. John Lydgate, an accomplished monk of Bury St Edmunds, had travelled in France and Italy before he became the most famous teacher in his time of rhetoric and poetry. He drew many to the monastery school of Bury St Edmunds, and himself wrote much good verse that was in high repute. Besides many short pieces and lives of saints, he wrote especially three larger poems—one was his *Troy Book*, on the siege of Troy; another was the *Story of Thebes*, with a pleasant introduction linking it to Chaucer's *Canterbury Tales;* the third, his most important work, was the *Falls of Princes*, a version through the French verse of Laurent de Premierfait, from the Latin prose of Boccaccio's *De Casibus Illustrium Virorum*. James I. of Scotland, captured as a child, instructed in English manners as a prisoner at the English court, married to a cousin of Henry V., and crowned at Scone in 1424, was too manly to be made a puppet in the hands of England. His poem, the *King's Quair*, celebrating his love for Jane Beaufort, is one of the best pieces written as in the school of Chaucer; and if, as is now hardly accepted, he was also the author of a piece so homely and vigorous as *Peblis to the Play*, with its humorous scenes of life among the people, he had a master's breadth of power.

Wyclif's followers were rigorously persecuted in the earlier years of the 15th century. In 1449 Reginald Pecock was raised from the bishopric of St Asaph to that of Chichester, and on the part of the bishops undertook an answer to the complaints made by the Lollards against the higher clergy. His answer, the *Repressor of over much Blaming of the Clergy*, a large work in English prose, admitted their right to be reasoned with, and gave to reason the same place that was assigned to it long afterwards by Richard Hooker, when he opposed the Puritan view at the end of Elizabeth's reign. There are, indeed, many points of resemblance between the arguments of Pecock's *Repressor* and those of Hooker's *Ecclesiastical Polity*. But Pecock, because he reasoned with the people in their own tongue, instead of compelling obedience, was condemned by his own order, and imprisoned for the rest of his life in Thorney Abbey; while Hooker

for like service in a later time won honour as a champion of the church. Civil as well as religious liberty was represented even in our scanty 15th-century literature by Sir John Fortescue, Chief-justice in the reign of Henry VI. Fortescue, when his king's cause was lost and he was an exile in France with the queen and the young prince who might hereafter be king in England, gave to the prince a lesson on the limits of an English king's authority, comparing it with the absolutism of the king of France. He wrote like a sound constitutional lawyer on the *Difference between Absolute and Limited Monarchy*, and about the year 1463 *De Laudibus Legum Angliæ*. By that time new powers had begun to work in Europe for the shaping of the future. The capture of Constantinople by the Turks in May 1453 drove into exile many learned Greeks, who earned their living in Italy and elsewhere by teaching. They had a ready welcome at Florence, where Cosmo de' Medici was establishing his power. There began in this way a diffusion of Greek studies, through which Plato came to life again, and his doctrines came in strong aid of the movement against fleshly corruptions of the church. A saying that arose then, *Cave a Græcis, ne fias hæreticus*, shows the supposed tendency of these new studies. At the same time a new force, which would quicken greatly the formation of opinion in the world at large, was coming into life through the discovery of the art of printing with movable types. In 1455 the printing of a Bible with such types was finished. The working printers, presently dispersing, carried their profitable skill to other places. There was a press at Rome in 1466, at Paris in 1469, and the new art was brought into England by Caxton about 1477. The 15th century closed with another event fruitful of great consequences—the discovery of the New World (1492).

Luther and Raphael, born in the same year, 1483, were youths of eighteen in the first year of the 16th century; Michelangelo and Ariosto were young men of twenty-six. The intellectual predominance obtained by Italy through the free life of her republics was not immediately destroyed by the establishment of petty tyrannies as single families won mastery over their fellow-citizens. The new lords, of whom Lorenzo de' Medici (who died in 1492) was a great typical example, spent freely the money of their subjects upon luxuries of art. They led the way in encouragement of every form of intellectual life that could keep active minds busy upon other questions than those which concerned their ancient rights. At the little Italian courts every gentleman was, to the best of his power, a small artist who cultivated ingenuity in clothes, in manners, and in words. When our English youth travelled, in Henry VIII.'s time, into Italy for polish, they brought home fashions of speech and writing that developed in new form an Italian influence upon our literature. This was not, as in Chaucer's time, the influence of one great writer on another, but the diffused social influence of a prevailing fashion.

Struggle for independence had raised poets in Scotland, of whom there is a long list in William Dunbar's *Lament for the Makers*, first printed in 1508, when Andrew Millar and Walter Chepman had just set up the first press in Edinburgh. Robert Henryson, schoolmaster of Dunfermline, shrewd, homely, and religious, author of the first pastoral in our literature, *Robin and Makyn*, of a sequel to Chaucer's *Troilus and Cressida*, the *Testament of Cresseid*, and of translations from Æsop's fables, was then dead. William Dunbar himself, the next great poet after Chaucer, may have been about forty years old when he received, in 1500, a pension of £10 Scots from James IV., whose marriage with Henry VII.'s daughter Margaret, in 1503, he celebrated with his poem of the *Thistle and the Rose*. It was probably in 1501 that Gavin Douglas dedicated to James IV. his poem of the *Palace of Honour*. In July 1513, two months before the disaster at Flodden, Gavin Douglas finished the earliest translation of the *Æneid* in our literature, with verses of his own to introduce each book. Gavin Douglas, become Bishop of Dunkeld, died of the plague in 1522, a pensioner at Henry VIII.'s court. Dunbar was dead in 1530. David Lyndsay, who became Sir David Lyndsay of the Mount, was associated with James V. of Scotland from his infancy, and addressed to him many admonitions on the sorrows of the people and the duty of a king. Lyndsay's *Satire of the Three Estates* was the most important example in our literature of the Morality Play that expressed moral teaching by the dramatic action of personified attributes and forms of life. It shadowed forth the reform wanted in the Church of Scotland; and the passing by the Estates in 1540 of what was called a friendly act of reformation was prepared for by the public acting of this satire in the presence of the king. Lyndsay's last poem, the *Monarchie*, was finished in 1553, and in this 'the Scottish poet of the Reformation,' as he has been called, becomes distinctly Lutheran. The vigour of these poets of the north was not equalled in the south under Henry VII., where Stephen Hawes, a gentleman of the king's chamber, wrote, among other poems, a *Pastime of Pleasure*, with an allegory of the course of life in knightly adventures, that show distinctly, but in form only, the advance of allegorical literature towards its crowning work in Spenser's *Faerie Queene*. John Skelton, who had been chosen for his scholarship to be a tutor to Henry VII.'s children, wrote in the reign of Henry VIII. satires against church corruption, in little torrents of short lines with continuities of rhyme, verse called Skeltonical. It poured out the complaints of *Colin Clout*, who represented the poor Englishman of country and of town, and it boldly attacked Wolsey himself in the height of his power. From Skelton, with whom he had fellow-feeling, Spenser borrowed afterwards for himself the name of Colin Clout.

Greek scholarship was still advancing, and was still associated with the free advance of thought. William Grocyn, having learned Greek in Italy, first taught it at Oxford in 1491. The physician, Thomas Linacre, who had also learned Greek in Italy, taught also at Oxford. In 1497, when Erasmus sought to learn Greek, he came from Paris to Oxford for it. John Colet, the founder of St Paul's School in 1510, and William Lily, its first headmaster, were Oxford scholars, associating their Greek studies with ideals of true life and a wise liberality of thought. Thomas More when at Oxford was inspired by these men, and his *Utopia* (Latin, 1516; Eng. trans. 1556) imagines a commonwealth in the New World lately discovered, and through playful wit brings thought inspired by Plato and by Plutarch into the Christian ideal of a higher policy than statecraft yet had known. More sought also to bring home the teaching of the Gospels by a Latin paraphrase. Translation of the Scriptures into the language of the people had many learned advocates who were restrained only by fear of mistranslations that would, as they thought, corrupt the Word of God.

Luther's translation of the New Testament into German appeared in 1522. Tyndale's translation into English followed in 1525. Sir Thomas More was its adverse critic, because he found Lutheran bias in the choice of words. In 1530 Tyndale finished printing his translation of the Pentateuch, made with Miles Coverdale's help. In October 1536 Tyndale was strangled and burnt near Brussels. In the same year Coverdale's completed translation of the Bible was admitted into England, and work

towards the production of a translation that would satisfy all judgments was continued.

From Italy there flowed new streams of literature. The *Arcadia* of Sannazzaro, finished in 1504, was in a form of pastoral that spread to other lands. The first eclogue of mark in France was Clément Marot's *Complaint on the Death of Louise of Savoy*, mother of Francis I., written in 1531, and paraphrased afterwards by Spenser in the eleventh eclogue of the *Shepherd's Calendar*. George of Montemayor, a Portuguese, produced in 1542 a *Diana Enamorada*, which joined force with the *Arcadia* of Sannazaro as an influence on English literature. Blended with influences from the Spanish romance of chivalry, it led to Sir Philip Sidney's romance of *Arcadia*, first published in 1590, after Sidney's death. Of the same parentage came also a long line of French romances, which continued far into the 17th century.

The modern drama, based upon the form of Latin plays then usually acted, had its rise in Italy. Ariosto first wrote comedies about the year 1498; his earliest, *I Suppositi*, was based on the *Eunuch* of Terence, and the *Captives* of Plautus. Trissino's *Sofonisba*, dedicated to Leo X. in 1515, and first printed in 1529, was the first Italian tragedy of mark. The Italian sonnet was first imitated in Henry VIII.'s reign by Sir Thomas Wyat and the Earl of Surrey. Experiments in unrhymed verse by the Italian poets led to the first use of blank verse in English literature, when the Earl of Surrey used it in translating two books of the *Æneid*, which had been so turned into Italian.

The great question of church reform became more passionate, and divided all Europe into two camps, which came to have their headquarters, one at Madrid, the other in London. Luther had died in 1546, when Calvin's age was thirty-three, and Calvin died at Geneva in 1564. Hugh Latimer preached before King Edward, and was burnt by Mary. John Knox, indignant against three ruling Maries, sounded from Geneva his *First Blast of the Trumpet against the Monstrous Regiment of Women*, just before the accession of Elizabeth. He could not make his peace with her, but, warned from England, he landed at Leith, and stirred Scotland to the heart with religious zeal. It had its aims in accord with the teaching of Geneva, but was associated by Knox with a masterly reshaping of provisions for the education of the people.

In Elizabeth's reign the struggle for all that they most prized, against Spain enriched by the wealth of the New World, lifted the hearts of men as the hearts of the old Greeks were lifted when they fought for freedom against Persia. Fashions and follies there were then as now, chiefly brought in from Italy, with an exuberance of ingenuity that touched alike the clothing of men's bodies and men's thoughts. Thus the Italian influence, which became dominant over outward forms, introduced that straining for conceits and dainty turns of speech, alliteration, and antithesis, which was so common as to need a name. It was called Euphuism from *Euphues*, the hero of a book by John Lyly, published in 1579, and written in the fashionable manner. Lyly wrote in that manner to win hearing. His aim was to advance a view of the need and nature of true education, which had been urged by one of the best scholars of the day, Roger Ascham, in his *Schoolmaster*, first published in 1570, two years after its author's death.

In the first twenty-one years of Elizabeth's reign English energies were growing. *The Mirror for Magistrates* is in the mediæval succession, but its 1563 edition had one contributor of genius, Thomas Sackville. In 1579 Edmund Spenser, aged about twenty-six, produced his first book, the *Shepherd's Calendar*, following Clément Marot in his way of applying pastoral images to the religious conflicts of the time, and boldly taking his place beside the disgraced Archbishop Grindal, with whose firmness in encouraging free search for Scripture truth the poet was in sympathy. In the same book Spenser paid homage to Tityrus (Chaucer) as his master. He took the style of Chaucer for his model, avoiding the false emphasis laid on tricks of thought and phrase. Spenser was Chaucer's successor, Milton's predecessor. In the great fragment of his *Faerie Queene*, which represents man through all his powers for good striving heavenward, and attaining only by the intervention of the grace of God—of which Prince Arthur is the bearer—all militant forces of his time have their expression. The *Faerie Queene* is throughout an intense utterance of the spiritual life of England under Elizabeth, in all that were then the forms of the long battle towards a higher life for man. England was full of song. Men felt proudly the rising vigour of their country. A tailor (John Stow) was inspired to write its annals. An attorney (William Warner) wrote in verse of *Albion's England*. The defeat of the Spanish Armada in 1588 removed the common danger that had knitted Englishmen together. In 1589 the Marprelate tracts against the bishops, and the replies to them, brought oppositions of opinion in the English Church into that bitter conflict of which Francis Bacon, then twenty-eight years old, pointed out the unseemliness in a paper addressed to the government on *Controversies in the Church of England*. Shakespeare's age was then twenty-five. He had come to London probably when twenty-two, two years before the defeat of the Spanish Armada, and at that time the English 'regular' drama was but twenty-five years old.

The first English comedy, *Ralph Roister Doister*, a version of the *Miles Gloriosus* of Plautus, had been written between 1534 and 1541 to be acted by Eton boys. It was a schoolmaster's chance substitution of English for Latin in a play written by him for his boys; and it was acted under conditions that would not prompt imitation. Its production, therefore, was an isolated fact. But the first tragedy, *Gorboduc*, by Thomas Sackville and Thomas Norton, acted in the Inner Temple at Christmas, 1560—actually on the first of January 1561—was a substitution of English for Latin in an English play written in the manner of Seneca, that drew to itself the attention of many young men who could write. Its grave dwelling upon the need of union to keep a people strong, a truth of deep significance to England at that time, pleased Elizabeth. The play was acted again before her, by command. It set an example that was followed at court, where English plays came into request. It showed also to young wits how they might furnish themselves with money by writing English plays to be acted by those gentlemen's servants who already had formed little companies for playing *Interludes*. Such interludes, short entertainments in dialogue by a few servants of the house, who used their skill in mimicry for the amusement of their lord and his guests, produced a form of literature in which John Heywood excelled. But these short pieces had no developed plots. Desire grew towards the new way of showing tales in action. It was an improvement on the most dramatic recitation by a single story-teller. But in the twenty-five years from 1561 to 1586 few plays of high mark were produced. There was little more than a wide spreading of the taste for the new kind of entertainment, and a development of companies of actors. At length a civic opposition drove the actors privileged to play in London out of rooms and inn-yards in the city into buildings of their own, just outside the jurisdiction of the mayor and corporation, which they erected for sole use as

theatres. These first theatres were built in 1576. Ten years afterwards Shakespeare came to London when the new conditions of the stage had made the way ready for plays of higher mark. John Lyly had produced court plays chiefly mythological. George Peele had already pleased the queen with his *Arraignment of Paris*. Christopher Marlowe began with *Tamburlaine* upon the public stage in 1586 or 1587, his short and brilliant career ending in 1593. Robert Greene, who died in 1592, Thomas Lodge, Thomas Kyd, and others maintained a poetical drama during the six, or about six, years of what may be called Shakespeare's apprenticeship. During these years he made himself generally useful, acted, and sometimes turned old plays into new. At the end of the six years this group of dramatists, the pure Elizabethan, passed away; and for the next six years, 1592 to 1598, in which Shakespeare was master, writing plays of his own, he seems to have had no strong competitors. But in or about the year 1598 many young dramatists —Ben Jonson, Dekker, Marston, Thomas Heywood, Middleton—who were to earn fame in the next reign began to write, while Shakespeare went on with his work, remaining foremost of all. Beaumont and Fletcher, Massinger, and Ford did not write any plays until after the death of Elizabeth. Webster wrote his two finest plays in the reign of James I., and emphasised, like others in his time, that element of terror in the drama which Aristotle had joined to pity. Webster lived into the middle of the 17th century. James Shirley, who was only nine years old when Elizabeth died, and who wrote plays chiefly in the reign of Charles I., lived until 1666, the last of those who are usually called Elizabethan dramatists. The period of highest achievement in our English poetical drama falls, then, within the first ten or twelve years of the reign of James I. But already in this best time of fruitage there are conditions of decay, which make it hard to say where ripening ends and rotting begins. The energies of struggle had developed a dramatic literature in Spain as in England. Influence of the Spanish drama, coinciding with a lower social tone in James's court, caused many of the plays of younger dramatists to find in intrigues of animal love the sole groundwork of invention. On the stage of Elizabeth's time there was no such restriction, but interest was shown in all the trials of the life of man.

The 17th century, from the accession of James I. in 1603 to the Revolution of 1689, was occupied by new forms of struggle about the limit of authority. Becket's struggle with Henry II. had been for sovereignty of the church over the king. From that time onward, Reformation movements chiefly were for war against the pope's claim of dominion. While England was in contest against Spain, Elizabeth was leader of her people. When removal of the danger from abroad gave freedom for domestic difference, the queen became unpopular. There was dread that civil war would come again after her death. The two chief heroic poems at the close of her reign, Drayton's *Barons' Wars* and Daniel's *Civil Wars of York and Lancaster*, were designed—as other poems and plays were then designed—to press on Englishmen a feeling of the ills that follow when this house is raised against this house. When James I. sought less wisely than Elizabeth to maintain and magnify the power of the sovereign, he soon made the question of the limit of authority political as well as religious, and prepared the way for civil war in the next reign.

Revolt against authority of mere tradition in the teaching of the schools had its chief leader in Francis Bacon, whose analytical mind looked in his *Essays* upon the nature of man himself, and in his philosophy upon the nature of the world without him. His two books of the *Advancement of Learning*, with which he began to lay foundations for his *New Organon*, were published in 1605, and his work as teacher of the right way of experimental search into nature, unimpeded by tradition, was suggested by a strong reaction against bondage to common opinion (the Idol of the Forum) or the teaching of great men who have played large parts on the stage of life (the Idols of the Theatre). Men with a bent for science began to inquire as Bacon counselled that they should, and grew in desire towards unbiased inquiry by well-planned experiments. They were searchers into nature so inspired who were incorporated in London as a Royal Society in 1662.

But James I., though Bacon's patron, knew little of the whole advance of free inquiry that Bacon represented only in one form of study. To obtain freedom of worship, English Puritans sailed for New England in the *Mayflower* in 1620, and added strength to the foundations of an England on the other side of the Atlantic, which had its origin in the vigour of Elizabethan navigators. Part of the region that Sir Walter Raleigh named Virginia, after the virgin queen, was granted by James I. in April 1606 to a London company, whose first settlers called their town Jamestown, in honour of the king, and who produced in Captain John Smith the author of a *True Relation of Virginia*, published in London at the close of the year 1608. This may be regarded as the first book in the English literature of America. The settlers in New England who had left Old England for conscience' sake, and who included many graduates, of Oxford and especially of Cambridge, brought a new strength to the New English world that is well represented in the record of the Mather family.

John Milton went to Cambridge in the year (1625) when Charles I. became king. He joined fine scholarship and the poet's temperament to strenuous endeavour towards freedom of thought. His high ideals were expressed with the power of a master poet who had subjected his mind to long and patient training. His earlier verse was pastoral, as he thought suited to a time of preparation for a higher flight; but the period of his prose works intervened between his earlier verse and the later in which he rose to the epic with *Paradise Lost*, published in 1667. His other epic, *Paradise Regained*, was published in 1671 with *Samson Agonistes*, his one drama, modelled on the Greek. In the controversies of the day about religion, Milton was the best representative of the first principle of the Independents. They would unite all men as fellow-Christians who built their faith upon the Bible, and would leave to each the right of joining himself to an independent congregation of the worshippers with whom he best agreed in his interpretation of the Bible. Richard Baxter was the ideal type of the Presbyterian who thought the Episcopal Church less scriptural than a church managed by presbyters and elders, but was as desirous as the ruling church to bring all Englishmen into accord with one church discipline and one form of belief. Of the church established by Elizabeth as *via media* between Rome and Geneva, the church of which Richard Hooker in his *Ecclesiastical Polity* had, at the end of Elizabeth's reign, best maintained the cause, Jeremy Taylor was in Stuart days the ablest supporter. God made us to differ that by wrestle of opinion we may win the victory for truth.

Milton's early poems were written at a time when the English drama seemed to break in its fall into a rainbow-tinted spray of song; Herrick, born lyrist, Wither, Suckling, Cartwright, Habington, Thomas

Traherne, Randolph, Cleveland, Lovelace, Cowley, Crashaw, George Herbert, and Henry Vaughan represent the graces and the follies and the grossnesses of life, the strife of parties, and the highest aspirations towards the divine ideal. Milton's *Comus*, the most beautiful example of the masque, which before Milton had been best developed by Ben Jonson, was an indirect plea for the high use of the poet's art, when Prynne had just expressed the Puritan antipathy to plays, masques, dances, in his *Histriomastix*. *Comus*, acted at Ludlow in 1634, was also a setting forth of the beauty of temperance and purity, at a time when the course of fashion, aided by the readiness of the king's friends to show that they were no Puritans, was bringing sensuality into repute. Dr Thomas Browne of Norwich—not Sir Thomas till the time of Charles II.—in his *Religio Medici*, published in 1642, joined faith in doctrines of the church with a free, reverent spirit of inquiry. Every page of that book was rich with subtle utterance of independent thought. Milton's prose pamphlet *Areopagitica* in 1644 enshrined in a piece written carefully after the manner of a Greek oration the cardinal principle that for the advance of truth there is no safeguard to be relied upon but free exchange of thought. 'Let truth and falsehood grapple,' Milton said; 'who ever knew truth put to the worse in a free and open encounter? Her confuting is the best and surest suppressing.'

This is the battle that runs through the history of English literature. All the prose writings of Milton in the Commonwealth time dealt essentially with the question of the limit of authority; they sought the best solution of the problem between king and people that had stirred up civil war. The Commonwealth was an experiment that failed. The Restoration was a going back to a new starting-point, and trying again for an answer to the problem. It was found at last in 1688. The argument for absolute authority had its best expression in the political philosophy of Thomas Hobbes, whose *Leviathan* appeared in 1651 as his contribution to the great controversy of the time. James Harrington's *Oceana* in 1656, and Richard Baxter's *Holy Commonwealth*, show the energies at work which have made English literature at all times a true and full expression of the people's life. They were in George Wither's verse and Andrew Marvell's satire; in Butler's *Hudibras* with a wide reach of wisdom in its wit that struck at everything insincere; in *Paradise Lost*, that shapes an epic to maintain God's love among the discord of disputes about predestination and free-will; in *Paradise Regained*, with its calm burden of Rest in the Lord, enforcing faith and patience in the darkest times—dark even as the times seemed to religious men who looked at the court and country in 1671—and in *Samson Agonistes*, which was added as a scriptural example of such faith. In all work of the best writers there was the best life of the time engaged upon its most essential problems. John Bunyan's *Pilgrim's Progress* in 1678 and 1684 found its answer in the religious feeling to which it appealed, still strong throughout the body of the people. The masterpiece of John Dryden, *Absalom and Achitophel* in 1681, and the poems that next followed, dealt altogether with those vital questions of the day which pointed to the coming revolution.

Strain for ingenious conceits had been an Italian fashion that spread to Spain and to France as well as to England. In all three countries it became laboured, and took the form called by Samuel Johnson 'metaphysical,' in the poetry of which John Donne in the reign of James I. was the favourite writer. At the same time Marino in Italy and Gongora in Spain illustrated the same form of decay. Our days of Euphuism were represented in Spain by the school of the 'Conceptistas,' and those whom we may call our later Euphuists were represented by the school of 'Cultos.' In France reaction against this laboured extravagance had begun in the days when English royalists of the time of Charles I. were in political adversity and lived in Paris. They who afterwards in England were patrons of literature attended the *salons* of the Marquise de Rambouillet, and were in contact with the critics and the poets who prepared the way for the predominance of France. Boileau, the master critic of this school, began his satires about the time of the Restoration, and summed up his views in his *Art Poétique* in 1673. A taste for criticism now spread; even the small wits prided themselves on sense. Boileau lived until 1711. Critics who followed his teaching in the letter rather than the spirit swarmed about him and survived him. The period of Latin-English thus came in, when writers, to avoid the low association of ideas with homely words, sought their vocabulary from the Latin side of the language, and wrote sentences that they would never speak.

Boileau opposed the strain of writers for extravagant conceits—which he called the paste brilliants of Italy—by fixing attention on the simplicity that graced the highest art in Roman literature of the time of Augustus. Works of Virgil and Horace were the models through which he would have nature to be studied. This was right counsel, but many misapplied it. In England they grew blind to the art of their own best writers who were not in obvious relation with the new French school. Deaf to the music of Chaucer and Spenser, they supposed that Waller, whose earliest verse was written in the reign of Charles I., and who died, aged eighty-two, in 1687, had been the first in England who wrote smooth verses and invented the right use of rhyme. Sir John Denham's poem on the view from *Cooper's Hill*, first published in 1643, was exaggerated into epic dignity. Dryden described it as a work that, 'for the majesty of the style, is and ever will be the exact standard of good writing.' Dryden was then advocating the disuse of blank verse in our plays, and he used for a few years the rhymed couplets preferred in France which found their way into the heroic play of the Restoration. These heroic plays, of which the first had been Davenant's *Siege of Rhodes*, were sustained in popularity by Dryden himself with plays like his *Tyrannic Love* in 1669, and *Conquest of Granada* in 1670. They retained much of the extravagance against which, on behalf of good sense, Boileau made elsewhere successful war; and the *Rehearsal*, by the Duke of Buckingham and others, produced in 1671, was a burlesque meant as a plea for good sense even in the theatre. The heroic plays passed into rhetorical tragedy, of which only two pieces by Otway, *Venice Preserved* and the *Orphan*, avoiding royal heroes, were distinguished by domestic pathos. But Charles II. left Otway to starve. The rhetorical tragedies became associated with an artificial stage delivery until the time of Garrick, who went straight to nature. In the comedy of the Restoration, Sir George Etheredge's profligate young gentlemen, who call themselves men of sense and have no reason in their lives, reproduce with a light touch, a grace of gracelessness, the fashionable manners of the time. But Molière, greater than Plautus or than Terence, had raised comedy in Paris to an intellectual supremacy that was felt by the best comic dramatists in England. Wycherley, whose four comedies were produced in the reign of Charles II.; Congreve, whose plays were all written under William III.; Sir John Vanbrugh, and Farquhar, who wrote also in the reign of Anne, learned from Molière to put a larger life into their art as dramatists, and produce what

has been entitled the Prose Comedy of English Manners.

Until nearly the end of the 18th century this French influence prevailed. It was maintained by the just predominance of French literature, which had reached its Augustan age; but this influence, like that of Italy, had in its strength an element of weakness that increased with years. In due time it was shaken off by one more great reaction, out of which came the forms of literature in the present day.

The 18th century in English literature shows especially the course of thought between the English Revolution of 1688, of which John Locke expressed the true ideal, and the French Revolution of 1789, that sought to establish an ideal of true citizenship. It failed, but showed the way to a success much slower of attainment, towards which the English literature of the 19th century labours in every generation with more conscious resolve. The 18th century was not an age, as Carlyle once called it, 'of shams and windy sentimentalities.' There were plenty of these; but the spirit of the century lies really in the great reaction against them. Corruptions in that section of society which usually calls itself the World, that touched religion to the quick, and put formal conventions in the place of truth, had stirred resentment. Pierre Bayle, in his *Dictionnaire Historique*, implied in all his pictures of the lives of men a world without a God. A scepticism of earnest, honest minds grew up, that denied God because it could see no truth in his priests. The corruption of society, greater even in France than in England, great in both countries through the evil lives of men whose high social position made them leaders of the weak, made vice appear to be the sand upon which civilisation had been built. Mandeville's *Fable of the Bees* began, even in Queen Anne's time, the satirical expression of this doctrine, which had its highest expression afterwards in France, through the writings of Rousseau. First there was this growing conviction of wrong; then followed in France the passionate desire for remedy.

There arose in Queen Anne's reign, from the genius of Daniel Defoe, the real beginnings of the modern newspaper and of the periodical essay. Newsletters, intended to give information to one side or other in the time of civil war, had already been published before the Commonwealth. After the Restoration, Sir Roger L'Estrange, having obtained for himself the 'sole privilege of printing and publishing all narratives, advertisements, mercuries, intelligencers, diurnals, and other books of public intelligence,' produced in August 1663 the first number of his *Public Intelligencer*. When the plague drove the court to Oxford, he produced, in November 1665, the first number of his *Oxford Gazette*, which became, when the court returned to London, the *London Gazette*, on the 5th of February 1666 (see GAZETTE). Other newspapers arose, which expressed opinion indirectly by representing facts in the form most agreeable to their subscribers. Daniel Defoe, having been sent to Newgate in 1703 for an ironical pamphlet against passionate attacks on the Dissenters, began, after his liberation, his journal, the *Review*, of which the first number appeared on the 19th of February 1704, and which appeared in and after 1705 three times a week until June 1713. This paper had two features which were new, and upon these the growing power of English journalism at its best was based. Defoe aimed at exact truth, palatable or unpalatable, in his record of facts; and he joined to his record independent comment. Thus he became the founder of what is now known as 'the leading article.' He also added to his *Review* a monthly supplement that dealt wholesomely with follies and fashions of society. The notion of this was developed afterwards by Richard Steele when he established the *Tatler* in April 1709. Out of the *Tatler* came Steele and Addison's *Spectator*, which began on the 1st of March 1711, and opened the way to many later efforts of the same kind to better and refine the ways of men.

In the foundation also of the modern novel of real life, which displaced the French romances of Gomberville, Calprenède, and Madeleine de Scudéri, themselves due, as we have seen, to Spanish romances and Italian pastorals, Defoe led the way with his *Robinson Crusoe* in 1719. This did not profess to be a novel, but was, like all following novels of Defoe, written in imitation of some other form of literature that had for its chief features a true record of experience of life. Defoe's picture of a single man battling against circumstance, unflagging in the energetic use of his own resources, with unfailing trust in God, expressed so completely the new interest in the development of man, that Rousseau afterwards, in his *Émile*, made *Robinson Crusoe* the first book to be put into the hands of the ideal pupil. As the movement towards larger assertion of individual and national life advanced in Germany, imitations of *Robinson Crusoe* were so many as to form a group in literature that became known as the *Robinsonaden*.

Pope, under Queen Anne, followed the critical fashion of the time, and made his mark first in 1711, with an *Essay on Criticism*, which was writing about writing about writing. His *Rape of the Lock*, in 1712–14, was, perhaps, the daintiest trifle ever written; but it was half-earnest play upon the idleness of fashion. Under George I. Pope earned money by translating Homer. But under George II. he had grown with the growth of his time, and to the full extent of his powers he dealt in his *Essay on Man*, his *Satires* and *Epistles*, with the deeper questions of life, and felt with the world about him that 'the proper study of mankind is man.' From the beginning of the reign of George II. our best literature expressed the growing interest in questions of the nature and the prospects of society. Swift, under Queen Anne, had followed the critical fashion of the time with his *Battle of the Books*, but joined to it the keen use of his wit in dealing with the dissensions about religion. That was in his *Tale of a Tub*. His other writings in Queen Anne's reign belonged almost without exception to those controversies of the day that shaped the course of history, and to the labour to let light into the lives of men. Under George I. Swift was Dean of St Patrick's, deep in politics of Ireland. At the end of that reign his *Gulliver's Travels* (1726) expressed the meanness to which life and its aims had sunk, not more contemptuously than Gay's *Beggar's Opera* (1728), and its sequel *Polly*, which placed highwaymen a little above, savages high above, the pollutions of a civilised society. In 1725 and 1726 Allan Ramsay's *Gentle Shepherd*, Thomson's *Winter*, and Dyer's *Grongar Hill* sent a healthy breath into our literature, the first sign of a renewed sense of the beauty of outward nature. Thomson completed his *Seasons* in 1730, showing, with distinct reference to the scepticism of the time, in the world that surrounds us, God, 'parent of good.' Pope sought in his *Essay on Man*, in 1732–38, to reason against those who believed that man and nature replied 'No' to the question, 'Is there a just God?' Butler's *Analogy* was published in 1736—an effort of sheer reasoning against the same creed of despair.

The same controlling force was upon all forms of life. It touched alike the pulpit and the stage. Garrick's triumph as an actor was a triumph of natural over conventional expression. 'If this

young fellow is right, we are all in the wrong,' said the old actor Quin. Even as late as 1768 and 1772, when Goldsmith's comedies, the *Good-natured Man* and *She Stoops to Conquer*, were produced, conventional notions of dignity and traditions of false sentiment caused alarm in the breasts of managers. Sheridan's *Rivals* in 1775, and *School for Scandal* in 1777, continued the emancipation of good wit from trammels of an artificial style. Collins's poems, first collected in 1765, and Gray's in 1768, foreshadowed, with exquisite art, something of the new in the forms of the old.

Good Samuel Richardson was with his time more fully than he knew when in his first novel, *Pamela*, in 1740, he asked his readers to care for the sorrows of a maid-servant. Henry Fielding in his novels painted life full of the spirit of the coming change. Byron afterwards described him as 'the prose Homer of human nature.' Fielding's *Tom Jones*, published in 1749, is a great landmark on the way from the English Revolution of 1688 to the French Revolution of 1789. Nature reasserts herself in the fresh liveliness of Smollett's novels, the last of them published in the year of his death, 1771. Fanny Burney's *Evelina* and *Cecilia* followed in 1778 and 1782; without breaking from the conventional, long-worded style, they were unconventional in substance. There was quick, fresh observation, with a grace of wit in their invention and character-painting. They were followed at the beginning of the 19th century by the works of Maria Edgeworth and Jane Austen.

Samuel Johnson died in 1784, after forty-seven years of life in London. In 1738, after his first year's struggle with poverty as a Grub Street author, he had published his *London*, a paraphrase of Juvenal's third satire. He won his way as a man of letters, never rich, but always firm to his own sense of right, delighting in the society of men, strong in wit combats, deeply religious. By his character he first gave its right dignity to the position of the professional man of letters. His toast to the next insurrection of the blacks, and his interest in the negro Francis Barber, whom he took as a servant, educated and treated as a friend, in visible protest against the valuing of man by the colour of his skin, may stand among many evidences of Johnson's part in the new sense of the fellowship of man. His *Rambler*, in 1750–52, following the *Spectator* in its aim, reduced to system the critical theory of the time, that sought for dignity on the Latin side of English. But Johnson lived with his time and led his time, and the style of his *Lives of the Poets*, written in 1779–81, is not that of the *Rambler*. When in 1764, Goldsmith in his *Traveller*, which, according to its second title, was a 'Prospect of Society,' expressed the spirit of the time in mournful review of the nations of Europe, it was his friend Johnson who added those last lines that spoke the language of the 19th century, by showing that the solution of the great problems of life lies for each man within himself. Goldsmith's *Deserted Village*, in 1770, expanded a passage in the *Traveller* into a picture of depopulation caused by greed of wealth, and yet more strongly expressed the new sense of social inequalities. It also combined a charm of simplicity with what was really dignified and graceful in the old style that was giving way before impatience of formalism. The *Vicar of Wakefield*, in 1766, in substance and in manner a poet's novel, expressed even more completely the advance of time. The transition from rhetorical forms to a style founded directly upon nature is well marked in Goldsmith and in Cowper. They are on the way to Wordsworth. A strong spirit of freedom was in them. In her old age, the daughter of his friend Lord Clare described Goldsmith, whom she had known in her youth, as 'a strong republican in principle, who would have been a very dangerous writer if he had lived to the times of the French Revolution.'

In other forms of literature there was a corresponding movement. David Hume, whose philosophy raised honest questions which put more clearly and forcibly the doubts that startled a faith based only upon traditional opinion, completed his *History of England* in 1761. Begun as a history of the Stuart times before the English Revolution, it became the first work in which the whole course of English history was told with an intellectual sense of sequence in the affairs of men. The first volume of Edward Gibbon's *Decline and Fall of the Roman Empire* appeared in 1776, the year of the death of David Hume. The last volume was published in 1788, the year before the fall of the Bastille. The book was suggested by the sight of Rome in ruin. Its design was, in days when modern states seemed tottering, to draw from Rome a study of the causes of decay. The scepticism of the 18th century was in Gibbon the more strongly marked by an elaborated pomp of words that contrasts with the philosophic calm and simplicity of David Hume. The year of the first volume of Gibbon's great work was the year also of the publication of Adam Smith's *Wealth of Nations*, crown to an arch formed by a series of studies on the nature of society and on the grounds of its well-being, that had its spring in the days of Charles II. from Sir William Petty, and passed through Locke's second *Essay on Civil Government* to Adam Smith. The first volume of Blackstone's *Commentaries on the Laws of England* appeared in 1764, and Jeremy Bentham began his career as a political economist with *A Fragment on Government, being a critique on Blackstone's Commentaries*, published in the same year as the *Wealth of Nations* (1776), the year in which Malthus was born. Thenceforward the study was continuous, though the social system it contemplated was just about to be transformed.

The year of the publication of the *Wealth of Nations* was the year also of the Declaration of Independence on the 4th of July by the English American colonies, which on the following 9th of September were first termed by Congress the United States. When the political action of this country made such an issue likely, the eloquence of Burke was spent in the endeavour to avert the revolution. The colonists would not bear taxation for imperial purposes without representation. The English government maintained the right to tax. 'Assert the right,' said Burke, 'but do not use it.' That was, in brief, the policy of the Rockingham administration which Burke inspired, and in association with which he began to devote his mind to the great questions that touched the destiny of nations. The American Declaration of Independence gave to the world another England in the New World as an independent civilising power. It was one result in the long process of evolution that has quickened the development of the whole race of man. If Burke, who seemed to be a friend to the Americans, was a bitter opponent of the French, it was because his Conservative mind, Liberal in its tendencies, sought to avert in one case the revolution that he dreaded, and sought in the other case to suppress a revolution that had broken out, and might possibly involve a struggle to secure great change by violence in his own country.

The thin volume published at Kilmarnock in 1786 revealed to the world in Robert Burns a lyrical poet and satirist of the first order, who found time later, amid the troubles of a short and stormy life, to fashion from his heart such love-songs as the world had never heard. William Cowper in his *Task* (published in 1784) said of the

towers of the Bastille that there was not an English heart that would not leap to hear that they were fallen. When they fell hearts of young poets in England did leap. William Wordsworth —then a youth of nineteen—conceived the high ideal that was sought by many who set loose the passions of the ignorant, and hoped within the lifetime of a generation to lift to its full height the race of man. He found his way to France, even took some part in the work of revolution; grieved over its failure, because his young spirit had seen heaven where Edmund Burke saw hell: the younger and the older man being alike sincere, alike inevitably drawn by bias of their minds to their appointed sides in the great controversy. The failure of the revolution did not fill Wordsworth with despair. While still cherishing his aspiration towards what Tennyson afterwards called a 'crowning race of man,' he came to feel that the way to such a race was long, since no state could be better than the citizens of which it is composed. But with unbroken hope he set himself to teach through verse the strength that grows out of the simple lives of men.

Thomas Campbell's *Pleasures of Hope*, in the last year but one of the 18th century, was a testament of hope left by the 18th century to the 19th. Wordsworth's *Excursion* in 1814, the year before Waterloo, was a poetical foreshadowing of the work of individual development into which the 19th century should grow. In its own time it was little understood. The tumult of the revolutionary spirit was in Byron; its pure ideal was in Shelley; its practical outcome was in Wordsworth; and a breath of health passed wherever Walter Scott's novels were read. Open expression of the reaction against Latin-English and the diction encouraged by the period of French influence was in Wordsworth's defence by preface and appendix of the style of the *Lyrical Ballads*, first published in 1798. He argued, and he acted upon his belief, that there is no separate book language; that the best thoughts are best expressed in a selection of the words in ordinary use. Again and again he laid stress on the word 'selection.' He was misapprehended, and gave some little cause for misapprehension by a defiant use in his poems of words and phrases which his better judgment, when the critical war was over and his cause had triumphed, led him afterwards to alter.

The impulse out of which Scott's poetry and Scott's novels grew it is usual to term Romanticism, as its most essential element was a revolt from the severity of classical form alike in choice and treatment of subjects for poetic expression. It was a revolt towards a more emotional and fearless expression of the relations of the human soul to the mystery and romance of the world around it. The vivid directness and imaginative power of Percy's *Ballads* (1765) gave a rude shock to the dull didactics of the 18th century, and the imitative work of the young Chatterton also revealed what influence our earlier poetry could effect upon a capable imagination. Cowper and Burns revealed the capacity for poetic expression of simple, natural language, and the earliest creations of Blake's strange spiritual genius foreshadowed a romantic revival in literature and art, which was to give us in the poetry of Coleridge, Shelley, Keats, and Rossetti almost the greatest poetic triumphs of the next century. Scott's romance was a direct issue of romanticism, and a host of imitators, under the mighty spell of the same impulses that made our greatest novelist, carried reverence for the past to strange ends in literature, art, and even religion. Charles Lamb turned 17th-century models to the best use, and disclosed the riches of the earlier drama. Not the least gain has been that revival of interest in English literature and language, which has revolutionised the modern study of our tongue and created anew an audience for Chaucer, for the lesser Elizabethans, and even, as time went on, for *Gawain and the Green Knight*, for *The Owl and the Nightingale*, and for Cynewulf. Englishmen have awoke to the fact that they possess a native literature infinitely richer in quality and larger in quantity than any people in the world.

The past was studied and the future battled for with independent energy. Above all things truth must be found. History stood more and more pledged to an accurate inquiry into the trustworthiness of all its facts. Every statement must be traced to its original authority; that ascertained, let each man reason on it as he would. Greek history was restudied by Grote and Thirlwall; Roman, by Merivale; the history of the Jews and of Latin Christianity by Milman; the history of England by Macaulay, Freeman, Stubbs, Froude, Brewer, Gardiner, Green. Buckle and Leckie studied history and theorised upon it. The *Edinburgh Review* (1802) and the *Quarterly* (1809) inaugurated a new era of criticism. Science made wonderful advance both in knowledge and in its application, as Francis Bacon would have it applied, to enlargement of the dominion of man. It not only abounded in results of accurate research, but developed a large power of generalisation founded upon patient experiment, by which especially Charles Darwin influenced 19th-century thought.

In church questions there was the same advance of fearlessness in the inquiry after truth, and the same strenuous endeavour to make truth bear fruit within the lives of men. Every tendency of religious thought had its faithful representative in Whately, Keble, Pusey, Newman, Dr Arnold, Maurice, Dean Stanley, Canon Liddon, Dr Martineau, and many more. The periodical press opened a free plain for ready encounter of all forms of thought in honest grapple with each other. George Henry Lewes in 1865 established the *Fortnightly Review* for the free conflict of opposite opinions within the lists of a single journal. This good example was followed promptly, in 1866, by the establishment of the *Contemporary Review*; and the *Nineteenth Century* appeared in 1877. With the increase of reading power, the novel of the 19th century took the place occupied in the 16th by the drama. Women among the novelists came to the front in literature as earnest helpers to a better day, and novels came to be used for study of the deepest problems of the time. Mrs Somerville in science, Mrs Browning in poetry, the Brontës and George Eliot in fiction, marked the advance from days when, with few exceptions, only men took part in the mind-labour of successive generations. The civilising power of the highest literature was diffused by the energies of vigorous and earnest men, William and Robert Chambers, Charles Knight, and others. Side by side with the free literature of England, a sister literature has grown in America which adds its forces to our own. The volume of the mighty stream of English literature has increased into an expanse that can be shown here by no more than a vague suggestion of its breadth and the direction of its flow. Our last great period in English literature is marked especially by the variety of forms in which all writers who obtained a large hearing dwell on individual fidelity to duty, in a life that is sincere and simple, as the one way to the highest possible for man. It was so in all the writings of Thomas Carlyle, of Dickens, of Thackeray, of George Eliot, of Matthew Arnold, and of Robert Louis Stevenson. It was so in Alfred Tennyson, whose *Idylls of the King* figure King Arthur throughout as Conscience, the king within the human breast. It was so in all

the writings of Robert Browning, who warns by many forms of dramatic expression against the vague ideal: and who represents the poet in his highest utterances, as he is throughout all literature, the voice of the worker when he feels most deeply the meaning of his work.

Tennyson's death left English literature in a headless state. But new forces were at work among the survivors—Meredith and Swinburne, Hardy and Bridges—and amidst the uncomfortable artificiality of the *fin de siècle* time new prophets were arising who became dominant a little later. Technique was studied. French, Russian, Irish, and Norwegian influences were felt in novel, short story, poetry, and drama. The war of science and religion drew towards its close. Evolution in its triumph was transformed. Through Butler and Nietzsche and Bergson the individual was related anew to the race and to the activity of the universe. Psychologists explored the hidden regions of his mind. Instincts became better known, less feared, and more respected. Man, like the universe, was found to be less simple that the old orthodoxies had chosen to think. Meanwhile, the humanitarian movement was ripening in democracy and social conscience. The consequences in literature of these changes in the spirit of the time are manifold.

American literature is dealt with under UNITED STATES, and there are paragraphs under AUSTRALIA and CANADA on the literature of those great British dominions. Scottish literature is treated at SCOTLAND. There are separate articles on BIOGRAPHY, the DRAMA, LETTERS, NOVELS, NEWSPAPERS, PERIODICALS, POETRY, ROMANTICISM; and the subject of English literature may be further studied in the articles devoted to the several authors named above, and to many others whom in such a sketch it is impossible to include.

See Thomas Warton's *History of English Poetry* (1774–78; new ed. 4 vols. 1872); J. Payne Collier's *History of Dramatic Poetry* (3 vols. 1831; revised and enlarged, 1879); Henry Hallam's *Introduction to the Literature of Europe in the Fifteenth, Sixteenth, and Seventeenth Centuries* (4 vols. 1837–39); Thomas Wright's *Biographia Britannica Literaria* (vol. i. Anglo-Saxon Period, 1842; vol. ii. Anglo-Norman Period, 1849); George Lillie Craik's *Sketches of the History of Literature and Learning in England* (1844–45), expanded in 1861 into a *Compendious History of English Literature and the English Language*; S. A. Allibone's *Dictionary of English and American Literature* (3 vols. Phila. 1859–71); Thomas Arnold's *Manual of English Literature* (1862); Hippolyte Taine's *Histoire de la Littérature Anglaise* (4 vols. 1863–64; translated by H. van Laun, 1871); William Minto's *Manual of English Prose Literature* (1872); A. W. Ward's *History of English Dramatic Literature to the Death of Queen Anne* (2 vols. 1875); Henry Morley's *First Sketch of English Literature* (1873; enlarged in 1886), and *English Writers* (10 vols. 1887–94); Stopford Brooke's *Primer of English Literature* (1880); Richard Wülcker's *Grundriss zur Geschichte der angelsächsischen Litteratur* (1885); Bernhard ten Brink's *Geschichte der englischen Litteratur* (1877–88; trans. 1883–94); Bierbaum's manual of English literature (1883); Schofield, *English Literature from the Norman Conquest to Chaucer* (1906); *The Cambridge History of English Literature*, edited by Ward and Waller (1907 *et seq.*); Perry's *English Literature in the 18th Century* (New York, 1883); Hettner's *Englische Litteratur* (6th ed. 1894); Körting's *Geschichte der englischen Litteratur* (1887); Scherer's *Essays on English Literature* (trans. 1892); Leslie Stephen's *Hours in a Library* (1874; new ed. 1892); Stopford Brooke's *History of Early English Literature to the Accession of King Alfred* (2 vols. 1892); George Saintsbury's *Elizabethan Literature* (1888), *Specimens of English Prose* (1885), *Seventeenth-century Lyrics* (1892), *Essays in English Literature* (1891), and *Nineteenth-century Literature* (1896); Gosse's *From Shakespeare to Pope* (1885), *Literature of the Eighteenth Century* (1889), and *Jacobean Poets* (1894); Henry Morley's *Library of English Literature* (5 vols. 1876–82); Chambers's *Cyclopædia of English Literature* (2 vols. 1842; new ed. 3 vols. 1901–3); Ward's *English Poets* (vols. i. to iv. 1880; vol. v. 1918); Craik's *English Prose Selections* (4 vols. 1892–94); Courthope's *History of English Poetry* (1895–1910); Garnett and Gosse, *English Literature: an Illustrated Record* (4 vols. 1903–4); the 'Handbooks of English Literature,' edited by Hales, and including *The Age of Pope* by Dennis (1894), *The Age of Dryden* by Garnett (1896), and *The Age of Wordsworth* by Herford (1897); Jusserand's *The English Novel in the Time of Shakespeare* (trans. 1888), and *Literary History of the English People* (trans. 1895, *et seq.*).

English River, (1) an estuary on the west side of Delagoa Bay; (2) another name for the Churchill River (q.v.).

Englishry. With the Norman conquerors of England, 'Englishry,' like 'Jewry,' was a term of contempt. In cases of murder, the hundred was punished, unless it could make a 'presentment of Englishry,' showing that the person slain belonged to the conquered race; and this invidious race-privilege was not abolished till the reign of Edward III.

Engrailed, a line composed of semi-circular indents. See HERALDRY.

Engraving, in the strictest sense of the word, is the art of scratching or incising marks or figures upon tablets of any hard substance. Certain forms of the art—such as decorative engraving for purely ornamental purposes upon metal, engraved writing upon tablets for the purpose of record, gem-engraving for the production of signets, cameo-engraving, &c.—are of extreme antiquity. But, in its more especial and restricted sense, the word engraving is understood to designate the cutting or incising of designs upon metal plates or blocks of wood, for the purpose of printing impressions from them in ink upon paper, or other similar substance. Engravings of this sort are divided into the two broad classes of engravings on metal, in which the lines to be printed are sunk or incised, and engravings on wood, in which the lines to be printed appear in relief, the wood between them being cut away. In the former the plate, having been inked and wiped on the surface, retains the ink only in its hollowed lines, from which it is conveyed to the paper by the pressure of the printing-press; whereas in the latter only the elevated portion of the surface of the block is inked by means of a roller, and being subjected to the press, it prints as a raised type. [WOOD-ENGRAVING is fully described under its specific heading; here we deal only with *Engraving upon Metal.*]

The metal most commonly used for engraving has been copper; but during the 19th century steel came to be largely employed on account of its hardness, which enables it to resist the wear of printing, and to throw off a far larger number of unimpaired impressions than could possibly be obtained from a copper plate. Steel, however, is less readily engraved upon than copper, and so is apt to yield a less free and artistic result; and, by means of a modern discovery, the surfaces of copper plates can now be protected by an extremely thin coating of steel deposited by galvanic action, which enables them to yield a large number of excellent impressions without being worn. Zinc plates have also been employed to some extent for etchings, especially by Seymour Haden, a very eminent 'painter-etcher,' who liked the 'fat,' picturesque, and varied line which this metal yields when bitten by the acid.

The earliest of the impressions taken from engraved plates are those most valued by connoisseurs, on account of their sharpness, clearness, and richness, qualities which are gradually lost as the surface of the metal becomes worn by repeated printing. The term 'working proofs' indicates trial impressions printed by engravers for their own use, to test the state of their work during its progress. 'Artist's proofs' are those bearing the signature of the painter or engraver, or of both,

which is held to guarantee the quality of the impression. 'Remark proofs' have a small design etched in the margin of the plates. 'Proofs before letters' are those thrown off before the printed titling, &c. has been added; and 'open letter proofs' are those in which the letters of the title are in outline.

THE PROCESSES OF ENGRAVING ON METAL.

Line-engraving.—The chief instrument of the line-engraver is the burin or graver, a small bar of steel, usually in the form of a quadrangular prism, pointed at one end, and with the other fixed in a rounded wooden handle. This instrument is held between the engraver's forefinger and thumb, which direct the motion of the point as it is pushed forward by the pressure of the palm of the hand on the wooden handle, and incises, upon the plate of polished metal placed beneath it, a line proportionate in breadth and depth to the amount of pressure used and the angle at which the point is applied, the metal being lifted clean out of the furrow in a long strip or shaving. In this manner the design is inscribed upon the plate: and, in printing, the plate is inked, its smooth surface is then wiped clean, so as to leave the ink remaining only in the incised lines, from which it is removed to paper by being passed through the printing-press.

Etching.—In this process a polished metal plate is coated with a thin transparent surface or 'ground' impervious to the action of acid. For this purpose a composition of white wax, gum-mastic, and asphaltum is usually employed, inclosed in a ball of silk. When this ball is applied to the heated surface of the plate, the ground melts and exudes through the cloth, and is spread evenly over the metal by means of a pad of cotton-wool covered with silk, termed a 'dabber.' The plate is then exposed to the smoke of wax tapers till it becomes of a uniform black colour, which enables the etched line, disclosing the shining metal, to be visible on its surface. Upon this plate, so prepared, the design is drawn with an 'etching-needle,' a sharp steel point fitted in a handle, and held like a pencil in the artist's hand. This needle removes the impervious ground where it is applied, disclosing lines of the bare metal, which are ready to be acted upon by the acid. The back of the plate having been protected by an application of Brunswick black, it is placed in the 'acid-bath,' a flat tray filled with a mordant, usually composed of nitric acid diluted with an equal volume of water, which attacks and corrodes the metal in the lines that have been exposed to its action by the needle. After sufficient time has been allowed for the palest lines of the subject to be bitten, the plate is removed from the bath; these lines are covered with a 'stopping-out varnish' of Brunswick-black, applied with a brush, which protects them from further action of the acid; and the plate is returned to the bath, which attacks the lines still exposed. This process is repeated as often as necessary to produce the desired variety in depth of the various lines of the design. When the biting is completed, the plate is finally removed from the bath, the 'ground' is cleaned off by means of turpentine, and the design appears incised on the metal. The plate is then inked and printed in a manner similar to that employed in a plate engraved with the burin, those lines which have been longest exposed to the acid printing darkest, as they are the deepest and retain most ink. Much also can be done towards obtaining an artistic result by leaving a small coating of the ink on certain parts of the smooth surface of the plate, this film of ink printing as a delicate tint. If it should be found that the lines are too shallow, the plate may be regrounded by means of a roller charged with the 'ground' being passed over the plate. This coats the level surface with the impervious 'ground,' but leaves the incised lines free, so that they may be again subjected to the action of the acid in the bath.

During modern times various new methods of etching, and modifications of the process described above, have been introduced. These will be found clearly and fully described in P. G. Hamerton's *Etcher's Handbook*. In particular, a process for drawing the subject while the plate is exposed to the acid was invented and much employed by Seymour Haden. He prepared the metal plate as above, and placed it in a shallow bath filled with a mordant composed of hydrochloric acid, chlorate of potash, and water. The subject is then drawn with the needle, the lines intended to be darkest being those first laid, so as to be longest exposed to the action of the acid.

It should be noticed that, while the early line-engravers worked with the burin alone, etching is combined with burin-work in most modern line-engravings; the subject being usually sketched with the etching-needle and bitten with acid, and the freer portions of foliage, &c. being also executed in a similar manner. 'Dry-point' is frequently employed in finishing the more delicate portions of line-engravings. The dry-point is an etching-needle sharpened in a particular way, and employed to scratch lines upon the bare metal. Unlike the burin, it does not cut a clean furrow out of the plate, but throws up the metal that it displaces in a ridge or 'bur,' which in printing yields a rich velvety blackness. When employed as an adjunct to line-engraving, this 'bur' is removed with the 'scraper;' and so treated, dry-point yields an extremely delicate line, very useful in finishing line-engravings and etchings. A 'ruling-machine' is also employed in producing the parallel lines representing flat skies in line-engravings.

Soft-ground Etching.—The metal plate is coated with ordinary etching-ground mixed with tallow, and a sheet of thin paper, with a certain degree of grain or texture in it, is stretched over the plate. The design is then drawn upon the upper surface of this paper with a hard black-lead pencil. On the paper being removed, it carries off adhering to its lower surface a portion of the etching-ground where pressure has been applied by the pencil-lines, exposing the metal of the plate, which is then bitten with acid, cleaned, and printed from, in the same manner as an ordinary etching. The impressions yielded by this process resemble a pencil-drawing or a lithograph.

Mezzotint-engraving.—This method differs from all other processes of metal engraving in that, while other engravers work from light to shade, and each line which they draw prints as a dark, the mezzotinter works from dark to light, and each touch which he adds to his plate prints as a light. Mezzotint-plates are prepared by the action of a kind of chisel, termed a 'cradle' or 'rocking-tool,' which passing over its surface roughens it, raising a 'bur' of innumerable small metal points, so that if the plate were then inked and printed it would yield an impression of a uniform black. The engraver, having traced his subject on the plate, proceeds to smooth the surface by removing the 'bur' with a scraper, in proportion as he wishes to introduce light into his design; the bur being left untouched in the darkest shadows, partially removed in the half-lights, and wholly cleaned away in the high lights, in which the surface is perfectly smoothed, and brought to a high polish by means of the 'burnisher.' In modern mezzotint-plates, etching and work in stipple are frequently introduced, in a mistaken effort to obviate that

softness and indefiniteness which is a characteristic of this method.

Aquatint-engraving.—In this process the polished metal plate is covered with a solution of resinous gum dissolved in spirits of wine. The spirit evaporates, leaving the resin deposited in minute granulations on the metal surface. The design is then transferred to the metal, and the plate is bitten in a bath of diluted nitric acid, which corrodes the portions left exposed between the grains of resin. The darkest parts of the design are longest exposed to the action of the mordant, the lighter parts being successively protected by a series of 'stoppings-out,' consisting of oxide of bismuth and turpentine varnish applied with a brush in a manner similar to that employed in the 'stopping-out' of an ordinary etching. The impressions produced resemble those yielded by mezzotint, both processes working by *spaces* and not by *lines*.

Chalk or Stipple Engraving.—The metal plate is coated with an ordinary etching-ground, and the subject is drawn upon it by means of a succession of small dots produced by the point of the etching-needle. The plate is then bitten in the usual way with acid, which corrodes the metal at the points uncovered by the needle; and it is afterwards finished by dots, applied with the point of the etching-needle or burin on the bare metal.

Mechanical and Photographic Process.—Engraving in recent times has suffered much from the rivalry of photographic and mechanical substitutes. The most important of these is known as photogravure or heliogravure. The beauty of the work produced by means of this process, in the reproduction of paintings, of drawings in monochrome made for the purpose, and of photographs direct from nature, has raised it to a position in which it bids fair, at no very distant date, to supersede engraving altogether; except in so far as the burin is used to touch up and finish the plates so produced. The processes employed will be described under PHOTOGRAVURE.

A photo-mechanical process which is much used in the reproduction of the plates of the older engravers and etchers, and in the production of intaglio etched plates from pen drawings, has been carried to great perfection, some of the work produced by Amand-Durand of Paris being quite equal to the finest hand etchings. A *positive* photograph is taken of the drawing or engraving to be reproduced (i.e. the lines are black, the whites clear glass); this is placed over a copper plate coated with a bituminous varnish, and exposed to the light. Where the lines of the photograph have protected the varnish from the light it remains soluble, but where the light has affected it through the glass it becomes insoluble. The varnish may then be dissolved from the lines, and the copper exposed exactly as if the etching-point had been used to make the drawing on an etching-ground. It is then etched in the usual manner, as already described, and finally touched up and improved with the graver.

There are many other mechanical and photographic processes of engraving, especially for the production of relief blocks, but their connection with engraving is remote. Such of them as are not well enough known by their distinctive names will be dealt with under ILLUSTRATION.

HISTORY OF ENGRAVING ON METAL.

Line-engraving.—The practice of engraving metal plates, for the purpose of printing impressions from them with ink upon paper, originated with the German and Italian goldsmiths about the middle of the 15th century. The goldsmiths were accustomed to take proofs of the metal objects which they decorated with engraved designs, in order to test the progress of their work; and these *nielli* (see NIELLO), or decorated plates of metal, in which the hollows were finally to be filled in with a black enamel, supplied the necessary hint as to the possibility of printing from engraved surfaces. The long-credited assertion of Vasari that the art of printing from engraved plates was invented and put into practice by Tommaso Finiguerra, a Florentine goldsmith in 1460, is not in accordance with ascertained fact. It is impossible to fix either date or discoverer of the printing process with any such precision. Finiguerra was, however, a most important pioneer in the budding art, and the *niello pax* he executed for the church of San Giovanni in Florence, now preserved in the Uffizi Gallery, and the unique impression from it in the Bibliothèque Nationale, Paris, will ever remain the most precious memorials of engraving.

Among the very earliest Italian prints are a series of ten engravings, known as the larger Vienna Passion, unique examples of which are in the Albertina Collection in Vienna, and the *Monte Santo de Dio* (1477) printed book in which engravings were used. These are the work of Antonio Bettini. The celebrated edition of Dante, with illustrations by Botticelli, follows in 1481. These are said to be engraved by Baldini, a somewhat obscure ascription. Among other early Italian line-engravers were Antonio del Pollajuolo (1429–98), who executed a few very scarce prints, showing that command of the figure for which he was celebrated as a painter; Robetta (*c.* 1510), whose works are excellent in design, though poor in *technique;* and Andrea Mantegna (1431–1506), whose productions are distinguished by an impressive gravity and by a dignified classical feeling. Most of these engravers were themselves painters, and engraved from their own designs; but in Marc Antonio Raimondi (*c.* 1488–*c.* 1530) we have an engraver in the modern sense, engaged in reproducing the works of other artists. He is mainly known by his noble transcripts of the works of Raphael, in which he was aided by the master himself, who sometimes corrected his outlines upon the copper. Among the modern line-engravers of Italy may be named John Volpato (1730–1803), known chiefly by his 'School of Athens' and other plates after Raphael; Raphael Morghen (1758–1833), whose most famous plate reproduces Leonardo's 'Last Supper,' though a finer work is his rendering of Van Dyck's portrait of Francesco de Moncada; Paul Toschi (1788–1854), celebrated for his transcripts of the frescoes by Correggio at Parma; and Louis Calamatta (1802–69), who worked much after Ingres.

Among the productions of the North we find an example of line-engraving upon metal earlier in date than any afforded by the schools of Italy. This is a 'Flagellation,' forming part of a Passional series, dated 1446, a work attributed to an engraver of Upper Germany. Among the other early German engravers are 'The Master of 1464 or of the Banderoles' and 'The Master of 1466 or of the Initials E. S.' But it is in Martin Schongauer (*c.* 1420–*c.* 1488) that we find the first really able and accomplished master of the German school. His admirable works—very quaint, and full of the richest decorative feeling—are extremely scarce, but they may be studied in the excellent fac-similes executed by M. Amand-Durand of Paris. Along with Schongauer may also be named Israel von Meckenen (*c.* 1480–1503), another prolific and excellent engraver. In Albert Dürer (1471–1528), however, we have the great master of the German school, alike in the admirably accomplished *technique* of his plates, in their nobility of design, power of draughtsmanship, and expressional qualities. Not far beneath him must be ranked Lucas van

Leyden (1494–1533), a productive and talented workman with the burin, though he was inspired by a less lofty and profound imagination, and dealt with homelier subjects than his great contemporary. At the early age of fourteen he had already produced several very accomplished plates, and he worked unceasingly, both as painter and engraver, till his death at the age of forty. Under the influence of Dürer, there sprang up a school of engravers working after their own designs. These men, distinguished by a dexterous use of the burin, and by very considerable invention and decorative skill, are known, from the small size of their plates, as 'The Little Masters.' They include Albert Altdorfer (*c.* 1488–1538), Jacob Binck (*c.* 1490–1569), Hans Sebald Beham (1500–50), Bartel Beham (1502–40), Heinrich Aldegrever (1502–*c.* 1555), Georg Pencz (*c.* 1500–50), and Hans Brosamer (*c.* 1485–1552). In the end of the 16th century a notable school of line-engravers arose in Holland, among the members of which Henry Goltzius (1558–1617) produced portrait-engravings of extreme delicacy and finish, and Henry Hondius (*c.* 1573–*c.* 1662) is also favourably known for plates of a similar class; while Schelte Bolswert (born *c.* 1586), Paul Pontius (*c.* 1596), Lucas Vosterman (*c.* 1580), Peter de Jode (1606–60), and others were members of a school which owed its rise to the influence of Rubens. Among the more modern German line-engravers are Johann Georg Wille (1715–1807), Georg Friedrich Schmidt (1712–75), and Johann Christian Friedrich Wilhelm Müller (1783–1816), known by his fine rendering of the 'Madonna di San Sisto;' all of whom worked for a time in France.

In France some of the earliest line-engravings are the illustrations to a book by Breydenbach, published at Lyons in 1488, and reproducing woodcut views published at Mainz two years previously. Noël Garnier (working up till 1540) is known by his copies from the German engravers; but in Jean Duvet (1485–1561) France first possessed an engraver of real ability. Considerably influenced by Mantegna, he produced his 'Martyrdom of St Sebastian,' and his series of 'The Apocalypse' and of 'The Amours of Henry II.,' works of considerable inventive power. He was followed by Claude Corneille (*c.* 1550), Jean de Gourmont (*c.* 1550), Jean Cousin (1501–*c.* 1589), Pierre Woeiriot (1532), and Etienne Delaune (1519–83), an able engraver who worked after Cousin, and is also known by his graceful hunting subjects and by his series of 'The Sciences' and the 'Twelve Months.' From such men we pass to the school of Fontainebleau, formed by Rosso and Primaticcio, of which, among the engravers, the most celebrated are Antonio Fantuzzi de Trento (1508–*c.* 1550), Léonard Tiry (working 1540–65), René Boyvin (1530–*c.* 1598); and Guido Ruggieri (working about 1570), Thomas de Leu (*c.* 1560–1612), and Léonard Gaultier (*c.* 1552–1641) may be named as good engravers of portraits, leading the way to the great school of French portrait-engravers in line of the 17th century, who carried the art to the utmost conceivable perfection of which their aims and method admitted. Among these are Claude Mellan (1598–1688); Robert Nanteuil (*c.* 1623–78), one of the most spirited and manly engravers of that or of any time; Jean Morin (*c.* 1600–*c.* 1666); Gérard Edelinck (*c.* 1640–1707), a native of Antwerp, summoned to France by Colbert; Gérard Andran (1640–1703), the most able draughtsman of the school, who largely employed etching in combination with his burin-work; and Antoine Masson (1636–1700). The line-engravers of this period are seen at their highest in their portrait-subjects, which are delightfully spirited and intelligent in handling, and—being frequently, as was usually the case with Nanteuil's work, done *ad vivum*, or from the engraver's own drawing made from the life—possess the highest interest and authenticity as direct and original portraits. Following these men come a group of portrait-engravers who were more exclusively employed in rendering the works of painters, and whose work, absolutely skilful and accomplished as it was, rendering details and reproducing textures with unexampled exactitude and variety of touch, was yet somewhat less manly, direct, and simple than that of their predecessors. Among these were Pierre Drevet the Elder (1663–1738); Pierre Drevet the Younger (1697–1739), from whom we have a superb portrait of Bossuet, after Rigaud; and Jean Daullé (1703–63). To Wille, Schmidt, and Müller we have already referred as engravers of German nationality working in France. Laurent Cars (1702–71), Nicolas de Larmessin (1684–1756), Bernard Lépicié (1699–1755), and Pierre-Louis Surugne (1717–71) produced admirably faithful transcripts from the figure-pictures of Watteau, Chardin, and other contemporary painters. Charles-Nicolas Cochin (1715–88), in addition to similar work, executed a series of valuable medallion portraits of most celebrated men of the time; and Jacques-Philippe Lebas (1707–83), Claude-Augustin Duflos (1701–84), Pierre-Philippe Choffard (*c.* 1729–1809), and Augustin de Saint-Aubin (1736–1807) transcribed with vivacity the vignette book-illustrations of Gravelot and Eisen. In more recent times Louis Copia (1764–99) and Barthélemy Roger (1770–1840) ably engraved the works of Prud'hon; Charles-Clement Bervic (1756–1822) was an accomplished pupil of Wille, influenced by the classical revival inaugurated by David; after whose works Pierre-Alexandre Tardieu (1756–1844), another pupil of Wille's, engraved much, though his most important plate is 'The Earl of Arundel,' after Vandyck. Auguste Boucher-Desnoyers (1779–1857) produced many thoroughly accomplished plates, chiefly after Raphael; Achille-Louis Martinet (1806–77) and Ferdinand Gaillard (1834–87) are to be regarded as the leading engravers of their time.

Among the earliest line-engravings published in England are the copperplates in 'The Birth of Mankind' (1540), and in a translation of Vesalius's *Anatomy* (1545), the illustrations of the latter having been copied from the original woodcuts by Thomas Geminus, who was also the translator; but William Rogers (*c.* 1545) is usually regarded as the first English line-engraver of mark. He is best known by his full-length of Queen Elizabeth, after Oliver. Several members of the De Passe family settled in England in the middle of the 17th century; and Renold Elstracke (*c.* 1620) and Francis Delarm (1590) were the chief engravers of the scarce and interesting historic portraits in Holland's *Basilikologia* (1618). A more important name is that of William Faithorne the Elder (1616–91)—a pupil, while in France, of Nanteuil's—among whose works is a portrait of Milton, '*ad vivum delin. et sculpsit, 1670.*' His plates lead us to those of William Hogarth (1697–1764), whose burin engraved, in a sound, honest, and straightforward fashion, many of the figure-subjects executed by his brush.

Next comes a group of far more accomplished engravers, who worked in a classic and finished, if somewhat formal manner. Among these are Sir Robert Strange (1721–92), known mainly by his transcripts from the Italian masters; William Woollett (1735–85), seen at his best when reproducing the landscapes of Claude and Richard Wilson; and William Sharp (1749–1824): while William Blake (1757–1827), a true and sensitive 'painter-engraver,' won an abiding place in the history of the art by his 'Illustrations of the Book

of Job.' The end of the 18th century and the earlier part of the 19th is distinguished by the achievements of the great school of English landscape-engravers in line founded by William Radclyffe (1780–1855), and including Robert Brandard (1805–62), J. T. Willmore (1800-63), and William Miller (1796–1882), whose admirable artistry translated with the most finished skill the subtlest cloud-effects of Turner. The vignette illustrations to Rogers's *Italy* (1830) and *Poems* (1834) are marvellous examples of the work, on a minute scale, of this school of engravers. Since the period of these men line-engraving has declined in England, the popular demand running more in the direction of etching and of various photographic reproductive processes; but within comparatively recent years we have had such accomplished burinists as G. T. Doo (1800–86), Lumb Stocks (1812–92), and C. H. Jeans (1827–79). In America, which has produced a singularly dexterous school of wood-engravers, and also several talented etchers, comparatively little of artistic worth has been done in line-engraving. Here the process has been chiefly used for book illustration, and for the reproduction of portraiture; and many of its practitioners have been artists of British nationality. For an account of American engravers, see W. S. Baker's *American Engravers and their Works* (Phila. 1875).

Etching.—Albert Dürer (1471–1528), so prolific as a line-engraver and a woodcut-designer, has also the distinction of being the earliest artist who used the process of etching; but the first—and as yet unequalled—master in this department is Rembrandt (1607–69), who, alike in portrait and subject etchings and in his rarer etched landscapes, is the perfect example of what a 'painter-etcher,' an etcher working direct from nature or from his own designs, should be. Much also was done by the pupils and immediate successors of Rembrandt, by such men as Ferdinand Bol (*c.* 1611–81), Philip de Koninck (1619–89); and later Adriaen Janszoon van Ostade (1610–85), Cornelis Pietersz Bega (1620–64), Nicolaas Berchem (1620–83), Paul Potter (1625–54), and Renier Zeeman (born 1612) all executed etchings worthy of preservation and study. By Van Dyck's own hand (1599–1641) is a series of masterly etchings from his portraits, plates which were afterwards completed by the burins of professional engravers. Daniel Nicolaus Chodowiecki (1726–1801), a most prolific etcher, born at Danzig, and working in Berlin, is known by his admirably spirited and graceful book-illustrations. Jan Barthold Jongkind and Carel Nicolaas van 's Gravesande produced landscape-etchings in essential sympathy with the work of the early Dutchmen; and Wilhelm Unger is favourably known as an etcher from paintings.

In Claude (1600–82), an Italian working in France, we have an etcher who infused into his work with the needle much of that delicacy and tenderness of tone and atmosphere for which his work with the brush is pre-eminent; and Jacques Callot (1592–1635) was a spirited and prolific etcher of figure-subjects. During the 18th century the sound traditions of etching seem to have been forgotten, and its true capabilities forgone in France and elsewhere; and the revived practice of the art, upon correct lines, dates from about 1840, when painter-etchers like Charles Daubigny (1817–78) and Charles Jacque (1813–94) began to find, in a periodical entitled *L'Artiste*, an outlet for the plates which they had etched for mere love of the process and of its artistic possibilities. The *Gazette des Beaux Arts*, established in 1857, is also intimately associated with the revival of the art in France, as was also M. Cadart, the Paris publisher. Among the more eminent of the modern French etchers may be named Charles Meryon (1821–68), known by his 'views' of Paris, 'views' which are also visions; Maxime Lalanne (1827–86), one of the most graceful masters of the point; Veyrassat; Félix Braquemond (1833–1914), a robust and vigorous etcher; the painter J. F. Millet, and Jules Jacquemart (1837–80), celebrated for his delicate and sensitive renderings of old jewellers' work and other precious objects of still-life, as well as for his transcripts from pictures. Alphonse Legros (1837–1911), naturalised in England, was an etcher of great but sombre power. We have here spoken mainly of the painter-etchers, but etching, of a particularly skilled and dexterous sort, has been largely employed in Paris as a freer, swifter, and less mechanical method than line-engraving for the reproduction of paintings. Among the most skilled of the French reproductive etchers are Leopold Flameng, Paul-Adolphe Rajon (1842–88), Charles Waltner, F. A. Laguillermie, and Le Rat.

In England, the first representative etcher is Wenceslaus Hollar (1607–77), a native of Prague, brought to this country by the Earl of Arundel in 1637. He worked under the constant pressure of extreme poverty, and much that he produced was beneath his best powers; but the finest of his prints are monumental and exemplary as specimens of the art. 'People sometimes say to me, "What is it you see in Hollar?" and I always reply, "Nearly everything,"' writes Seymour Haden. During the years that succeeded Hollar, the true spirit of the process was lost sight of in Britain, as abroad; though the mere processes of the art were kept alive by their use in preparation and subordination to line-engraving, and by the practice of such etchers as Thomas Worlidge (1700–66) in England, and David Deuchar and John Kay (1742–1826) in Scotland. It was Andrew Geddes, A.R.A. (1783–1844), whose example first gave a wholesome and vigorous stimulus to the practice of the art; and, in particular, he produced some most effective work in dry-point. Such of the etchings of David Wilkie, R.A. (1785–1841), as the 'Gentleman at his Desk,' are excellent in aim and spirited in treatment; but both Geddes and Wilkie must be studied in the scarce original states of their plates, not in the much-worn issue of 1875. Turner (1775–1851) used etching with admirable power and unerring selection of line in the plates of his *Liber Studiorum*, where the light and shade was afterwards added by mezzotint, applied usually by the hand of a professional engraver. A considerable stimulus was given to the art in England by the establishment of the Etching Club, which began to publish portfolios in 1841; and still more by the publication, in 1868, of P. G. Hamerton's *Etching and Etchers*, and the establishment of the *Portfolio*, a magazine chiefly devoted to etchings, under his editorship, in 1870. The Etching Club included in its membership such able etchers as Samuel Palmer (1805–81), J. C. Hook, C. W. Cope, and Seymour Haden, an amateur who ranks with James M'N. Whistler at the very head of the painter-etchers working in England. Among the leading practitioners of the art in these days are to be reckoned Sir Frank Short, R.A., and Frank Brangwyn, R.A. A powerful group of Scottish etchers embraces William Strang, A.R.A., D. Y. Cameron, R.S.A., Muirhead Bone, and James M'Bey, all diverse, but all highly original. R. A. Macbeth is known by important transcripts from Frederick Walker and George Mason; while Mortimer Menpes has rendered 'The Banquet of the Officers of the Archers of St Adrian' of Frans Hals in the largest dry-point on record. Among the earlier of the artists who practised etching in America may be named William Dunlap (1766–1839), the historian of American

art; George L. Brown (q.v.), known by his nine 'Etchings of the Campagna, Rome' (1860); and Edwin Forbes, who, about 1876, published a portfolio of forty plates of 'Life Studies of the Great Army.' In 1866 M. Cadart of Paris established a French Etching Club in New York, which did a good deal to foster the art. The *American Art Review*, founded in 1879, during the two years of its existence afforded a means for the publication of etchings. Second only to Rembrandt in mastery of the art is to be placed Whistler, who, cosmopolitan as he was, can be claimed by America. Among the most talented of recent etchers in America may be named Frank Duveneck (1848–1919), who produced some admirable Venetian street-scenes, Otto Bacher, Henry Farrer, Joseph Pennell, Stephen Parrish, Mary Nimmo Moran, Thomas Moran, Charles Platt, and Frank Milton Armington.

Soft-ground Etching.—This process was effectively employed by John Sell Cotman (1782–1842) in his architectural subjects, by Samuel Prout (1784–1852), and by John Ruskin (q.v.) in the illustrations to the first edition of his *Seven Lamps of Architecture* (1849); but it has now been superseded by lithography, which attains similar results in a readier way, and is much less costly in printing.

Mezzotint.—The process of mezzotint was invented by an amateur, Ludwig von Siegen (born 1609, at Utrecht), an officer who held the appointment of 'Kammerjunker' to the Landgrave of Hesse-Cassel. In 1642 he forwarded to his patron a portrait of his mother, the Dowager Landgravine of Hesse, as the first-fruits of his newly-discovered process, stating, in the letter which accompanied it, that 'how this work was done, no copperplate-engraver or artist can explain or imagine.' In 1654, after having executed other plates in the same manner, Von Siegen visited Brussels, and there came into contact with Prince Rupert (1619–82), who had already been practising etching, and to him, for the first time, the inventor disclosed his process. It was adopted by the prince, who was assisted by Wallerant Vaillant (1623–77), and was afterwards practised by Theodore Caspar von Fuerstenberg, one of whose plates is dated 1656; Johann Thomas of Ypres, who is stated to have acquired the art at Frankfort; Abraham Blooteling (1634–*c.*1695), an admirable engraver of portraits, who worked for a time in England; Gerard Valck (1626–*c.*1720); and by many of the leading Dutch painters and engravers of the century. During the 18th century mezzotint-engraving declined in Holland, and, indeed, on the Continent generally, though Jacques Christofle Le Blon (born 1670 at Frankfort, died 1741 at Paris) devised a process for printing mezzotints by means of which various colours of ink appeared in each impression. The art was to some extent revived in Vienna, about 1780, by Jacobe, who had studied in London under the great English mezzotinters of the period; and, in the same city, Johann Peter Pichler (1765–1806) executed some admirable plates, particularly his transcripts from the flower-pieces of Van Huysum.

In France we have mezzotint-plates by J. Van der Bruggen (born 1649, at Brussels), dated from Paris as early as 1681. Sebastian Barras (born *c.*1680 at Aix; died 1710), Isaac Sarrabat (working 1695–1701), and Bernard Picart (1673–1733) are other mezzotint-engravers who worked in France; but here the process was comparatively little used on account of the great excellence of the French line-engravers.

It was, however, in England that the art was most extensively and successfully practised, as is indicated by one of the phrases used on the Continent to designate mezzotint-engraving, *la manière anglaise*. The process was introduced in 1660 into England by Prince Rupert, whose method is described in Evelyn's *Sculptura, or the Art of Chalcography* (1662). He executed some fifteen plates, among which the chief are the 'Great Executioner' and the 'Standard-bearer.' Sir Christopher Wren (1631–1723) and John Evelyn (1620–1706) have been believed, on rather insufficient evidence, to have practised the art. William Sherwin's plate of Charles II. is dated 1669; Francis Place (1650–1728) scraped a few portraits, including one of Charles I., free in style and delicate in gradation; Isaac Beckett (1653–1719), and particularly John Smith the Elder (1652–1742), worked much after the portraits of Kneller; and John Faber the Younger (born in Holland, 1684; died in London, 1756) engraved series of 'The Beauties of Hampton Court' and 'The Members of the Kit-Cat Club' after the same artist, transcribed the portraits of many minor portrait-painters of the time, and also engraved many subject-pictures, one of the finest being a mezzotint from Frans Hals's 'Man playing the Guitar' (1754). Richard Earlom (1743–1822) is seen at his highest in his mezzotints from Dutch flower-pictures, prints which are unrivalled for delicacy; and among his other works are his reproductions, in combined etching and mezzotint, of Claude's *Liber Veritatis* drawings. We have now reached the perfect time of the art in England, the period of the great school of mezzotinters who reproduced with splendid power the works of Reynolds and his contemporaries, with whose style of painting, with whose broad generalising touch, the method of mezzotint is in most essential sympathy. Among the greatest of these men are James M'Ardell (1710–65), by whose prints Reynolds said 'I shall be immortalised,' Edward Fisher (1730–85), James Watson (1740–90), John Jones (1740–1810), J. Raphael Smith (1750–1812), Valentine Green (1739–1813), William Dickinson (1746–1823), S. W. Reynolds (1773 or 1774–1835), and Charles Turner (1773–1857). The mezzotint-prints executed after Sir Joshua alone include the work of about sixty different engravers. Some of these men, such as Charles Turner and S. W. Reynolds, took part in the plates of the *Liber Studiorum* of J. M. W. Turner (himself an accomplished mezzotinter, as certain plates of that series attest), and engraved the portraits of Raeburn, works especially adapted for reproduction by their method; and William Ward (1766–1826) scraped a few splendid prints after another Scottish painter, Andrew Geddes. The latest and most effective development of pure mezzotint in landscape includes the renderings by Thomas G. Lupton (1791–1873) of Turner's 'Ports' and 'Rivers' of England, and the transcripts by David Lucas (1802–81) from the works of Constable, a series executed, like the *Liber Studiorum* of Turner, under the closest supervision of the painter; who, however, did not, like Turner, himself use the scraper, though he longed to do so, writing to his engraver, 'How I wish I could scratch and tear away with your tools on the steel.' On account of the larger number of impressions which could be printed from them, steel plates had already been introduced by the mezzotinters, but these being scraped with somewhat less facility than the copper plates formerly employed, tended much to the deterioration of the art and to the loss of its especial qualities of freedom and painter-like breadth, especially when the mezzotint work was largely supplemented, as was now commonly the case, by the burin, and by etching and stipple-engraving. By means of this modern method engravers of first-rate power, such as Samuel Cousins (1801–87), were capable of producing attractive and excellent plates; but in the hands of inferior workmen the

results attained by this bastard combination of various processes were pitiably inartistic. One of the first inaugurators of a distinct revival of the art upon the old legitimate lines of pure mezzotinting upon copper was Joseph Josey, who engraved very sympathetically Whistler's 'Thomas Carlyle' and 'Portrait of the Artist's Mother.' William Campbell (1855–87) executed several excellent mezzotints after Burne-Jones. A powerful impetus towards right technical methods was given by Sir Hubert von Herkomer (born 1849 in Bavaria; died 1914), and among his pupils D. Wehrschmidt (Veresmith) and William Henderson have engraved excellently after Holl's portraits, and Gerald Robinson is favourably known by his delicate transcript from Van Dyck's bust portrait of Henrietta Maria in the royal collection. Seymour Haden added mezzotint to the later states of his powerful etching from Turner's 'Calais Pier'; and Sir F. Short, in addition to original work, has produced, in combined etching and mezzotint, some admirable copies from Turner's *Liber Studiorum*. Mezzotint was the first form of engraving practised in America, Peter Pelham (*c.* 1684–1751) having removed from London and settled in Boston before 1727, the year in which he published, from his own painting, a mezzotint of the Rev. Cotton Mather, which was followed by various other portraits of eminent Americans. Among the other mezzotint engravers of America may be named Thomas B. Welch (*c.* 1814–74), and John Sartain (born in London, 1808; died 1897).

Aquatint-engraving.—This method is believed to have been invented by Jean-Claude-Richard de Saint-Non (1730–1804), a French draughtsman and etcher who studied in Italy, and to have been communicated by him to Jean Baptiste Le Prince (1733–81), a native of Metz working in Paris, who sold the secret to the Hon. Charles Greville. By him it was disclosed to Paul Sandby, who was the first to practise the method in England, using it to reproduce his Welsh landscapes, and carrying it to great perfection in his 'Views in the Encampments in the Parks' (1780). It was also employed in Scotland by David Allan (1744–98), who engraved in this manner his illustrations to Ramsay's *Gentle Shepherd* (1788). F. C. Lewis (1779–1856), the best aquatint-engraver of his time, is known by his reproductions of the drawings of Claude and of Lawrence; and he added the aquatint light-and-shade to the first plate of Turner's *Liber Studiorum*, mezzotint being employed for this purpose in the rest of the subjects of the series. Catherine Prestel (died in London, 1794), a German, executed some fine plates in combined etching and aquatint; and in Spain Goya (1746–1828) employed a similar union of processes in the wild and bizarre plates which he produced. Aquatint is now little used, but Brunet-Debaines adopted it with accomplished skill in his renderings of the landscapes of Turner.

Chalk or Stipple Engraving.—Jean Charles François (1717–69) is said to have been the first engraver to employ this process, and for its discovery he received a pension of 600 francs from the French king, along with the title of 'Graveur des desseins du Cabinet du Roi.' He used the method chiefly for the reproduction of drawings in crayons, for which it has since been very popular until the discovery of Lithography (q.v.) and of Photography (q.v.), by which such fac-similes can more accurately and readily be produced. He was followed by Giles de Marteau the Elder (1722), another able engraver. The process was introduced into England by William Wynne Ryland (born 1732; executed for forgery, 1783), who worked in this method after drawings by the old masters and the designs of Angelica Kauffman; but the most celebrated of the stipple-engravers working in England was an Italian, Francesco Bartolozzi (1725–1815). In America some good portrait engraving in stipple was produced by David Edwin (1776–1841), an Englishman who studied in his native country and in Holland, and by Ion B. Forrest (1814–70), a Scotsman trained in London.

Works dealing with the history and practice of engraving are very numerous. In Dr W. H. Willshire's *Introduction to the Study and Collection of Ancient Prints* (2d ed. 1877), a useful book of reference, will be found a list of nearly a hundred works denoted to engraving. A. M. Hind's *History of Engraving and Etching* (new ed. 1923) is exhaustive and thoroughgoing, J. H. Slater's *Engravings and their Value* (5th ed. 1921) is valuable for biographies. For an account of technical processes, the student may consult T. H. Fielding's *Art of Engraving* (1841), P. G. Hamerton's *Etcher's Handbook* (1871), the various editions of his *Etching and Etchers*, and his *Graphic Arts* (1882). *Le Peintre-Graveur* of Adam Bartsch (Vienna, 1803–21, and Leip. 1854), with its supplements by J. D. Passavant (6 vols. Leip. 1860–64), and A. P. F. Robert-Dumesnil's *Le Peintre-Graveur Français* (8 vols. Paris, 1835–50), and the 11 volumes of its continuation by Georges Duplessis, are the standard catalogues of old prints. Among the other works that may be named are W. Y. Otley's *Early History of Engraving* (2 vols. 1816); Georges Duplessis's *Histoire de la Gravure en France* (1861), *Les Merveilles de la Gravure* (1869), and *Histoire de la Gravure* (1880); and Bryan's *Dictionary of Painters and Engravers* (edited by George C. Williamson, 4 vols. Lond. 1903–6); and there are separate monographs and catalogues for the more important engravers. See also *The Print Collector's Handbook*, by A. Whitman (Lond. 1901); Bourcard's *Graveurs et Gravures* (Paris, 1910); S. R. Koehler, *Etching, its Progress and History* (1886); Herkomer, *Etching and Mezzotint Engraving* (1892); Wedmore, *Etching in England* (1895); Pennell, *Etchers and Etching* (1920); Lumsden, *Art of Etching* (1925); and the valuable series of fac-similes by M. Amand-Durand of Paris.

Engrossing, a term used to describe the conduct of those who buy up merchandise in large quantities to obtain command of the market. This was formerly an offence punishable by law and by municipal regulations; as were also the offences of forestalling (buying merchandise on its way to market) and badgering or regrating (buying to sell again at an unduly enhanced price). The old laws in restraint of trade were not found to work well. So far from making the necessaries of life cheap as they were intended to do, they discouraged producers and traders, and so made prices abnormally high. The English statutes on the subject were therefore repealed in 1772, and the offences of engrossing, &c. were finally abolished, both in England and in Scotland, in 1844. In the United States, engrossing is a common-law offence; and the constitutions of several states declare that monopolies are 'contrary to the genius of true government;' but with the development of modern commerce these restrictions became obsolete. See ASSOCIATIONS, TRUSTS, AND CARTELLS.

Engrossing a Deed means the writing it out in full and regular form on parchment or paper for signature. The person who engrosses is usually a law-stationer or clerk. In Scotland, the corresponding term is 'extending a deed,' and till 1874 it was necessary that the person extending the deed should be named in the testing clause. See DEED.

Enharmonic, originally the name of one of the three Greek scales, is now applied to music constructed on a scale containing intervals less than a semitone—e.g. where the difference is recognised between G♯ and A♭, or D♯ and E♭. On the old organ built by 'Father' Smith for the Temple Church in London these notes had separate keys. But in modern keyed instruments, tuned, as they now universally are, in equal temperament, these

notes are represented by the same sound; and the possibility is afforded of enharmonic *modulation*, in which a chord belonging to one key is, by a change merely of its notation, made the means of passing into another key. The chords commonly used in this change are the diminished seventh, or equivocal chord, which may be written in four different ways, and (less often) the dominant seventh, which may be changed into the German sixth. See MUSIC.

Enkhuizen, a town of North Holland, one of the 'dead cities of the Zuider Zee,' 35 miles NNE. of Amsterdam. It once sent out 400 ships to the herring-fishery, and had 40,000 inhabitants; but its harbour has gradually silted up. It was the first town to throw off the Spanish yoke (1572), and in 1625 was Paul Potter's birthplace. Pop. 8000.

Enlistment in Britain was, until 1802, in the hands of middlemen, who received a commission for their trouble. Since that year it has been managed by the adjutant-general's department. Formerly, a soldier enlisted for life, and could never look forward to retiring on a pension while still possessed of a fair share of health and strength. This was changed in 1847 by an act which limited the term of enlistment to 10 years for infantry, and to 12 for cavalry or artillery. A soldier could then either quit the army without pension, or re-engage for the remainder of 21 years, at the expiration of which time he was entitled to a pension for life; and in 1868 twopence a day was added to the pay of every soldier so re-engaged. This system was not compatible with the formation of trained reserves, with which to bring the army to fighting strength in the event of war, and in consequence the 'Army Enlistment Act' of 1870 was passed. Under this act men still enlist for 12 years, but with the understanding that 7 years or less shall be passed with the colours, and the remainder in the reserve. This is known as 'short service;' and a reserve of trained soldiers has thus been formed who are liable to be called back into army service if great emergency arises during their reserve service. The Army Act of 1881 substantially improved the procedure of enlistment, and has been since amended. There is now no risk that the man shall be improperly influenced, as by liquor; and the recruiter's 'shilling,' which used to compel the man to enlist, is abolished. The law of enlistment is laid down in the Army Act (see ARMY DISCIPLINE). The man is given by the recruiter a notice paper, which tells him particulars of service, and the questions he will be asked, and time and place at which he is to appear. Follows the primary military examination by the recruiting *officer*, who asks him the authorised questions from the attestation paper, and obtains a reference as to character. This is followed by the medical examination. The man is now taken before the 'attesting officer' or a magistrate; his answers are entered on the paper, he takes the oath of allegiance, the paper is signed by him, by a witness, and by the attester. The Recruit (q.v.) next appears before the approving officer, and only after that is he fully enlisted. A false answer on attestation is punishable under the Army Act. At any time within three months, unless the Army Reserve (q.v.) has been called out, the recruit can buy his discharge. An apprentice can be claimed by his master at any time within a month, subject to certain provisos. Special reserve men (see under ARMY) enlist for 6 years, and then have the option of continuing for spells of 4 years, up to the age of 45. The territorial force are *enlisted*—not *enrolled*, as the volunteers were—and have thus become subject to military law whenever on duty. See DESERTION, DISCHARGE, FOREIGN ENLISTMENT ACT, and RECRUIT; and for the manning of the navy, see NAVY.

Enna. See CASTROGIOVANNI.

Ennemoser, JOSEPH, a medico-philosophic writer, was born in 1787 at Hintersee, in the Tyrol, and commenced his medical studies at Innsbruck in 1806. On the rising of the Tyrolese against the French in 1809 he followed Andreas Hofer as his secretary; at the close of the war he went to Erlangen, and subsequently to Vienna, for the purpose of concluding his studies. In 1813 he raised a company of Tyrolese marksmen, who were of great service during the campaigns that followed. After the peace of Paris he finished his curriculum at Berlin, and devoted himself to the study of animal magnetism. In 1819 he was made professor of Medicine at Bonn, where he lectured until 1837; he then practised for a time at Innsbruck, but in 1841 removed to Munich, where he obtained a great reputation by the application of hypnotism as a curative power. He died 19th September 1854. Among his numerous writings *Der Magnetismus in seiner geschichtlichen Entwickelung* (Leip. 1819) is reckoned his principal work.

Ennerdale Water, a lake of Cumberland, 8 miles ESE. of Whitehaven, is fed by the Liza, descending from Great Gable by the north side of the Pillar and the Steeple, and drained by the Ehen, which runs some twelve miles west and south by Cleator and Egremont to the Irish Sea near Sellafield. The lake measures 2½ miles by ¾. It stands 368 feet above sea-level; has a maximum depth of 148 feet; an average depth of 62 feet; and contains about 1978 million cubic feet of water. Wordsworth makes Ennerdale the scene of *The Brothers*.

Ennis, a municipal borough of County Clare, Ireland, on the Fergus, 25 miles NW. of Limerick, and 151 WSW. of Dublin by rail, is a neat town, with some good houses. Here are the Catholic cathedral of Killaloe diocese, a fine court-house, the Clare lunatic asylum, large flour-mills, a school founded by Erasmus Smith (1689), a column to O'Connell (1863), and a memorial to the 'Manchester Martyrs.' Till 1885 Ennis returned one member to Parliament. Pop. 5500.

Enniscorthy, a market-town of Wexford, beautifully situated on the navigable Slaney, 78 miles S. of Dublin by rail. The Roman Catholic cathedral of Ferns diocese is the principal edifice. There is a large corn-trade. The population is about 5500. Enniscorthy grew up round a castle, still entire, founded by Raymond le Gros, one of the early Anglo-Norman invaders. Cromwell took it in 1649; and the rebels from Vinegar Hill (q.v.) stormed and burned it in 1798.

Enniskillen, a municipal (till 1885, also parliamentary) borough, the capital of County Fermanagh, 87 miles WSW. of Belfast, and 117 NW. of Dublin by rail, is beautifully situated on an isle in the river between Upper and Lower Loughs Erne. Around are richly cultivated eminences and many fine mansions; whilst among its own edifices are the Protestant and Catholic churches (the latter a fine modern building), the large barracks, a lofty monument to Sir Lowry Cole, and the Royal Portora School. The chief manufactures are cutlery and straw-plait. The population is 5000. Enniskillen is famous for the victory, in 1689, of the troops of William III., under Lord Hamilton, over a superior force of James II., under Lord Galmoy. The banners taken in the battle of the Boyne hang in the town-hall. The regiment of Enniskilleners, or 6th Dragoons, was first instituted from the brave defenders of the town.

Ennius, one of the earliest Roman poets, the father of the Roman Epos, was born at Rudiæ, in Calabria, about 240 B.C., and was probably of

Greek extraction. He is said to have served in the wars, and to have risen to the rank of a centurion. In Sardinia he became acquainted with Cato the Elder, and returned with him to Rome when about the age of thirty-eight. Here he gained for himself the friendship of the most eminent men, among them Scipio Africanus the Elder, and attained (what was then exceedingly rare in the case of an alien) to the rank of a Roman citizen. He supported himself in a decent but humble manner by instructing some young Romans of distinguished families in the Greek language and literature, his accurate knowledge of which explains the influence he had on the development of the Latin tongue. He died when he had attained the age of seventy, about 170 B.C. His remains were interred in the tomb of the Scipios, and his bust was placed among those of that great family. Ennius tried his powers in almost every species of poetry, and although his language and versification are rough and unpolished, these defects are fully compensated by the energy of his expressions and the fire of his poetry. His poems were highly esteemed by Cicero, Horace, and Virgil: the last, indeed, frequently introduces whole lines from the poetry of Ennius into his own compositions, and owes him the whole structure of certain episodes. His memory seems to have been lovingly cherished by his countrymen: *Noster Ennius*, 'Our Ennius,' they used to call him. Of his tragedies, comedies, satires, and particularly of his *Annales*, an epos in 18 books, only fragments are extant. What adds to our regret is that it is believed his whole works were extant as late as the 13th century. The fragments have been edited by Vahlen (1854), Müller (1885), and Dr Ethel Steuart (*Annales*, 1925); the dramatic fragments by Ribbeck (1873). See Lucian Müller, *Quintus Ennius* (1884); Ribbeck, *Römische Tragödie* (1875); Sellar, *Roman Poets of the Republic* (2d ed. 1881); Simcox, *Latin Literature* (1882); Norden, *Ennius und Vergilius* (1915).

Enns, a river of Austria, rises at the northern base of a branch of the Noric Alps in the land of Salzburg, 12 miles S. of Radstadt, and flows 190 miles (only the last 20 navigable) in a general northerly direction, till it joins the Danube a few miles below Linz. Its chief affluents are the Salza and the Steier. From ancient times the Enns has formed the boundary between Upper Austria (Ober der Enns) and Lower Austria (Unter der Enns). Having mostly a rapid fall, it is chiefly important from the valuable water-power which it supplies.

Enoch, 'the seventh from Adam' (Jude, xiv.), 'walked with God' (Gen. v. 21–24), and, after a life of 365 years, 'was not, for God took him.' It is probable that the number of the years of Enoch was in some way connected with the number of days in the solar year. Partly from this, and partly from the interpretation of his name (Heb. *Hanōkh*) as 'initiated,' arose the later Jewish legend that Enoch had invented writing, arithmetic, astrology, and astronomy. He was held to have predicted the flood, and to be the possessor, through revelation, of the knowledge of all mysteries in heaven and earth. By the Arabs he is called *Idrîs* ('the experienced' or 'learned').—For the Glasgow 'St Enoch,' a corruption of 'St Thenaw,' the name given by St Serf to St Kentigern's mother, see the article KENTIGERN.

Enoch, BOOK OF. There are two books ascribed to Enoch in Jewish apocalyptic literature, the one known as 'The Book of Enoch,' the other as 'The Book of the Secrets of Enoch.' The Book of Enoch itself is a library rather than a volume, and includes at least five different documents, written at different periods, and dealing with different subjects. The first book (chaps. i.–xxxvi.) was written about 170 B.C. It contains an interesting theory as to the origin of sin, which it explains as due to the lust of angels for the daughters of men (Gen. vi. 1–8). The second book from a chronological point of view consists of chaps. lxxxiii.–xc., and belongs to the Maccabean period (166–161 B.C.). The third book (chaps. xci.–civ.) is usually dated between 134 and 95 B.C. It represents the position of the Pharisees of the period, and finds the solution of the problem of evil in a belief in the future life. The fourth book (chaps. xxxvii.–lxxi.) belongs to the first half of the 1st century B.C., but its specific date cannot be determined. It is distinguished for its development of the conception of the Messiah, whom it portrays as 'the Son of Man.' The fifth book (chaps. lxxii.–lxxxii.)—the Book of Celestial Physics, as it is called—is an attempt to establish a Hebrew calendar to supersede the pagan calendars in vogue at the time. There can be little doubt that New Testament theology owes a very considerable debt to the Book of Enoch, especially to its Messianic conceptions, which are in advance of the ideas on the subject found elsewhere in this literature. The Book of Enoch exists in its entirety only in an Ethiopic version.

The Book of the Secrets of Enoch is a comparatively recent discovery, having been brought to light in a Slavonic version in 1892. It was probably written at Alexandria between 1 and 50 A.D. The book describes the ascension of Enoch and his voyage through the seven heavens. Each of these heavens is described at length. The second heaven, for instance, is the abode of the fallen angels, and the prisoners awaiting eternal judgment. The third is the place of Paradise, the home of those 'who turn their eyes from unrighteousness and accomplish a righteous judgment.' The sixth heaven is the dwelling-place of the angels who regulate the powers of nature, and record the deeds of men. The seventh heaven contains the throne of God surrounded by a multitude of the heavenly hosts. The book throws no little light on the conception of the heavens in the New Testament.

The best edition of these books is found in the *Oxford Apocrypha and Pseudepigrapha* (1913).

Enos (the ancient *Ainos*), a seaport, on a rocky isthmus near the mouth of the Maritza, about 35 miles NW. of Gallipoli. It has some trade in wool, cotton, leather, wax, &c., but its harbour is now choked with sand. Pop. 8000, principally Greeks.

Enríquez Gómez, ANTONIO (properly ENRÍQUEZ DE PAZ), a Spanish poet, the son of a baptised Portuguese Jew, was born at Segovia, early in the 17th century. He entered the army in his twentieth year, and rose to the rank of captain; but in 1636 fled to Amsterdam, and, having there professed the Jewish faith, was in 1660 burned in effigy at a Seville auto-da-fé. The date of his death is not known. For his twenty-two comedies, of which some passed as Calderon's, and his poems, see Ticknor's *History of Spanish Literature*.

En'schede, a town of Holland in the province of Overyssel, 30 miles ENE. of Zutphen. Rebuilt since its destruction by fire in 1862, it has large yarn and cotton mills. Pop. 41,500.

Ensign was, until 1871, the title given to officers of the lowest commissioned rank in the British infantry (the corresponding rank in the cavalry being Cornet), because they carried the regimental Colours (q.v.) or ensign. Formerly this was a duty attended with much danger when in action, and considered highly honourable; but colours are no longer taken into battle, and officers

of the rank of ensigns and cornets are now called second lieutenants. See also FLAG.

Ensilage. See SILAGE.

Enstatite, an important rock-forming mineral. It is essentially an anhydrous silicate of magnesia, but usually contains also small percentages of alumina and ferrous oxide. It belongs to the pyroxene group of minerals.

Entablature, that part of a design in classic architecture which surmounts the Columns (q.v.), and rests upon the capitals. It is usually about two diameters of the column in height, and is divided in every style of classical architecture into three parts—architrave, frieze, and cornice. These parts vary in their relative proportions in different styles. In Doric architecture, for example, if the entablature be divided into eight equal parts, two of these form the height of the architrave, three that of the frieze, and three that of the cornice. In the other styles, the relative proportions are as three, three, and four.

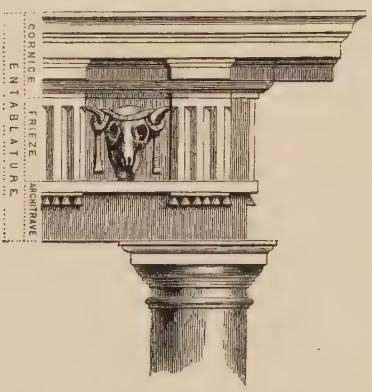


Fig. 1.—Example of Doric Entablature.

The *Architrave* is the horizontal portion which rests immediately upon the abacus of the column. It is usually ornamented with horizontal mouldings, with flat spaces or *fasciæ* between. The upper moulding always projects farther than the others, so as to throw off the rain. This moulding varies in different styles. In Doric (fig. 1) it is a plain square projection, with small pendants or *guttæ* under the triglyphs. In the other styles it is generally an ogee or talon moulding. These mouldings are frequently enriched with leaf ornaments, and in very florid designs the fasciæ are also enriched.

The *Frieze* is the middle portion of the entablature, between the top of the architrave and the bed of the cornice. In the Doric style it is ornamented with triglyphs or slight projections, divided by angular grooves into three parts. The spaces between the triglyphs (called metopes) are square, and are either plain or enriched, either with figure-sculpture, as in the Parthenon, or with bulls' heads, pateræ, or other ornaments. In the other styles the frieze is never cut into portions, but is either left quite plain or ornamented with figure-sculpture or scroll-work. The former is most usual in Greek art, the latter in Roman. In late Roman works the frieze is sometimes *swelled* or made to project with a curve.

The *Cornice* forms the upper portion of the entablature. It is divided into several parts. The lower moulding or mouldings resting on the frieze are called the bed-mouldings, the lower member of the upper projecting part is called the Corona (q.v.), and between the two there are frequently introduced modillions and dentil bands. The bed-moulding is generally of an oval or echinus form, and is frequently enriched with the egg and tongue or leaf ornaments. The upper moulding of the corona is generally of a *cyma recta* form (see COLUMN, fig. 1), and is often ornamented with lions' heads. These represent the openings through which the rain was at first led off from the roof-gutters cut in the top of this moulding, and were retained as ornaments after their original use was discontinued. The corona projects well over the frieze and architrave, and protects them from rain, while at the same time, by its broad shadow, it gives repose and variety of effect to the building. The *soffit*, or under side of the corona, is frequently panelled and ornamented with pateræ.

Origin.—The component parts of the entablature are said, with some appearance of truth, to owe their origin to the forms of the construction of the oldest temples. These were of wood, and were put together in the manner most natural for that material. The square beams laid across from post to post are represented by the architrave; the triglyphs of the frieze are copied from the ends of the cross-beams; the cornice is taken from the boarding which covered the rafters and ties of the roof—projected so as to throw off the rain; and the dentils and modillions show the ends of the rafters left uncovered. It is not supposed that these features were intentionally imitated by the classic architects, but that the original wooden construction produced forms which were afterwards traditionally though unconsciously followed.

Whatever the origin of the entablature may have been, it is a remarkable fact, as connected with Greek and Roman art, how persistent the entablature was as a feature in the decoration of all classic styles. So long as buildings consisted of one story in height, this was quite natural; but after this simple system was abandoned, and when, as in Roman architecture, several series of columns and entablatures were piled one above the other—not used constructionally, but simply applied to the face of the building—the cornice, frieze, and architrave still retained their places and proportions. In the revived Roman art of the 16th century the entablature was used in a manner still further removed from its original purpose (fig. 2).

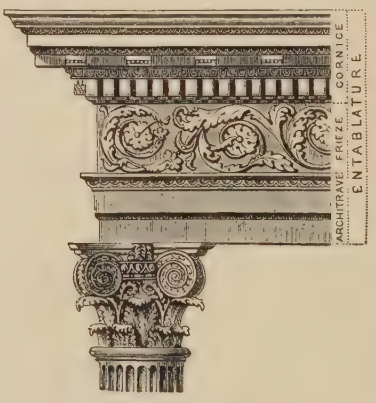


Fig. 2.—Example of Composite Entablature.

The strict proportions of the various parts were entirely lost sight of. The frieze was increased in height, so as to admit of small windows, to light the Entresol (q.v.) or mezzanine, and in the French and English forms of the Renaissance the various members become still more attenuated and altered from the original design (see RENAISSANCE). But in no modification of classic

architecture, however debased, is the entablature wanting. The architrave, frieze, and cornice are essential portions of every classic design.

Entada, a genus of leguminous climbing shrubs (sub-order Mimoseæ) remarkable for their great pods. The egg-sized seeds of *E. gigalobium* are carried by the Gulf Stream not only to the Canaries, but to Nova Zembla, where their occurrence suggested the name of 'Chestnut Bay.'

Entail. The desire to preserve in our own family land which we have either inherited or acquired appears to be inherent in the human mind. Arrangements of this nature were not known to primitive peoples, among whom land descended according to strict customary rules which could not be altered by the act of an individual owner. In some of the ancient Greek states owners of property were permitted to name successors to their estates, and to appoint a substitute who should take the estate on the failure of him first named. The substitute so appointed was permitted to succeed on the death of the institute (as he was called) without leaving issue or without alienating the estate. Under the Roman law the practice of settling land upon a series of heirs, by means of *Fideicommissa* (q.v.), grew up, and was sanctioned by the state. These deeds, in their early form, contained merely a substitution of heirs. But by the later law a much fuller form of settlement was admitted, whereby the estate was protected from every sort of alienation. The limitation to a particular line of descent, the prohibition to alienate or burden with debt, and the still more peculiar feature of the declaration of forfeiture in case of non-compliance are to be found in both forms. There are, however, two points in which the Roman law differed from modern laws of entail. It did not recognise the right of Primogeniture (q.v.), and after the legislation of Justinian the limitation of the deed was restricted to four generations. For the right of primogeniture, as recognised in deeds of entail, we are indebted to the feudal law. That system, which has united with the civil law to form a basis for the codes of modern Europe, did not, in its original form, recognise the right of a holder of land to alienate his feudal benefice, or even to alter the succession, because on the failure of heirs the feu returned to the superior. But the right of the eldest son to represent his father, both in the duties and privileges of the fief, if not an original principle of the system, was universally recognised in the days of its greatest power.

In *England*, the Saxons seem to have prohibited the alienation of lands by those who had succeeded to them under condition that they should not alienate. The law of primogeniture was not recognised. But after the Norman Conquest feudal grants were often made 'to A and the heirs of his body,' or 'to A and his heirs, if he shall have heirs of his body.' The estate thus given was regarded as a fee-simple conditional; on the birth of an heir of his body, A would acquire the fee; and, like other owners in fee after the 13th century, he was at liberty to alienate. To prevent this, the feudal lords obtained the enactment of the statute *De Donis*, by which it was directed that the fee given with the words above quoted should in all cases descend according to the form of the gift; so that, in the case supposed, A would not have a fee-simple, an estate to him and his heirs-general, which he was free to alienate, but a fee-tail—i.e. a fee *taillé* or cut down, which he could not alienate so as to bar the rights of his issue. Under the statute, lands might be settled in tail, or in tail male, or in tail special—i.e. on a man and the heirs of his body by a particular wife. A settlement in tail special was somewhat analogous to a settlement in Frankmarriage (q.v.).

The restraints on alienation thus imposed were contrary to sound policy, and the courts permitted tenants in tail to bar or cut off the entail; a tenant in possession was permitted to bar all rights of other persons, and so to turn his own estate into a fee-simple. From the time of Edward IV. down to 1833 this was effected by means of fictitious actions, called Fines and Recoveries; for these cumbrous and expensive forms the 3 and 4 Will. IV. chap. 74 substitutes a simple disentailing deed. A strict settlement of land usually begins with an estate for life to an existing person, followed by an estate tail to his son. When the donee of the estate tail comes into possession, he can disentail and alienate at his own discretion. If not in possession, he can dispose of his own rights and those of his issue; but he cannot destroy the entail, so as to bar remaindermen and reversioners, and turn his estate into a fee-simple, unless with the consent of the 'protector of the settlement,' who is usually the tenant for life. An estate tail is a freehold of a limited description. Tenant in tail in possession may commit Waste (q.v.). Formerly, an estate tail was not liable to the debts of the tenant, but by 1 and 2 Vict. chap. 110 this restriction has been removed. Copyhold lands have been held not to fall under the operation of the statute *De Donis*. A limitation, therefore, which in a freehold creates an estate tail, in copyhold lands creates a fee-simple conditional, according to the old common law, except where the custom of the manor is to the contrary. But, by trust-conveyances, copyhold estates may be settled in the same way as freeholds. The rules against Perpetuities (q.v.) prevent property from being tied up for an indefinite period; but family estates are usually re-settled by owners and heirs of entail in each generation. Lord Cairns's Settled Land Act, 1882, has given to tenants for life absolute power of sale upon notice to the trustees of the settlement, and without petition to the court, the price being invested for the persons interested under the settlement. By a series of statutes in England, tenants for life have also received large powers of managing and improving their estates.

In *Scotland*, as in England, entails appear first to have taken their rise from the feudal usages, and from the Roman law, the forms of which were closely followed by conveyancers. It has been observed by Lord Kames that, while the feudal system was in its vigour, every estate was in fact entailed, because no proprietor had any power to alter the order of the succession. But when the stricter feudal principles gave way, and the power of alienating land began to be recognised, the holders of estates sought by deed to secure in their own families the lands which they possessed. The form first adopted for this purpose was the simple destination, whereby the estate was simply limited to a particular series of heirs, without prohibition to alienate, or declaration of forfeiture for contravention of the will of the grantor. In this form the deed must have resembled the early English entails. The feudal law of primogeniture having been received as a principle of common law, the estate would naturally descend from father to son in the line indicated by the deed. But, as it was held that those succeeding under this deed were not restrained from alienating, the practice of adding prohibitory clauses was introduced. Entails in this form were held to bind the heir from granting gratuitous alienations; but he was not restrained from selling the estate, or burdening it with debt. Early in the 17th century a further addition was made to the form of the deed by the introduction of irritant and resolutive

clauses—i.e. clauses declaring the act of alienation to be null, and to infer the forfeiture of the estate. The form thus adopted, which resembles closely the form of the Roman deed already noticed, was fortified by a decision of the Court of Session on the Stormonth entail in 1662, holding that an estate so protected could not be attached by creditors. This decision created much difference of opinion amongst lawyers as to the power of the grantor thus to protect an estate from the onerous act of the heir. In consequence the famous Scotch Entail Act, 1685, chap. 22, was passed, by which it was enacted that an estate conveyed by a deed fortified by prohibitory, irritant, and resolutive clauses, and recorded in a particular register, should be effectually secured in the line of destination. This act has always been most strictly viewed by Scottish lawyers; and entails which have been found deficient in any of the prescribed requisites have been regarded by the courts as utterly ineffectual. The operation of the old entail act was found, notwithstanding, to be of the most oppressive character. Statutes were in consequence passed from time to time, empowering heirs of entail to exercise larger powers of ownership than could be granted under the Act of 1685, and to make provisions for their families. Chief among these were the Montgomery, the Aberdeen, and the Rosebery Acts. At length, by 11 and 12 Vict. chap. 36 (known as the Rutherfurd Act), the power of fettering lands by a strict entail has been finally destroyed. By this act, heirs under an existing entail may disentail, with the consent of certain heirs next in succession; and in all entails made after 1st August 1848, and also in old entails where the heir in possession was born since 1st August 1848, the heir of entail in possession may, by means of a simple deed of disentail, free his estate from the restrictions of the entail. A statute in 1875 gave the heir in possession larger powers of permanent improvement and the right of buying out the interest of the next heirs at a compulsory valuation; and the Entail (Scotland) Act, 1882, gave further powers of disentailing in the case of entails made since 1848, and in all cases a practically absolute power of sale to be exercised on petition to the court, the price being invested for behoof of the heirs of entail. From statistics returned to parliament in 1882, it appeared that disentailed land was rapidly re-entailed in Scotland.

In *America*, before the Revolution, the English law as to estates tail prevailed. But in the United States, the law of entails has been gradually abandoned by the several states; and property can now be fettered to a limited extent only, by means of executory Devises (see WILL). In *Germany*, family settlements of a very strict character, and 'private laws' regulating the descent of property in certain noble houses, are permitted by the laws of some of the states which form the German empire. In *France*, the power of creating entails has varied much at different periods, from the right to make a perpetual entail, which appears to have been the original principle, to a limitation to four, and at one time to two degrees. But by the Code Napoléon, arts. 896–897, entails are now absolutely prohibited. In *Spain*, also, entails, till then permitted under certain restrictions, were entirely abolished by the Cortes in 1820. Thus it will be seen that the right of securing land in a particular family, which commends itself to the natural feelings, has been found so oppressive in operation, and so injurious to the public interest, that, after an existence of more than 600 years, it has been practically discarded almost simultaneously by the general consent of modern nations.

Entebbe, the administrative headquarters of Uganda, is on the NW. shore of Victoria Nyanza.

Entellus Monkey, or HANUMÂN (*Semnopithecus Entellus*), the most sacred monkey of the Hindus, worshipped as half divine, and regarded as the host of ancestral souls. The body is 4½ feet in length, from ashy-gray to dirty yellow in colour; the face is dark, with bushy grayish-white whiskers; and the tail is longer than the body. Entellus

Entellus Monkey (*Semnopithecus Entellus*).

monkeys live in troops, are noisy and quarrelsome, and do much mischief near towns and plantations, but are nevertheless reverenced and petted. They are sometimes identified with the Langur. For the mythology, see HANUMAN.

Entente Cordiale (Fr., 'cordial understanding'), a term which originated, according to Littré, in the French chamber of deputies in 1840–41. Since the Anglo-French Convention of 1904 (about Egypt, Morocco, and Newfoundland) the term has been used especially to denote the friendly relation, short of formal alliance, between France and Great Britain; extended later to France's ally Russia, and so forming a 'Triple Entente,' balancing the triple alliance of Germany, Austria-Hungary, and Italy, until the outbreak of war in 1914.—Dr Beneš's 'Little Entente' between Czechoslovakia and Yugoslavia (1920) was joined by Rumania in 1921.

Enteric Fever. See TYPHOID FEVER.

Enteri'tis (Gr. *enteron*, 'an intestine'), inflammation of the bowels, is a name at the present day reserved for inflammation affecting the inner mucous coat of the bowel, the term Peritonitis (q.v.) being applied to inflammation of the outer coat. Inflammations of special parts receive the name of colitis, appendicitis, &c. Enteritis forms the chief feature of some infective diseases due to the growth of special organisms, such as typhoid fever, dysentery, cholera. It may be acute, when, if severe, it is a dangerous condition often associated with inflammation of the stomach (gastro-enteritis). This acute type occurs in the summer diarrhœa of young children (see DIARRHŒA) and in outbreaks of food-poisoning, and a very violent form of enteritis is brought on by the action of irritant poisons like arsenic. In some persons enteritis of a milder type comes on after exposure to cold and damp. Occasionally enteritis is chronic, as in cases following dysentery or caused by tuberculosis. The chief symptom of enteritis is diarrhœa, with griping pain, in severer cases also vomiting and rise of temperature with, it may be, delirium, and later collapse and failure of the heart's action. In treatment the food should be lessened as much as possible, even withheld for a day or two, in order to minimise the irritation of the bowel; rest in bed with warmth to the abdomen is essential.

In the Lower Animals.—Among horses, inflam-

mation of the bowels generally results from some error of diet, such as a long fast followed by a large, hastily devoured meal, such as raw potatoes, boiled or indigestible and easily fermentable food, or large draughts of water at improper times. When thus produced, it is frequently preceded by colic, affects chiefly the mucous coat of the large intestines, and often runs its course in from eight to twelve hours. With increasing fever and restlessness, the pulse soon rises to 90 or upwards, and, unlike what obtains in colic, continues throughout considerably above the natural standard of 40 beats per minute. The pain is great, but the animal, unless delirious, instead of recklessly throwing himself about, as in colic, gets up and lies down cautiously. Respiration is quickened, the bowels torpid. Cold sweats, stupor, and occasionally delirium, precede death. When connected with, or occurring as a sequel to influenza, laminitis, and other complaints, the small intestines are as much affected as the large, and the peritoneal as well as the mucous coat of the bowels. When the animal is seen early, whilst the pulse is still clear and distinct, and not above 70°, and the legs and ears warm, bloodletting is useful, as it relieves the overloaded vessels, and prevents that extravasation of blood which speedily becomes poured out in the interior of the bowels. This disease should be treated as follows: Care should be taken not to further irritate the bowels by the administration of purgative or even aperient medicines, as the supposed constipation is due to the bowels having lost their function—loss of function being one of the phenomena of inflammation—and not to a dry condition of their contents. Anodynes and sedatives, as laudanum in two-ounce doses, or belladonna extract in two or three drachm doses, should be repeated every two hours until pain is relieved. Morphia and atropia subcutaneously injected are also now largely used by veterinarians with fomentations to the surface of the abdomen and an occasional clyster of warm water. No attempt should be made to force the bowels to action after apparent recovery, or the inflammation may be re-excited.

Enteritis in cattle is mostly produced by coarse wet pasture, acrid or poisonous plants, bad water, and overdriving. The symptoms are fever and thirst, a quick but rather weak pulse, restless twitching up of the hind limbs, tenderness of the belly, moaning and grinding of the teeth, and torpidity of the bowels. Calves generally die in three or four days, other cattle in a week or nine days. Enteritis in sheep mostly occurs in cold, exposed localities, and where flocks are subjected to great privations or improper feeding. The symptoms and treatment resemble those of cattle. The treatment prescribed for the horse is applicable to the cow, the doses being one-third larger.

Enteropneusta, a class of worm-like animals, including Balanoglossus (q.v.) and Cephalodiscus (q.v.). It is of great zoological importance because of the characters in which the members resemble vertebrates. The name, literally 'gut-breathers,' refers to the paired respiratory pouches opening from the front part of the alimentary canal.

Entomology (Gr. *entomon*, 'an insect,' *logos*, 'a discourse'), the study of Insects (q.v.).

Entomostraca, a general name for the lower orders of Crustacea, including Phyllopods, Ostracods, Copepods, and Cirripedes. See CRUSTACEA.

Entophytes. See PARASITIC PLANTS, PLANTS (DISEASES OF), SYMBIOSIS; also FUNGI.

Entozoa, internal animal parasites such as Tapeworms (q.v.). See PARASITIC ANIMALS.

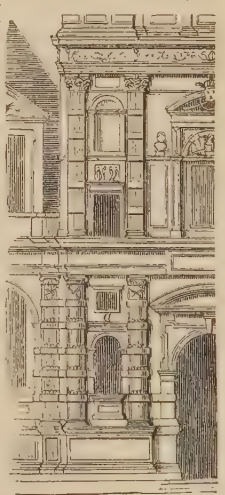
Entr'acte, in Music, is an instrumental piece, composed in the form of a short symphony or overture, to be performed between the acts of a play.

Entrecasteaux. See D'ENTRECASTEAUX.

Entre Douro e Minho, or, as it is frequently called, MINHO, a province of Portugal, in the extreme north-west of the country, is bounded on the N. by the river Minho, and on the S. by the river Douro. Area, 2800 sq. m.; population, 1,300,000. It has been called the Paradise of Portugal. The climate is agreeable and healthy. The chief productions are wine, oil, flax, maize, wheat, barley, oats, and vegetables. Wine is shipped largely at Oporto, the capital. Along the coast are numerous fisheries, at which great numbers find employment. The province of Minho consists of three districts, Braga, Vianna, and Oporto.

Entrenchments are the earthen parapets thrown up to give cover against the enemy's fire, and the ditches or trenches from which the earth is obtained for them. They may be either of the most hasty or of the most deliberate kind. Of the former class are the various patterns of shelter-trench, in which the men stand, kneel, or lie in the trench 1 foot 6 inches to 3 feet deep, and fire over a parapet 1 foot 6 inches to 2 feet 9 inches above the ground-level, and also the different saps used for siege purposes, in which the trench forms the roadway towards the fortress attacked, and the parapet gives cover to the troops using it. The deliberate kind include all field and permanent works, having a thick parapet of considerable height, over which the men fire, and by which they are protected, while the ditch from which the earth for the parapet has been dug forms an obstacle in its front (see FORTIFICATION). The term is also used for any fence, building, wood, or other natural cover that has been scientifically prepared for defence.

Entre Rios ('between rivers'), a province of the Argentine Republic, in the 'Mesopotamia Argentina,' between the Paraná and the Uruguay (whence its name). Estimated area, 20,000 sq. m.; population, about 416,000. The country is chiefly pastoral, but an increasing proportion is being put under cultivation, a wide area being now devoted to maize and wheat. The province is fertile and well watered, being even subject, in the south, to annual floods; nevertheless, the climate is very healthy. Lime and gypsum are worked. Cattle-raising and the making of meat-extract are important industries. The capital is Paraná (q.v.).



a, Entresol.

Entresol is a low story between two main stories of a building, generally above the first story, but in London most usually between the ground-floor and the first story. *Mezzanine* is another name for the entresol, as also for its low, broad windows.

Entropium, or ENTROPION (Gr. *en*, 'in,' and *trepō*, 'I turn'), inversion of the edge of the eyelid, consequent either on loss of substance on its inner surface, or on excessive action of the muscle (the orbicularis palpebrarum) which closes the lids. The eyelashes are turned inwards and rub upon the globe during the movements of the lids, producing much irritation, and sometimes opacity of the cornea. Temporary relief may be obtained by plucking out the misdirected lashes by the roots;

but the radical cure of severe entropium requires a careful adaptation of the surgeon's art to the circumstances of the particular case, and should not be attempted by unskilled hands. The most common cause of entropium is granular conjunctivitis. See EYE (DISEASES OF).

Entry, FORCIBLE. See FORCIBLE ENTRY.

Envelope, a wrapping, covering, or enclosing medium. Thus, the perianth of a flower is called its floral envelope; in a comet the nebulous covering of its head is the envelope; and in mathematics the locus of the ultimate intersection of a series of curves is termed an envelope. As a manufactured article, an envelope is a paper bag or pocket for containing letters, stationery, and other postal matter. Previous to 1840 envelopes were little known or used, though in Paris in 1653 a postal delivery was instituted, for which prepaid envelopes were used. Bishop Burnet, writing in 1714, mentions the use of an envelope for a letter; and Dean Swift, in his *Grub Street Poets*, writes:

> No letter in an envelope
> Could give him more delight.

In 1839 Rowland Hill, whose postal reforms were largely instrumental in their introduction, spoke of 'the little bags called envelopes.' With the establishment of prepaid postage in the United Kingdom on 1st May 1840, the adhesive stamp and an envelope with an allegorical design by Mulready, R.A., were simultaneously put on sale. The convenient stamp quickly displaced the Mulready envelope in public favour; a vast supply prepared for sale had to be destroyed, and the Mulready envelope has become a philatelic curiosity. It was not till towards 1850 that the use of envelopes became common. Now their manufacture is a huge industry, in which much ingenious machinery is employed.

The early forms of envelopes were made and folded by hand, and for exceptional forms, required in small quantities, hand-making still is practised. But for standard sizes, machines turning out as many as 100,000 per working day are exclusively employed. The first efficient envelope-making machine was patented in 1844 by Warren de la Rue and Edwin Hill. That machine differed from those now in use only in not gumming and folding the envelope in one operation. In modern practice a pile of 500 sheets or more, if the paper is thin, is cut at one operation by the steel blades of a punching-machine into blanks, of the shape and size of the required envelope. The adhesive solution used in the gumming process consists of gum arabic or dextrine, and is applied to the overlaps of the blanks by the gum-picker fed with the solution, as printing-ink is supplied to inking-rollers. In the folding-box the two sides and the lower flaps are pressed together and sealed. The envelope is next carried forward on an endless chain, and in its progress the gum on the upper flap is dried. Various devices for fastening envelopes are in use. For the carrying of heavy articles, envelopes strengthened with a lining of calico are employed.

In the stationery trade certain standard sizes of envelopes are recognised, corresponding with the size of the paper they are meant to enclose. Square or court envelopes are prepared for single-folded correspondence paper, whilst commercial or oblong forms accommodate twice-folded sheets. Again, in the trade a distinction is made betwixt what is called envelope shapes and bag shapes, the essential difference being that in the envelope shape the upper or sealing part is on the long side, whereas in the bag shape the sealing flap is on the narrow side of the envelope. Opacity is in general a desideratum in envelope paper, an object sometimes helped by printing lines on the inside of the paper. On the other hand, some envelopes have a panel of transparent paper through which the address shows.

Environment, a modern term for the influencing surroundings of an organism. Neither plant nor animal can be understood as a rounded-off unity; the whole life or function is made up of action and reaction between the organism and its environment. Streams of matter and energy from without preserve the relative constancy of the organism, as of a special wave-crest in the sea; while changes in the streams have their corresponding changes within. The plant or animal has obviously a strong unity of its own, but even that is in part due to ancestral welding under the hammers of the environment. It may seem, too, to vary of itself like a fountain in the air, but throughout all its rises and falls there blows the wind of the environment. The influence of outside conditions has been recognised by most naturalists from the time of Hippocrates, and is taken for granted in our everyday speech and action. There is considerable difference of opinion, however, as to the importance and degree of this influence. Thus Buffon, Treviranus, and Geoffroy St Hilaire regarded the surroundings as *directly* hammering changes on the organism; while Erasmus Darwin and Lamarck regarded internal changes as *indirect* functional results of new environment. Charles Darwin allowed a measure of truth in both these positions, but emphasised the indirect destructive action of the animate and inanimate environment in the struggle for existence. These three positions are still held, some emphasising one, others another, the majority combining the three (see EVOLUTION).

The external influences may be classified in four groups: (1) Molar or Mechanical; (2) Chemical; (3) Molecular or Physical; (4) Vital or Animate. A few instances of each kind will be given.

(1) *Molar or Mechanical Influences.*—Confined space brings about a dwarfed brood. Currents mould the sponges and corals, chisel the shells, cut up the water leaves; and the wind blows the trees out of shape. Vertical pressure may broaden out the form or produce latent life; while the very weight of structures effects many changes, from the mode of an egg's dividing to the slope of a tree's branches. On the whole, however, the mechanical hammers effect least.

(2) *Chemical Influences.*—Subtler but more potent are the influences which we group together as chemical. Good aeration—i.e. abundant oxygen—quickens development and stimulates the whole life. The 'vital combustion' is more rapid. In drought some animals become desiccated (see DESICCATION), and the Axolotl (q.v.), removed from the watery bed into less moist environment, becomes an Amblystoma. The composition of the medium seems to have a great influence on the forms and phases of simple unicellular life, and it is often very important in the case of eggs, embryos, and larvæ. Remarkable and perplexing changes may result from a slight change in the chemical composition of the sea-water. Food may be included under this group, and its influences are the greatest. To Claude Bernard the whole problem of evolution was very much a question of variations in nutrition. It is the food, to a large extent, which conditions the cyclic changes in cell-life from an active ciliated phase to a passive amœboid or encysted one (see CELL). Parasites in their passivity illustrate a nemesis at least exaggerated by their copious nutrition. Abundant food is associated with growth and asexual multiplication; the plant sends out its runners, the plant-lice continue their rapid parthenogenesis (see APHIDES), but a check to nutrition hastens the sexual climax. C. W. Beebe caused the scarlet tanager (*Piranga erythro-*

melas) and the bobolink (*Dolichonyx oryzivorus*) to keep their breeding plumage through the year by giving them fattening food and keeping them without much exercise in dim light. According to Sutton, hypertrophy of one part over another has been the principal process in the transition from hermaphroditism to unisexuality, while Barfurth emphasises the importance of fasting as a progressive factor in evolution. From the cell-cycle to the colour of canaries' feathers, the importance of the food-factor is widely demonstrable.

(3) *Physical Influences.*—Heat stimulates growth and hastens the reproductive maturity, while cold tends to dwarf and often produces coma. Maupas increased the rate of reproduction in an Infusorian five times by an elevation of 17° C. in the temperature of the water. Dr W. H. Dallinger has described how the monads which he succeeded in educating to stand a temperature high above the usual fatal point became not a little altered at the crisis of each successive elevation. Weismann has shown how an artificial winter induces the winter colouring of a certain Butterfly (q.v.). The sunlight which kills the floating germs has a beneficent action on most organisms, very notably on plants. In some cases it seems to affect colour, and Poulton has altered the colour of his Caterpillars (q.v.) by the tint of the glass under which they lived, or has produced golden chrysalids by keeping them in gilded boxes. Electric and probably magnetic energies seem also to have influences.

(4) *Vital Influences.*—In the web of life organisms influence one another indirectly in a hundred ways, but they have likewise their direct influences. There are animate as well as inanimate 'hammers.' Sea-spiders specifically alter Hydroids, and Semper also notes the mutually influencing associations of a snail and a coral, of an Annelid and an Antipathes (a genus of Zoantharia). Crustacean parasites may very effectively alter their crustacean hosts, and internal guests have also marked results. In some cases, such as galls, insects produce individual modification in the plants they frequent.

Hundreds of cases of external influence, now on one system, now on another, are known, but few are thoroughly understood. The observation of the results is one thing, their rationale another. In a general way, barring purely mechanical modifications, the influences are referable to two classes—one set increasing constructive processes, storage of energy, passivity, anabolism; the other set increasing destructive processes, expenditure of energy, activity, katabolism.

The susceptibility of organisms to outside influences is very varied. Simple and young forms are evidently more in the grip of external circumstances than are complex and adult organisms. The cell, the seedling, the child, are more impressible than the worm, the tree, the man. Passive forms also, like sponges and algæ, corals and trees, are much more under the tyranny of surroundings than active organisms with devices at command for parry or escape. The vegetative system, again, is oftener affected than the reproductive.

The degrees of influence are also very varied. The dints of the environment may be deep or superficial, very direct or very remote in their results. A primary influence from without may have more than one result within the organism, by starting correlated variations. The influence may remain without apparent result in the individual, and yet the nemesis may be evident in the offspring. Influences may also accumulate within the organism without any evident outcrop for a time, but at length an indirect, at first sight spontaneous, change may be the far-off result. The influence of environment in forcible distribution, in a cataclysmic destruction of local fauna, and the countless indirect results of changed conditions must also be kept in view.

It remains unproved that bodily modifications induced by changes in the environment can be transmitted to the offspring as such or in any representative degree (see HEREDITY). The relation between organisms and their environment remains, however, of essential importance. We must recognise the fact of the constant dependence of the living creature on its surroundings, the fact of transient individual adjustment and lasting individual modification, the fact that modifications may have secondary effects on the offspring, and the fact that environmental changes may act on the germ-plasm as variational stimuli.

See Semper's classic work, *The Natural Conditions of Existence as they affect Animal Life* (Inter. Sc. Series, 1880); T. H. Morgan, *Experimental Zoology* (1907); the articles DARWINIAN THEORY, EVOLUTION, HEREDITY, WEISMANN, and authorities there named.

Envoy, a diplomatic minister inferior to an Ambassador (q.v.). Like the latter, he receives his credentials immediately from the sovereign, though he represents not his prince's personal dignity but only his affairs. He thus ranks above the Chargé d'Affaires (q.v.). See CONSUL.

Enzeli, now PAHLEWI, on the Caspian, is the port of Reshd (q.v.).

Enzymes. See FERMENTATION.

Eoanthropus ('dawn-man'), a generic name given by Dr Smith Woodward in 1912 to a late Pliocene or early Pleistocene race of man (*Eoanthropus Dawsoni*), represented by some fragments of a skull and mandible found by Mr Charles Dawson in a gravel-pit at Piltdown, Fletching, near Lewes. A canine tooth was got in 1913; new fragments in 1915. The skull is remarkable for its extreme thickness. Owing to the fragmentary character of the remains, attempted reconstructions disagree. Sir Arthur Keith's restoration gives the Piltdown man a skull and brain of approximately the form and size of modern races. Dr Smith Woodward gives him only about two-thirds of the modern man's brain-capacity. The jaw, on the other hand, is much more ape-like. Some think it a chimpanzee's. Eoanthropus thus differs from the Neanderthal race, which has a more simian brain and more human jaw. We may regard the human stem as divided into four branches —Pithecanthropus, Eoanthropus, Neanderthal, and that represented by present-day man.

Eocene System, in Geology. This is the lowest or oldest series of strata included in the Tertiary division. The name Eocene (*ēōs*, 'dawn,' *kainos*, 'recent') was introduced in 1830 by Lyell, whose classification of the Tertiary formations was based on the proportions of living species of molluscs which the strata contain. The oldest members of the series, containing as they do only an extremely small proportion of such recent forms (according to Lyell, 3½ per cent.), were looked upon as indicating the dawn of the existing state of the molluscan fauna. With necessary modifications, Lyell's classification has maintained its place, but the names of the various subdivisions of the Tertiary strata, first suggested by an examination of the European deposits, are now used without reference to the precise percentage of living molluscan species which the beds may chance to contain. The Eocene beds rest unconformably upon the Chalk or Cretaceous strata—hence there is a break in the succession. A movement of elevation followed upon the close of the Cretaceous period, and the sea disappeared from middle Europe. Probably the British area at this time was connected with what are now the opposite coasts of the Low Countries and

France, and considerable denudation of the later Cretaceous deposits supervened. Ere long, however, partial subsidence set in, and at the beginning of Eocene times the sea commenced to invade those regions in the south-east of England, the north of France, and the low grounds of Belgium, in which we meet with the oldest accumulations of Tertiary times.

The Eocene system, as developed in England, occurs chiefly in two districts, called respectively the London and Hampshire basins. In the north of France it forms another large basin, in the centre of which is Paris, and it likewise spreads over a considerable area in Belgium. The strata are partly of fresh-water and partly of marine and brackish-water origin, and consist principally of more or less unconsolidated sands, clays, loams, marls, &c., with which are here and there interstratified layers of limestone and lignite. Grouping the Anglo-French and Belgian strata together, we have the following succession:

	England.	France and Belgium.
Upper Eocene.	Barton Clay and Upper Bagshot Sands	Gyps marin: Sables moyens.—Wemmelian.
Middle Eocene.	Bracklesham Beds: Middle Bagshot Sands.	Calcaire grossier.—Lækenian: Bruxellian.
Lower Eocene.	Lower Bagshot Sands	Wanting in France: Panisellian, Upper Ypresian.
	London Clay and Bognor Beds	Wanting in France.—Lower Ypresian.
	Oldhaven Beds	Not recognised.
	Woolwich and Reading Beds	Argile plastique: Lignites du Soisonnais.—Upper Landenian.
	Thanet Sands	Sables de Bracheux.—Lower Landenian and Heersian.

In the south of Europe the Eocene system is developed on a much larger scale. In place of the limited basins of the Anglo-French and Belgian areas we encounter a thick and widespread series of limestones and calcareous sandstones. These accumulations appear on both sides of the Mediterranean, in Spain, and in Morocco. They enter largely into the composition of the Apennines, the Alps, the Carpathians, and the Balkans; they extend through Greece, Egypt, and Asia Minor, and thence through Persia and the Himalayas to the coasts of China and Japan. The most characteristic feature of these thick calcareous beds is the occurrence in prodigious numbers of nummulites—a foraminifer. Another noteworthy feature of the Eocene system of southern Europe is the occurrence in the Alpine region of Bavaria of certain sandstones, &c. (locally called *Flysch*), in which appear many gigantic erratics of various crystalline rocks—the precise source of which is not known. They may possibly have been derived from the archæan masses of Bohemia. In North America the more important Eocene strata are the great lacustrine deposits of the Rocky Mountain region and the plateaus lying to the west. But marine deposits of the same age occur also along the borders of the Atlantic, the Mexican Gulf, and the Pacific.

The flora of the Eocene is represented chiefly by dicotyledonous and monocotyledonous plants, and had a prevalent Indo-Australian character. Palms, screw-pines, cypresses, and various proteaceous plants grew in England in early Eocene times, and with these were associated species of custard apple, gourd, melon, oak, walnut, magnolia, &c. Amongst the forms of later Eocene times were species of gum-tree, nettle-tree, and banksia, fan-palms and screw-pines, aroids and cacti. Evergreens were represented by laurels, cypresses, and yews, while deciduous trees were represented by species of maple, plane, willow, poplar, elm, beech, chestnut, hornbeam, walnut, fig, &c. The fauna, like the flora, is also indicative of somewhat tropical conditions. Among the characteristic molluscs were species of Conus, Voluta, Cypræa, Oliva, Nautilus, &c. Sharks were numerous, such as Otodus, Lamna, and Carcharodon; and reptiles were represented by turtles, terrapins, snakes, lizards, crocodiles, and alligators. None of the great Mesozoic Saurians, however, survived into Tertiary times. Among the more remarkable birds were Odontopteryx, the jaws of which had tooth-like denticulations, and Dasornis, akin apparently to the extinct gigantic Dinornis of New Zealand. Early forms of modern types were also present, such as species of heron, gull, vulture, buzzard, woodcock, quail, pelican, flamingo, ibis, &c. Many of the mammals of Eocene times were remarkable for the union of characters intermediate between marsupials and carnivores. Tapir-like animals, such as Palæotherium, seem to have abounded. Another common form was Anchitherium, which had affinities to the Palæotheres and true horses. There were also many hog-like animals with intermediate or generalised characters, as well as transitional hornless forms of deer and antelopes. From the Eocene also come the earliest of the Prosimiæ—the lemuroid Cænopithecus, as well as ancestral forms of bats, hedgehogs, and squirrels. From the American Eocene lacustrine beds have been obtained remains of some very remarkable types. Among these are four-toed and five-toed ancestors of the horse, and Dinoceras, an animal as large as the elephant, furnished with three pairs of horns and two long tusk-like canines (see DINOCERATA). Another strange order of animals (Tillodonts) combined characters which are now met with in such distinct groups as the ungulates, rodents, and carnivores.

The Eocene deposits of the Anglo-French and Belgian area appear to have accumulated in an inland sea opposite the mouths of one or more great rivers. In Eocene times large areas which are now land were under water; the Mediterranean extended farther north and south than it now does, while eastwards it stretched into Asia, perhaps to the Indian Ocean. The Pyrenees, Alps, Carpathians, and Himalayas were inconspicuous heights. Since the Nummulitic sea washed their base, they have been upheaved for thousands of feet—the old floor of that sea is now met with in the Alps at heights of over 10,000 feet, in the Himalayas at 16,500 feet.

Eolians. See ÆOLIANS.

Eoliths, a name given by some archæologists to very early and roughly broken Flint Implements (q.v.), or natural flints assumed to have been used as weapons by human beings at an earlier date than the oldest and rudest palæoliths. See ANTHROPOLOGY, STONE AGE.

Éon de Beaumont, CHARLES GENEVIÈVE TIMOTHÉE D', known as the *Chevalier d'Éon*, was born at Tonnerre, in Burgundy, in 1728, studied law, and became an advocate. He attracted the notice of the Prince de Conti by some political writings; and in 1755 was introduced by the latter to Louis XV., who employed him in diplomatic missions to Russia and Austria. After serving a short time in the army, not without distinction, he was sent to London in 1762 as secretary of embassy, and shortly after was made minister plenipotentiary. On the death of Louis XV., the French ministry deemed it prudent to recall him, as they were afraid he might betray their secrets to the English government, which made him brilliant offers. After much negotiation, Éon consented to surrender certain compromising papers, and submit to the condition imposed by Louis XVI. of wearing feminine garb, which he had often before assumed as a disguise, and which he now wore till his death. The doubt as to his sex, fostered by his parents in his childhood, was maintained, for reasons which can only

be conjectured, till the end of his life. On the outbreak of the French Revolution, while he was again in London, he offered his services to the French nation, but nothing came of his offer. He maintained himself by giving lessons in fencing till in 1796 he was disabled by an accidental wound, after which he was reduced to great destitution. He died 21st May 1810, when an examination of his remains by a surgeon settled the question of his male sex, and put an end to the curiosity of the English public. His writings appeared at Amsterdam (1774) under the title of *Loisirs du Chevalier d'Éon*. The *Mémoires* which bear his name are not genuine. See Telfer, *The Chevalier d'Éon de Beaumont* (1885–96); Laughton's *D. N. B.* article (1888); a monograph by Vizetelly (1895), and the Life by Homberg and Jousselin (1904; Eng. trans. 1911).

Eos. See AURORA.

Eosin. See DYEING.

Eötvös, JOZSEF, BARON (1813–71), Hungarian author, was born and died at Budapest. He became an advocate in 1833, but soon devoting himself to literature, published two comedies and a tragedy, a work on prison reform, his first great novel, *The Carthusian* (1838–41), *The Village Notary* (1846; Eng. trans. 1850), &c. In the revolution of 1848 Eötvös was Minister of Public Instruction, as again under Andrassy (1867) after three years of exile.

Eozoön, the name given in 1864 by Sir William Dawson to an assumed organism (apparently a foraminifer) whose supposed remains constitute reefs of rock in the Archæan System in Canada; but the belief that it is inorganic steadily gained ground, and is now universally accepted.

Epacridaceæ, a small order of heath-like shrubs or small trees, usually indeed reckoned as the Australian sub-order of Ericaceæ, from which they are chiefly distinguished by the epipetalous stamens destitute of the peculiar specialisations of anther-dehiscence or appendages. Many species —e.g. *Epacris grandiflora*, &c., are cultivated in our greenhouses along with the heaths proper. A few produce edible berries. See CRANBERRY.

Epacts (Gr., 'additions'), in Ecclesiastical Chronology, a set of nineteen numbers used for fixing the date of Easter and other church festivals, by indicating the age of the moon at the beginning of each civil year in the lunar Cycle (q.v.). At the reformation of the calendar in 1582 it was found that the Golden Numbers could no longer by themselves serve the purpose of adjusting the double reckoning by lunations and by the tropical or true year; and thus, instead of adopting the more rational computation, the Roman Church devised the artificial and involved method of epacts. The main point to determine is the age of the moon (in entire days) at the beginning of each civil year, or the number of days between the end of the ecclesiastical year in December and the 1st January succeeding. Thus, subtracting 354 days (12 lunations) from 365, we should have 11 days for the first annual epact, then 22 for the year following, then 3, 14, 25, 6, 17, 28, 9, 20, 1, 12, 23, 4, 15, 26, 7, 18, and 29; the series of 19 numbers being obtained in succession by adding 11, and when the sum exceeds 30, subtracting that number. This illustration, however, is simpler than any actual case, by reason of the leap-years, which require 12 to be added for the following epact, and of the fact that no lunation is exactly 30 days long. When the lunar cycle of 19 years is completed, the epacts recur again in the same order. In the Anglican reckoning, as distinguished from the Roman, it is noteworthy that the Gregorian epact for any year is the same as the Julian epact for the year preceding, owing to the coincidence that 11, the number of days lost on the Julian account before our parliament adopted the reformed Calendar (q.v.), is also the number of days between the lunar and the solar years. The epact determines by subtraction the date of the first new moon in January; then by adding 29 and 30 alternately the successive new moons throughout the year are assigned to their respective dates. See Delambre's *Astronomie Moderne*, vol. i. 4–32.

Epaminondas, the most eminent of Theban generals and statesmen, and one of the noblest figures in Greek history, was born towards the end of the 5th century B.C. He was descended from an ancient but impoverished family, and led a retired life till his fortieth year, profiting by the instructions of Lysis the Pythagorean, an exile from Tarentum, who inspired him with enthusiasm for the elevated ideas which it was the object of his life to realise. Plutarch tells us that Epaminondas saved the life of Pelopidas in battle in 385, which was the beginning of one of the most famous friendships of antiquity. After the desperate but successful stratagem by which his fellow-citizens recovered the *Cadmeia* and expelled the Spartans (379), Epaminondas stepped forward immediately into the ranks of the patriots; and, when sent to Sparta in 371 to negotiate a peace between the two countries, displayed as much firmness and dignity as eloquence in the debate which ensued upon the question whether Thebes should ratify the treaty in the name of all Bœotia, the result of which ratification would have been equivalent to a recognition of her claim to supremacy over the Bœotian towns. To this the Lacedemonians demurred, and the war was again resumed; Epaminondas was appointed to the chief command, and along with Pelopidas, with an army of but 6000 men, defeated twice that number of the enemy at Leuctra (371). Two years later, with Pelopidas, he marched into the Peloponnesus, and incited several of the allied tribes to fall away from Sparta. On his return to Thebes, Epaminondas was accused of having violated the laws of his country by retaining the supreme power in his hands beyond the time appointed by law, but was acquitted in consequence of his open and animated defence. In the spring of 368 the war between Thebes and Sparta was renewed with increased fury, and Epaminondas made a second and somewhat unsuccessful invasion into the Peloponnesus, receiving on his return a check from Chabrias at Corinth. To atone for this unsuccessful undertaking he advanced with 33,000 men into Arcadia, and joined battle with the main body of the enemy near Mantinea, in the year 362 B.C. Epaminondas charged at the head of his men, and broke the Spartan phalanx, but was mortally wounded in the breast by a javelin. Being told by the physicians that he would die as soon as the weapon was extracted, he waited till he heard that the Bœotians had gained the victory, then drew out the javelin with his own hand, exclaiming: 'I have lived long enough.' See his Life by Cornelius Nepos, and, in German, Bauch (1834) and Pomtow (1870).

Epaulette (from the French *épaule*) is a fringed shoulder-knot worn since 1795 by commissioned officers of the British navy, sub-lieutenants wearing one of gold lace, and other ranks two. Crowns, anchors, and stars worked in silver on the epaulette, and the size of the cords of the epaulette itself, indicate the degree of rank. Previous to the Crimean war officers of the British army wore gold epaulettes, and the men worsted ones. Many foreign nations still retain them for both naval and military officers.

Épée, CHARLES MICHEL, ABBÉ DE L', instructor of the deaf and dumb, was born at Versailles, 25th

November 1712. Taking orders, he became a preacher and canon at Troyes, but eventually, on account of his Jansenist opinions, was deprived of this office, and now lived in retirement in Paris. In 1765 he first began to occupy himself with the education of two deaf and dumb sisters; and, as he asserts, without any previous knowledge of Pereira's efforts in the cause, invented a language of signs, by which persons thus afflicted might be enabled to hold intercourse with their fellow-creatures. His attempts being crowned with success, he determined to devote his life to the subject. At his own expense he founded an institution for the deaf and dumb, which was first publicly examined in 1771, and from 1778 received an annual subsidy. It was not, however, converted into a public institution till two years after his death, which took place 23d December 1789. He wrote two or three works on his system, for an estimate of which see Hartmann's *Deafmutism* (Eng. trans. 1881). See DEAF AND DUMB.

Epeira, a genus of spiders, the type of a family called Epeiridæ, including the common Garden Spider (*Epeira diadema*). See SPIDER.

Eperies (Slovak *Prešov*), an old town of Czechoslovakia, on the Tarcza, 150 miles NE. of Budapest. It is the seat of a Greek Catholic bishop, and has a college. A conflagration of 7th May 1887 destroyed 400 houses and most of the chief public buildings. It manufactures earthenware, linens, and woollens, and has some trade in corn and Tokay wine; whilst in the vicinity are the Sovar salt-works. Pop. 18,000.

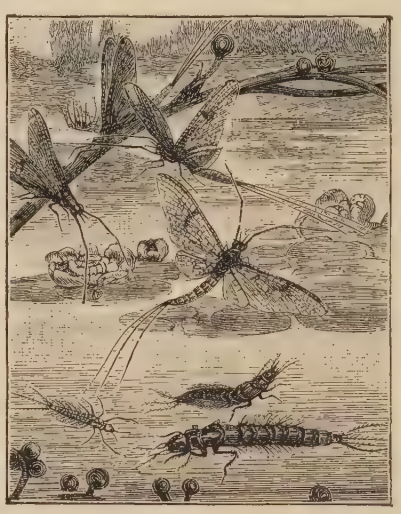
Épernay, a town in the French department of Marne, is the headquarters of the *Vins de Champagne*, and is situated in the midst of a rich vine-growing district, on the left bank of the Marne, 19 miles WNW. of Châlons. It is handsomely built, clean, and well paved. Its environs consist, for the most part, of elegant villas, with vaults attached, belonging to the Champagne wine-merchants. Épernay manufactures large quantities of earthenware from a clay obtained in the neighbourhood, and called *Terre de Champagne;* also hosiery, refined sugar, and leather. It has a brisk trade in bottles, corks, wire, &c., as well as wine. Pop. 22,000.

Ephah, a measure of capacity in use among the Hebrews, equivalent to about $8\frac{2}{3}$, or, according to others, 6·468, imperial gallons.

Ephemera ('day-fly' or 'May-fly'), a genus of well-known insects which appear in vast numbers on summer evenings from rivers, canals, and ponds, and after a short merry life disappear as suddenly as they came. The genus Ephemera is type of the family Ephemeridæ or May-flies in the wide sense. The family is usually ranked among the amphibious Neuroptera, not far from Dragon-flies and Perlidæ.

A thin delicate body, with filmy wings, of which the anterior are much the larger and sometimes the only pair; rudimentary mouth-parts in the adults, which fast throughout their short aerial life; a long-lived voracious larval existence in the water, with so-called tracheal gills for aquatic respiration, are striking features of the Ephemerids. The antennæ are short and awl-shaped; the eyes of the males are very large; the head-shield is enlarged, covering the rudimentary mouth-parts; the middle ring of the thorax is exaggerated; the legs are delicate; the thin abdomen ends in two or three long filaments.

The life-history of these delicate ephemeral insects is very interesting. The eggs are laid in the water and give rise to aquatic larvæ, which live sometimes two or three years, moulting many times. They prefer running water, hide under stones or make burrows in the mud, have well-developed mouth-parts, and feed hungrily enough on other insects. The tracheæ or air-tubes, as the figure shows, are expanded in plate-like or tuft-like paired structures down the sides of the posterior body. A pupa stage eventually follows, during which the larva acquires wings and other adult structures, but the insect which emerges and leaves the water is, curiously enough, not yet ready for its short adult life. Though it has wings, it is still encumbered by a delicate robe. This sub-imago, as it is often called, finds some resting-place on grass stem or tree trunk, gets rid of its last encumbrance, and begins its life of a day. The cast-off ghost-like exuviæ are found in great



Metamorphoses of the May-fly.

numbers. In the summer evening the males and females enjoy a brief merry love-dance. The females are fertilised, the eggs are dropped into the water, and then sometimes in a single day the bright crowd is gone. It is literally true that at the moment of their climax they die.

The most familiar species is *Ephemera vulgata*, the common May-fly, the green drake (sub-imago) and gray drake of anglers. Palingenia, Heptagenia or Bäetis, Cloë, Caenis, are almost common genera. The adult larvæ are used for bait; the corpses of the adults are sometimes abundant enough to serve as manure. The Ephemerids date back to the Devonian epoch. See ANGLING.

Ephemera (from Gr. *epi* and *hēmera*, 'on a day'), or FEBRIS DIARIA in Latin, a fever which lasts only a single day, or part of a day, and is generally dependent on some slight local irritation. It hardly requires any other treatment than the removal of the cause, if known.

Ephemeris. See ALMANAC, and DIARY.

Ephesians. EPISTLE TO, one of the letters written by St Paul during his imprisonment, probably at Rome. It is very doubtful if the epistle was written specifically to Ephesus. The earliest MSS. omit the words 'in Ephesus' in the opening verse, and it is difficult to suppose that the apostle would have written to a church where he had worked for three years, and must have made many friends, without sending personal messages and salutations. Many modern scholars regard the epistle as a circular letter addressed to a group of churches in the province of Asia. It forms a companion epistle to Colossians, with which it has many points of similarity. Both these epistles are characterised by a very exalted conception of the

Person of Christ, and in Ephesians the doctrine of the church is more highly developed than in any other epistle. The question of the Pauline authorship of Ephesians has been raised anew by Dr Moffatt in his *Introduction to the New Testament*. Dr Moffatt thinks that the style and linguistic characteristics of the epistle are un-Pauline, and that the theological outlook is in advance of that which we find in the genuine epistles. His arguments, however, are not conclusive, and the general tendency among modern scholars is to maintain the Pauline authorship of the epistle.

Ephesus, one of the twelve Ionic cities of Asia Minor, was situated in Lydia, near the mouth of the river Cayster, in the midst of an alluvial plain. It was long before Ephesus acquired any political importance, in spite of being a sacred city from an early period. Subdued first by the Lydian, and next by the Persian kings, it was included, after the death of Alexander the Great, in the territories of Lysimachus (281 B.C.), by whom it was greatly strengthened. Ultimately it came into the possession of the Romans; and in the time of Augustus, when Strabo wrote, it was 'the greatest place of trade of all the cities of Asia west of the Taurus.' This was also its condition when visited by St Paul, who resided here three years; but the destruction of its great temple by the Goths, in 262 A.D., gave it a blow from which it never recovered. In 431 it was the scene of the *third* general council of the Christian Church. Its general history, while a city of the Byzantine empire, was unimportant, and before the days of Tamerlane it had almost completely perished.—The ruins of Ephesus comprise a stadium 687 feet long, fragments of a great theatre (alluded to in the account of St Paul's preaching in the city), of an odeum or music-hall, and of various walls and towers, belonging to the Greek, Roman, and Byzantine eras. About a mile north-east of the ancient city was the site of the famous Temple of Diana. This marvellous building, one of the seven wonders of the world, was originally built by Chersiphron; but on the night (as is said) when Alexander the Great was born (356 B.C.), it was fired by Herostratus, an Ephesian, thereby to immortalise his name. It was afterwards rebuilt by the inhabitants in a style of greater splendour than before. It was the largest Greek temple ever constructed. Its length, according to Pliny, was 425 feet, its width 220; and the number of its columns 127, each 60 feet high. Wood's excavations (1869–74), carried much further and completed by Hogarth (1904–5), proved that there were two older temples under it (one of 600 B.C. and one of the time of Crœsus, apparently finer than its successor); and masses of votive tablets, statuettes of the goddess, and Egyptian scarabs were found. In the third temple were numberless statues and pictures by the best masters of Greece. The altar of the goddess was principally adorned with the works of Praxiteles. Plundered of its treasures by Nero, and burned (as has been mentioned) by the Goths, it was most likely finally destroyed by the iconoclasts, in the reign of Theodosius I., who issued his celebrated edict against the ceremonies of the pagan religion 381 A.D. The site is now occupied by some wretched villages, the principal of which is Ayasaluk.

See Falkner, *Ephesus and the Temple of Diana* (1862); J. T. Wood, *Discoveries at Ephesus* (1877); Fergusson, *The Temple of Diana at Ephesus* (1883); *Forschungen in Ephesos* (i. 1907); Hogarth, *Excavations at Ephesus* (1908); and the articles ARTEMIS and SEVEN SLEEPERS.

Ephod, a principal part of the official dress of the Jewish high-priest, was a vest of rich colour and materials, covering the breast and waist, with shoulder-straps; on each shoulder was placed an onyx stone, with the names of the twelve tribes engraved, six on each, and a pouch for the Urim and Thummim. Ephods made of common byssus were worn by other priests.

Eph'ori (Gr., 'overseers'), an order of magistrates in ancient times which appears to have originated at Sparta, and to have been peculiar to the Doric governments. Herodotus attributes their creation to Lycurgus, and Aristotle to Theopompus (770–720 B.C.). Their duty was to superintend the internal administration of the state, especially affairs of justice, and to oversee some part of the education of youth. They were five in number, were elected by and from the people—on which Aristotle observes that through them the *dēmos* enjoyed a participation in the highest magistracy of the state—and held their office only for one year. Their influence gradually increased, for their powers were so ill defined that it was difficult to say what was *not* under their cognisance and authority. Ultimately the kings themselves became subject to the supervision of the ephori; thus, Cleomenes was brought before them for bribery, Agesilaus was fined, and Pausanias imprisoned. They also transacted the negotiations with foreign powers, subscribed treaties, raised troops, intrusted the army to the king or some other general, and, in fact, acted as the executive of the state. Their authority was at last destroyed by Agis and Cleomenes, who put the whole college to death, and restored the old Spartan constitution (226 B.C.). See Dum, *Entwickelung des Spartanischen Ephorats* (1878).

Ephraem Syrus, 'the prophet of the Syrians,' a celebrated teacher, orator, and hymn-writer of the Syrian Church, was born at Nisibis about 306. After Nisibis was taken by the Persians in 363 he removed to a cave near Edessa, which was already a chief seat of Syrian learning. He there devoted himself to prayer and fasting, and the study of the Scriptures. He died at Edessa about 378. His day is in the Roman Church the 1st of February, and among the Greeks and Maronites the 28th of January. Ephraem's strict orthodoxy, his asceticism, and his great learning were the admiration of his contemporaries; and the works he has left behind him, written in a fervid and popular style, sustain his reputation as an orator and poet. He was a most fertile writer. Part of his works have come down to us in their original Syriac, part in Greek, Latin, and Armenian translations. Of the Syriac writings the chief are his commentaries (based on the Peshito), extending to nearly the whole of the Old Testament, and they include also numerous discourses and elegies, mostly written in lines of seven syllables, grouped in strophes of from four to twelve lines each. Ephraem counteracted the influence of the Gnostic hymns of Bardesanes and Harmonius by writing better hymns of a strictly orthodox tendency. The Greek writings which bear his name are mainly sermons and short religious treatises. An edition containing 156 of these was published by Edward Thwaites at Oxford in 1709. There are editions by Assemani, in 6 vols. folio (3 vols. Greek texts and 3 vols. Syriac texts, with Latin translations, Rome, 1732–46), and Mercati (Syriac, Greek, and Latin, Rome, 1915, *et seq.*). The Syriac text of his select works was edited by Overbeck (Oxford, 1865). A tasteful English translation of a number of pieces was published by Henry Burgess in 1853. Ephraem's Commentaries on the Epistles of St Paul are extant in Armenian (ed. by Aucher, Venice, 1836). See treatises on Ephraem and his works by Lengerke (1831), Alsleben (1853), Gerson (1868), and Zingerle (1876).

Epiblast. See ECTODERM, EMBRYOLOGY.

Epicharmus, a famous Greek poet, was born in the island of Cos in the 6th century B.C. He spent the latter part of his life at the court of Hiero of Syracuse, and died at the age of ninety. Epicharmus is called by Theocritus the father of comedy, and Plato assigns to him a place among comic writers as high as that of Homer among epic poets. None of Epicharmus's works survive entire; but we possess several fragments and the titles of thirty-five. They embraced a wide variety of topics, mythological, social, and political. From one of them Plautus borrowed the plot of his *Menæchmi.* See Lorenz, *Leben u. Schriften des Epicharmus* (1864).

Epic Poetry (Gr. *epos,* 'a word,' 'a discourse'), the longest and most elaborate form of narrative poetry, wherein are celebrated continuously and in the grand style the momentous enterprises and great achievements of one or more heroic personages of history or tradition. A distinction is to be drawn between 'epics of growth' and 'epics of art.' Epics of growth consist of collections of ballads or poems composed by different authors at different times, and dealing with a connected series of events; examples are the *Kalevala,* the *Rámáyana* and *Mahábhárata, Beowulf, Chanson de Roland,* and the *Nibelung* story (Icelandic version). In this sense the epic is one of the earliest poetic forms in which the human imagination has found expression, and is important not merely from a literary standpoint, but also from the point of view of the light so thrown on questions of sociology, ethnology, and archæology. As distinct from epics of growth, epics of art are epics in which events are grouped round some great structural thought by a single poet consciously adopting the long-established form and accepted model of the epic of growth; examples are the *Argonautica* of Apollonius and of Flaccus, the *Æneid,* the *Thebaid* of Statius, the *Lusiads, Paradise Lost,* and *Jerusalem Delivered.* Such epics as the *Iliad* and the *Shah Nameh* really belong to both classes at once, the raw material of the epic of growth being transformed in its passage through the mind of the master of the epic of art. From romantic poetry the epic form is mainly distinguished by a greater solidarity in its subject-matter. For subject the *Iliad* and *Odyssey,* Virgil's *Æneid,* the *Poema del Cid,* Ariosto's *Orlando Furioso,* and Tasso's *Jerusalem Delivered,* and other epics turned to the achievements of the gods and heroes of old, or to the deeds of the little less mythic knights of mediæval chivalry; on a religious theme Milton, in his *Paradise Lost,* produced one of the world's greatest epics, and Klopstock wrote his *Messiah;* Lucan in his *Pharsalia,* Silius in his *Punica,* Camoens in his *Lusiads,* Ercilla in his *Araucana,* Voltaire in his *Henriade,* De Menezes in his *Henriqueida,* and others, went to the field of documented history, but all with ill-success, save Camoens, the field of authentic history being, from the nature of the case, much less rich in true epic inspiration than the field of fabled and storied antiquity.

Owing to the somewhat elusive nature of the conception of epic poetry, much diversity of opinion has always existed as to precisely what works are to be ranked as epics. Ossian's *Fingal,* however, would seem too empty of narrative interest for inclusion; Dante's *Divina Commedia,* if not something *sui generis,* is an allegory; Barbour's *Bruce* and Blind Harry's *Wallace,* though heroic, are hardly epic; Spenser's *Faerie Queene* is essentially allegorical; Southey's *Roderick* and Morris's *Life and Death of Jason* are in the last resort romantic; while Tennyson's *Idylls of the King* lacks both the arrangement and interrelation of an epic. Such poems as Scott's *Marmion* have been classed by some as genuine miniature epics. To quite another class—the mock-epic—belong such poems as Pope's *Rape of the Lock,* Butler's *Hudibras,* and the like. It may be that with the advance of civilisation the epic manner has become in very large measure outworn, but certain it is that since the time of Milton no great epic has appeared, as witness in England the failure of Glover's *Leonidas,* and the small promise of success held out by Keats's unfinished *Hyperion.*

For various epics see separate articles, or articles on the authors of these epics; see also W. P. Ker, *Epic and Romance* (1897, new ed. 1922); J. Clark, *A History of Epic Poetry* (1900); G. Murray, *The Rise of the Greek Epic* (3d ed. 1924); H. M. Chadwick, *The Heroic Age* (1912); W. M. Dixon, *English Epic and Heroic Poetry* (1912); L. Abercrombie, *The Epic* (1917).

Epictetus, a celebrated disciple of the Stoa, was born at Hierapolis, in Phrygia, about 50 A.D. He was at first the slave of Epaphroditus, a freedman of Nero, at Rome, and endured his severe treatment with characteristic stoic equanimity. After being manumitted he devoted himself to philosophy, and was banished by Domitian, along with several other philosophers, from Rome. He settled at Nikopolis, in Epirus. He left no works behind him, but his pupil Arrian, the historian of Alexander the Great, collected his maxims with affectionate care, in the work entitled *Enchiridion* ('Handbook') and in eight books of Commentaries, four of which are lost. These reveal the simple and noble earnestness of the philosopher's character, as well as that real heartfelt love of good and hatred of evil which is often assumed to be an exclusively Christian feeling. Epictetus believes in our 'resemblance' to God, in our 'relationship' to him, and in our 'union' with him through the coincidence of the 'will' and the 'soul;' he recognises the contest between good and evil, the life-struggle in the heart, the divine life against which the law in the members wars; and he affirms the necessity of 'invoking God's assistance in the strife,' that the inner life may become pure as God is pure. His ethics teach self-renunciation, endurance, and the duty of confining the ambition within the limits of the attainable. There are editions by Schweighäuser (1799–1800), and Schenkl (1894–98). See STOICS.

Epicurus, an illustrious Greek philosopher, was born 341 B.C., in the island of Samos, where his father, Neocles, was a schoolmaster. At the age of eighteen he repaired to Athens, but his stay was short, and he returned to Asia. He had attached himself to the study of philosophy, especially that of Democritus; his own scheme of physics is evidently based on the atomic system of Democritus. At Mitylene he first opened a school of philosophy; and there and at Lampsacus and elsewhere he taught for some years. In 307 B.C. he returned to Athens, and established a school of philosophy in a garden which he purchased and laid out for the purpose. From this circumstance his followers were called the 'philosophers of the garden.' Although Epicurus laid down the doctrine that pleasure is the chief good, the life that he and his friends led was one of the greatest temperance and simplicity. They were content, we are told, with a small cup of light wine, and all the rest of their drink was water; and an inscription over the gate promised to those who might wish to enter no better fare than barley-cakes and water. The calumnies which the Stoics circulated concerning him are undeserving of notice, and were at no time generally believed. Epicurus's success as a teacher was signal; great numbers flocked to his school from all parts of Greece and from Asia Minor, most of whom became warmly attached to their master, as well as to his doctrines, for Epicurus seems to have been characterised not

less by amiability and benevolence than by force of intellect. He died 270 B.C., in the seventy-second year of his age.

Epicurus was a most voluminous writer. According to Diogenes Laertius, he left 300 volumes on Natural Philosophy, Atoms and the Vacuum, Love, the Chief Good, Justice, and many other subjects. These works are lost: the only writings of Epicurus that have come down to us are three letters, a few fragments from the *Volumina Herculanensia*, and a number of detached sentences or sayings, preserved by Diogenes Laertius. The principal sources of our knowledge of the doctrines of Epicurus are Cicero, Plutarch, and, above all, Lucretius, whose great poem, *De Rerum Natura*, contains substantially the Epicurean philosophy.

Although the majority of Epicurus's writings referred to natural philosophy, he seems to have studied nature with a moral rather than a scientific design. According to him, the great evil that afflicted men—the incubus on human happiness—was fear; fear of the gods and fear of death. To get rid of these two fears was the ultimate aim of all his speculations on nature.

He regarded the universe (*to pan*) as corporeal, and as infinite in extent and eternal in duration. He recognised two kinds of existence—that of bodies, and that of *vacuum*, 'the void'—i.e. space, or the intangible nature. Of his bodies, some are compounds, and some atoms or indivisible elements, out of which the compounds are formed. The world, as we now see it, is produced by the collision and whirling together of these atoms. He also held the doctrine of perception by *images* (Gr. *eidōla*), which are incessantly streaming off from the surface of all bodies, and which are necessary to bring us into *rapport* with the world without. In psychology he was a materialist, holding that the soul is a bodily substance, composed of subtile particles disseminated through the whole frame.

In seeking to understand the phenomena of the heavens he has no scientific end in view; his sole object is to enable the mind to account for them to itself, without the necessity of imagining any supernatural agency at work. He did not deny that there are gods; but he strenuously maintained that as 'happy and imperishable beings' they could have nothing to do with the affairs of the universe or of men. 'Beware,' he says, 'of attributing the revolutions of the heaven, and eclipses, and the rising and setting of stars, either to the original contrivance or continued regulation of such a being. For business, and cares, and anger, and benevolence are not accordant with happiness, but arise from weakness, and fear, and dependence on others.'

Having proved in his psychology that the dissolution of the body involves that of the soul, Epicurus argues that the most terrible of all evils, death, is nothing to us, 'since *when we are, death is not; and when death is, we are not.* It is nothing, then, to the dead or the living; for to the latter it is not near, and the former are no longer in existence.'

He held that pleasure was the chief good, and it is from a misapprehension of the meaning of this word as used by him that the term Epicurean came to signify one who indulged his sensual appetites without stint or measure. At the same time, it is easy to see that the use of the word 'pleasure' was calculated to produce the mischievous results with which the later Epicureanism was charged. (For the Cyrenaic hedonism, see ARISTIPPUS.) According to Epicurus, the sources and tests of all ethical truth are the feelings, and these are two, pleasure and pain. We delight in the one, and avoid the other instinctively. 'When we say that pleasure is the end of life, we do not mean the pleasures of the debauchee or the sensualist, as some from ignorance or from malignity represent, but freedom of the body from pain, and of the soul from anxiety. For it is not continuous drinkings and revellings, nor the society of women, nor rare viands, and other luxuries of the table, that constitute a pleasant life, but sober contemplation that searches out the grounds of choice and avoidance, and banishes those chimeras that harass the mind.' Epicurus rests justice on the same prudential basis as temperance. Denying any abstract and eternal right and wrong, he affirms that injustice is an evil, because it exposes the individual to disquietude from other men; justice is a virtue, because it secures him from this disquietude. The duties of friendship and goodfellowship are inculcated on the same grounds of security to the individual.

Among the Romans the system of Epicurus was adopted by many distinguished men. Horace, Atticus, and Pliny the Younger were Epicureans; Seneca, nominally a Stoic, drew much from Epicurus; and the great poem of Lucretius must have recommended the system to many. In modern times Epicureanism was resuscitated in France by Père Gassendi, who wrote Epicurus's life and a defence of his character in 1647; and many eminent Frenchmen have professed his principles.

See ATOM, ETHICS, DEMOCRITUS, LUCRETIUS; Zeller's *Philosophy of the Stoics, Epicureans, and Sceptics* (trans. by Reichel; new ed. 1880); W. Wallace, *Epicureanism* (1880); R. D. Hicks, *Stoic and Epicurean* (1910); and monographs by Gizycki (Halle, 1879), Kreibig (Vienna, 1885), Cassel (Berlin, 1892), Bignone (Bari, 1920).

Epicycle. See PTOLEMAIC SYSTEM.

Epicycloid is the name of a peculiar curve. When a circle moves upon a straight line, any point in its circumference describes a Cycloid (q.v.); but if the circle moves on the convex circumference of another circle, every point in the plane of the first circle describes an epicycloid; and if on the concave circumference, a hypocycloid. The circle that moves is the generating circle; the other, the base. The describing point is not necessarily in the circumference of the generating circle, but may be anywhere in a radius or its prolongation. It has many remarkable properties, and is even useful in the practical arts. The teeth of wheels in machinery must have an epicycloidal form, in order to secure uniformity of movement.

Epidaurus, a town of ancient Greece, on the eastern shore of the Peloponnesus, in the district of Argolis. During the most prosperous period of Grecian history Epidaurus was an independent state. The form of government was originally monarchical, but, after many vicissitudes, it eventually became and remained oligarchical. At an early period Epidaurus became one of the chief commercial cities of the Peloponnesus. It was chiefly famous for its temple of Æsculapius, to which patients resorted from all parts of the Hellenic world, seeking a cure for their diseases. The site of this temple, about 5 miles west of the town, is still called Hieron, 'the sanctuary.' Epidaurus had also numerous temples and a magnificent theatre, at present in a more perfect state of preservation than any other in the Peloponnesus, with sufficient accommodation for 12,000 spectators. At the modern *Epidavro*, a small village, in January 1822 a congress from all parts of Greece assembled, and promulgated the constitution known as the constitution of Epidaurus.

Epidemic (Gr. *epi*, 'upon,' and *dēmos*, 'people'), a disease which attacks unusual numbers of people simultaneously or in succession, and which, in addition, may travel from place to place. A disease which habitually affects numbers of persons in one locality is called Endemic (q.v.). By primitive men, epidemics above all other forms of sickness tend to be regarded as due to super-

natural agency; and until the middle of the 19th century, when the doctrine of contagion as caused by living germs came to be generally accepted, epidemics were held to be the result of some peculiar change in the constitution of the atmosphere. This idea appears clearly in the works of Sydenham during the 17th century.

Most epidemics are now traceable to the development of disease-producing microbes. Occasionally an epidemic is the result of some impurity in the food supply of a district, e.g. symptoms set up by lead or arsenic in beverages commonly drunk, as in the arsenic poisoning epidemic caused by impure beer in 1900, and the ancient attacks of ergotism in France, caused by the presence of a fungus in diseased rye-bread. See ERGOT.

The diseases which produce the most common epidemics, and which affect especially young persons, for example, scarlet fever, measles, enteric fever, whooping-cough, diphtheria, are always present among the community. At definite seasons, as Buchan and Mitchell have shown, they become more virulent and affect a greater number of people, and they then attract special attention as epidemics. For example, in London on an average of the years from 1861 to 1900 the deaths from scarlet fever in November were about three times as numerous as those from the same disease in March, there being a continual but varying number through the other months of the year. There is thus a tendency to epidemics of this disease during the late autumn; and the other infectious diseases have a similar seasonal variation, with regularly recurring epidemics in some definite month or months of the year. Thus enteric fever epidemics recur about August, and reach their height in October and November; diphtheria is commonest from September to December; whooping-cough from January to April; while measles has a double outbreak each year in June and in December; and smallpox tends to become serious especially in January and May. Infantile diarrhœa appears at the hottest period of the year, and is worst when a specially hot summer supervenes. In addition to this annual variation most of these diseases have a tendency to recur with special severity every four or five years, and when the history of the centuries is examined it is found that some of the most fatal diseases have tended to sweep widely over the world in recurring cycles separated by many generations. This feature is often to be explained on the basis of an inherited immunity, which the community loses when the disease has been quite absent for a long period; for example, in 1875 measles being introduced into the Fiji Islands for the first time, more than a quarter of the whole population died from the effects. For details regarding infectious diseases, see CHOLERA, PLAGUE, SMALLPOX, &c., and for their prevention see INFECTION.

History of Epidemics.—In the middle ages, as a result probably of the insanitary conditions found in crowded fortified cities, as well as owing to personal uncleanliness, epidemics proved a terrible scourge. The disease known as Plague, Pestilence, or 'Black Death,' was especially terrifying. The plague of Athens, described by Thucydides, is now generally identified as having been either typhus or cerebro-spinal fever, while the no less celebrated epidemic in the time of Marcus Aurelius was very probably enteric fever. The first account of bubonic plague in Europe as we now know it, a very fatal infectious disease with glandular swellings or buboes, dates from the 6th century A.D.—the plague of Justinian. The great epidemic or series of epidemics in the 14th century, known as the 'Black Death,' appears to have started in China, and after a few years reached Europe, which it ravaged in a succession of outbreaks throughout that century. In the whole of Europe, Hecker calculates that one-fourth of the population, or 25,000,000 people, died. In the 15th and 16th centuries there were numerous epidemics of plague, but during the 17th century it had largely died out, though Defoe makes it memorable by his *Story of the Great Plague* in London in 1664–65. Since then various outbreaks of markedly slighter severity have occurred in Europe.

Another disease which broke out in epidemic form in England during the 15th and 16th centuries, and from which many people died, was the 'sweating sickness,' which has been identified with the 'Picardy Sweat,' an epidemic often affecting France in the 18th and early 19th centuries.

Still another disease of which epidemics can be traced back to the 9th century in France, and which is portrayed in numerous ancient pictures and MSS., is that known variously as *St Anthony's Fire, Ignis Sacer, Mal des Ardents*, or by its modern name of *Ergotism*. This has been a good deal confused with erysipelas, but is quite a different disease, due to eating bread made from rye in which the fungus *Claviceps purpurea* has developed. The disease was characterised by excessive pain and mortification of the limbs, which turned black as if they had been burned up with fire; often also there were spasms, and the malady came on suddenly in religious houses, towns, or whole districts, where bread had been made from the diseased grain. It occurred right up to the 17th century, when its nature became known, so that its prevention is now possible.

Typhus fever, which has received numerous names, such as pestilential, putrid, jail, and hospital fever, has long been known throughout Europe as productive of deadly but very limited epidemics. Old writers tell of its ravages in beleaguered towns, and of the 'black assizes,' where judges, jurymen, and public fell victims to an epidemic brought into court by prisoners from the jails. It has been confused with cerebro-spinal or 'spotted' fever, which resembles it in causing a stuporous condition and a purple eruption, as well as in affecting barracks, jails, and other crowded localities.

Cholera, which is constantly endemic in the deltas of India, frequently during the 19th century spread in epidemic form along the trade-routes by sea to Egypt, or by land through Persia, and produced outbreaks of the disease in Europe.

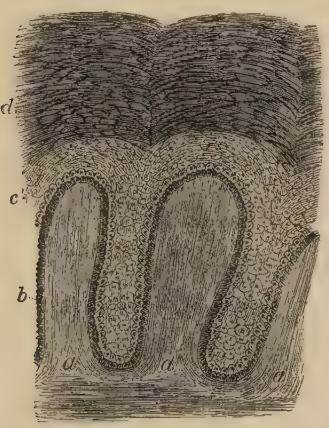
Mental diseases tend to occur in epidemic form, not only because profound disasters like war, famine, and plague leave the community mentally unbalanced, but also because even in ordinary times the type of insanity and nature of delusions conform to current habits and events. Thus in the mediæval state of society, when wide, lonely spaces existed between towns and habitations, and when human beings were subject constantly to the attack of wild animals, a common form of insanity was that of the *Werwolf* (q.v.), *loup garou*, or, as known to the Greek medical writers, *lycanthropy*. Men and women imagined themselves turned at times into wolves or other animals, roamed in the forests, and attacked those against whom they had a grudge. The idea was fostered by a wealth of folk-lore, tradition, and superstition, and the Bishops Olaus Magnus and Majolus in the 16th century state that in Prussia, Livonia, and Lithuania, the werwolves were far more destructive than the 'true and natural wolves.'

Another type of mental epidemic is found in the various outbreaks of dancing mania. After the outbreaks of plague in the 14th century, parties of people called Flagellants, who assumed responsibility for the sins of the community, went through

the countries of Europe dancing and scourging themselves in expiation. The dancers who betook themselves for cure to the shrines of St Vitus from 1374 onwards, the leaping ague which affected the people of Forfarshire in the 18th century, and limited outbreaks of religious dancing in the United States in the 19th century, are examples of similar mental affection involving many people.

See Hecker's *Epidemics of the Middle Ages* (Eng. trans. 1846); Hirsch's *Historical and Geographical Pathology* (Eng. trans. 1883–85); Creighton's *History of Epidemics in Britain* (1891–94); Sticker's *Abhandlungen* (1908–12); and *Handbuch der Geschichte der Medizin* (1903, ii. 736–901).

Epidermis (Gr. *epi*, 'upon,' and *derma*, 'the skin'), scarf-skin or cuticle, forming an external covering of a protective nature for the true skin or corium. Its under or attached surface is accurately moulded upon the true skin, and when the two are separated the cuticle presents impressions which exactly correspond to the elevations and depressions in the corium. The thickness of the epidermis varies from $\frac{1}{200}$ to $\frac{1}{10}$ of an inch, according to the amount of protection which the delicate and sensitive corium requires in different localities. Thus, it is thickest and hardest in the palms of the hands and soles of the feet, but this is not altogether the result of an increased growth due to intermittent pressure, for the difference is well marked even in the fœtus. The epidermis consists of many layers of stratified cells superimposed on each other; and since they cover a free surface exposed to the air, the cells are classed in the group of stratified epithelia. The cells vary in shape, those placed next the corium being elongated in form, while those most superficial are flat and scale-like. On this account it is usual to describe the epidermis as consisting of two strata—an outer or *superficial horny stratum*, and a deeper or *mucous stratum* (or *rete Malpighii*). The *horny stratum* consists of cells, many of which have lost their nuclei and assumed the form of hard flattened scales of polygonal outline. The deepest layer of this stratum consists of closely packed cells with indistinct outlines and a clear, almost homogeneous, appearance, which has given them the name of the *stratum lucidum*. The superficial cells of the horny layer are regularly cast off by desquamation, and replaced by those beneath them. In reptiles and amphibians this layer is periodically cast off in a more or less entire state, a new one being previously formed beneath it; and in man desquamation in large patches occurs after certain diseases, especially scarlet fever.



Perpendicular Section of the Skin of the Leg of a Negro (magnified 250 diameters):

a, *a*, papillæ of the cutis; *b*, deepest intensely coloured layer of perpendicularly elongated cells of the mucous layer; *c*, upper stratum of the same layer; *d*, horny layer.

The *mucous stratum* lies next the corium. It consists of nucleated cells of various shapes. Those next the corium are elongated and placed perpendicularly to its surface. Above these are cells more rounded or polyhedral in outline, and possessing many spines or prickle-like processes, by the points of which the cells adhere to each other, and thus leave fine lymph channels through which the nutrient plasma is transmitted to the cells. The colouring matter of the epidermis is found in the cells of the mucous stratum. A more or less dark pigment is often deposited in the face, neck, and hands of the fair races of men during exposure to the sun, forming isolated colour-spots called freckles; but in the dark races the pigment-granules are distributed throughout the cells of the mucous stratum, the deepest or perpendicular cells being the darkest. Instances of white negroes are on record, not as a consequence of change of climate, but as an abnormal condition of the epidermis. Fine nerve-fibrils penetrate between the cells of the mucous stratum, and undergo a certain amount of ramification, but do not form a network. In some reptiles, and in the Edentata among mammals, the epidermis forms large plates or scales, while epidermal appendages assume various forms—e.g. hair, nail, spines, bristles, feathers, claws, hoof, horns, &c.

In *plants* the epidermis is formed of flattened cells, usually only one layer deep, frequently bearing hairs and stomata. The exposed cell-walls upon the outer surface are frequently thickened as the cuticle. See LEAF.

Epidote. Under this name are included several minerals, which are of some importance as rock-formers. Only two need be mentioned here, *Zoisite* and *Pistazite*, or *Epidote proper*. Zoisite, or lime-epidote, is a silicate of alumina and lime, the alumina sometimes being replaced by ferric oxide to the extent of 2 or 3 per cent. It crystallises in rhombic prisms, which are often curved or sharply bent. Usually it occurs as large imbedded crystals or as foliated and columnar aggregates, chiefly in crystalline schists, especially such as are rich in amphiboles. It is generally light-coloured—white, yellowish, or brownish-gray. Its hardness = 6½. Pistazite, or epidote proper, is a silicate of alumina and lime in which the alumina is replaced by ferric oxide up to 17 per cent. or thereabout. Hence it is often spoken of as iron-epidote. It has a peculiar dark yellowish-green colour, known as pistachio-green. It crystallises in monoclinic prisms, and has a hardness similar to that of zoisite. The largest and best developed crystals are met with amongst the crystalline schists and gneisses, and not infrequently in metamorphosed limestones. In eruptive rocks it occurs only as a decomposition-product after pyroxenes, amphiboles, micas, and felspars.

Epigastrium (Gr. *epi*, 'over,' and *gastēr*, 'the stomach'), the part of the Abdomen (q.v.) which chiefly corresponds to the situation of the stomach, extending from the sternum towards the navel or umbilicus. It is called in popular language the pit of the stomach.

Epigene (Gr. *epi*, 'upon,' *gennaō*, 'I produce'), a term applied to those geological agents of change which affect chiefly the superficial portions of the earth's crust, as the *atmosphere*, *water*, *plants*, and *animals*. See GEOLOGY.

Epigenesis, a technical name for the modern conception of the development of the organism by the growth and differentiation of a simple germ—i.e. by the division or segmentation of a fertilised egg-cell. This conception, now a commonplace, was first definitely enunciated by Harvey (1651), and was reasserted with cogent demonstration by Wolff in 1759, in opposition to the generally received theory that the germ contained a pre-

formed miniature model of the organism which only required to be unfolded. See EMBRYOLOGY.

Epiglottis, a cartilaginous valve which partly closes the aperture of the larynx. See LARYNX, and DIGESTION.

Epigoni. See ADRASTUS, THEBES.

Epigram, a word derived from the Greek, and literally signifying an 'inscription.' The epigrams of the Greeks were simply inscriptions on tombs, statues, and monuments, written in verse, and marked by great simplicity of style, extended to any short, terse thought in verse. The founder of the art was Simonides of Ceos, many of whose epigrams were inscribed on the tombs of the heroes who fell in the Persian war. It was among the Romans that the epigram first assumed a satirical character; the greatest Roman masters were Catullus and, in particular, Martial, whose obscenity unhappily was more easily imitated than his genius. In modern times an epigram is understood to be a very short poem, generally from two to eight lines, containing a witty or ingenious thought expressed in pointed phraseology, and in general reserving the essence of the wit to the close, as the serpent is fabled to keep its sting in its tail. It may be the medium for the expression of almost any feeling, provided only it is in form brief, pointed, and exquisite. Epigram, however, fits best the expression of satire—an admirable example is that of Rogers:

> Ward has no heart, they say, but I deny it;
> He has a heart, and gets his speeches by it.

The Latinists Scaliger, Buchanan, More, Stroza, and John Owen (1560–1622) wrote epigrams, and the form was later kept in artificial life by Vincent Bourne, Porson, Byron, and Walter Savage Landor. Sir William Watson has produced some excellent examples of the epigrammatist's craft. In earlier generations of English literature the epigram was a favourite form, almost every poet in the 16th and 17th centuries having written them. John Heywood 'invented and did' as many as six hundred; other past but forgotten masters are Thomas Freeman, Samuel Sheppard, Thomas Bastard, Thomas Bancroft, and Henry Parrot. A few examples by Herrick, Quarles, and Ben Jonson still survive, while many thousands that cost much labour in the making sleep in secure oblivion. The French excel all other nations in the epigram. Their earliest epigrammatist of any note was Clément Marot (1495–1544); their best are J. B. Rousseau, Lebrun, Voltaire, Marmontel, Piron, and Chénier. The epigrams of German writers are for the most part happily expressed moral proverbs (*Sinngedichte*), but the *Xenien* of Schiller and Goethe contain not a few sharp and biting verses of a satirical character. Logau's famous *Deutscher Sinngedichte Drey Tausend* appeared in 1654; later epigrammatists were Kleist, Opitz, Gleim, Hagedorn, Klopstock, A. W. Schlegel, Lessing, and Herder. A large collection of English epigrams was that of Weever (1599). Good epigrams have been written by Cowley, Waller, Dryden, Prior, Swift, Addison, and Young; but the greatest master of the epigrammatic spirit in our literature is Pope.

See Booth, *Epigrams, Ancient and Modern* (1863); Dodd, *Epigrammatists of Medieval and Modern Times* (2d ed. 1875); Adams, *Book of Epigrams* (1879); Aubrey Stewart, *English Epigrams and Epitaphs* (1897); R. M. Leonard, *Epigrams* (1915).

Epigraph (Gr. *epi*, 'upon,' and *graphō*, 'I write'), a terse inscription placed upon architectural or other monuments, for the purpose of denoting their use or appropriation, and very frequently worked in and forming part of their ornamental details. See INSCRIPTIONS.

Epilepsy (*epilēpsia*, 'a seizure') is recognised by loss of consciousness and a convulsion. It is the underlying morbid condition, however, not the mere seizures, that constitutes the disease. It affects all races of man, and is not unknown among lower animals. Its striking phenomena have been described by the oldest medical writers. By the ancients it was regarded as due to demoniac possession, or to the anger of an offended deity. Their physicians called it the *morbus sacer*. Hippocrates alone, to his credit, maintained its origin was no more supernatural than any other disease. The common English name is the 'falling sickness.'

The word 'epilepsy' is now used largely as a symbol under which are grouped a great variety of conditions due fundamentally to faulty energy distribution. The nervous system consists of a large number of receiving organs by which impressions from the outside world are derived. These, through processes of cerebral association, are elaborated into the physical equivalents of psychic products of higher complexity which are eventually transformed into further physical complexes whose function is to set in action the lower motor centres, and produce the appropriate muscular response. As the in-coming stimuli are so many, the out-going activities are correspondingly diverse, but a healthy organism is able, by reason of its nervous mechanisms, so to distribute the energy received as to bring about a series of harmoniously adjusted activities. The failure to properly utilise and distribute its energy efficiently characterises the epilepsies. The epileptic discharge is thus essentially a manifestation of energy at greatly reduced adaptive efficiency, and indicates that the essential defect is destructive, and causes a blocking of paths of outlet structurally, or by inhibition, and thus accumulates the discharge within relatively narrow paths.

The genuine epileptic comes from a tainted stock. Epilepsy may not appear in the ancestors, but they and often the collaterals show evidences of various ill-defined nervous disorders. Epilepsy and feeble-mindedness show a similarity in their hereditary reactions, and appear to be due to a defect in the germ-plasma—i.e. they are both recessives. They are often found associated.

Seizures of an epileptic character may be associated with organic disease of the brain—e.g. injury, congenital defect, tumour, vascular lesions, syphilis, and arterio-sclerosis. The late Dr Hughlings Jackson described a type of fit in which the convulsive movements are first limited to one group of muscles, and involve progressively further muscle groups—e.g. they may begin in the hand, and spread to the arm, trunk, and leg. Consciousness is not usually lost unless the convulsion spreads to the opposite side. This type is termed 'Jacksonian epilepsy,' and occurs when the lesion presses on or involves the motor area of the brain. It may be cured by operation.

Essential epilepsy is usually divided into two main types: (1) The *severe form*, or epileptic fit proper (the *grand mal* of the French). The onset is sudden, but may be preceded by a warning, the *aura*. It is often ushered in by a cry. The loss of consciousness precedes or accompanies the cry, and the patient falls down in a state of tonic spasm. The face becomes livid and cyanosed, and respiration is in abeyance. This stage may last from a few seconds to a minute and a half. The first sign of yielding is the development of a fine rapid tremor, which soon gives place to sudden, quickly repeated, shock-like contractions of greater degree and severity, which occur at gradually lengthening intervals, and finally cease after two or three desultory jerks. The duration of the

clonic stage varies, but is longer than the tonic, and is followed by muscular relaxation and stupor, from which the patient passes into deep sleep, and finally recovers. On awakening he is quite unconscious of what has happened; he may have a severe headache, or be morose or irritable, and in some cases feels much freer mentally than before the onset. In rare cases, just before or more commonly after the convulsion, a condition of active excitement may occur—*epileptic mania*—during which he may be homicidal or suicidal. Fortunately the efforts are diffuse and not coherently directed; the attack is usually brief and calls for restraint, but ends in complete exhaustion. Although epileptic seizures usually occur separately, several may follow each other at such short intervals that the attacks merge into one another and overlap, and unconsciousness becomes continuous, a condition known as *status epilepticus*. This is very dangerous, and often fatal. The convulsion may be replaced by what is termed an *epileptic equivalent* or *psychic epilepsy*. In this state almost anything may be done, and the patient has no recollection of what has happened after it is over. In the early stage of a seizure there is a danger of the patient falling into the fire, or being drowned in a bath, and in the tonic phase suffocation may occur from the face being buried in the pillow. During the clonic stage tongue-biting is common.

(2) *Slight forms* (*petit mal*) may be merely a momentary confusion of thought or loss of consciousness. The patient may simply pause for an instant during conversation, look strange, and then go on with what he was saying. Or he may fall down and get up again immediately, or there may be a feeling of faintness, or a momentary twitching of one or more groups of muscles, with pallor of the face and unconsciousness. This form may be followed by a somnambulistic-like stage of *automatism*, during which some unusual or inappropriate act may be performed of which there is no recollection afterwards. Perhaps the commonest act is undressing. The medico-legal aspect of these cases is of importance, since a patient, in a condition of post-epileptic automatism, may commit serious and complicated crimes, of which he has afterwards no knowledge.

The major seizures may occur for many years without any special degree of dementia resulting, this being largely determined by the frequency of the attacks. The usual psychical state of the minor type is a mild degree of mental impairment, chiefly loss of memory for recent events. The combined type with both major and minor seizures shows the greatest frequency of fits, sometimes several hundred a month, and presents the most profound degrees of dementia, little influenced by treatment.

Essential, or idiopathic, epilepsy is now regarded as a life-reaction comparable to rage or anger in a bad-tempered individual, of excessive emotionalism in the supersensitive. The epileptic constitution, independent of the deteriorating influence of excessive attacks, which only brings it more markedly in view, was recognised about 1860. At birth the potential epileptic children have fits of meaningless crying. As they grow up their non-pliability to nursery ethics—obedience and deportment—becomes obvious. Extreme lability of mood is frequent. Consecutiveness of purpose in play and capacity to be amused is short. Tantrum episodes are common. Their maladaptive defects are shown with other children. They demand the play to be arranged to suit themselves; the game must be played a certain way, and continued or stopped as they direct. Their likes and dislikes are extreme. At school interest and attention continually vary. Extreme brilliance in some subjects and ignorance in others is the general rule. Because of their extreme nervousness and inability to conform to school routine they become intolerant of school life and rebel at its demands. Thus in infancy and early childhood the adjustment to the social and physical environment is incomplete and unsatisfying; and, thrown back on itself, there is a reinflation of self-importance and sensitiveness. Childhood is thus a fruitful period for new stresses, and hence epileptic attacks occur in the predisposed. The next stressful period is puberty. They are unwilling to take on a proper attitude of apprenticeship. They have the innate instability of the constitutional inferior without his good-natured indifference; their feelings are easily hurt; they have ill-defined paranoid persecutions, which cause them to react frequently with violence, insolence, and hatred. The lack of good-fellowship renders them incapable of co-operative teamwork; the requirements of interdependence and subordination to the main purpose galls and irritates them beyond endurance. During adolescence they begin to present an odd mixture of primary defects of instincts. With no intimate friends, the potential epileptic holds himself aloof; he is a free-lance, able and usually anxious to work his will upon the world. Freed from the trammels of social concern and demand, the intellectual efforts of the potential epileptic work with less stress than the normal, but the social customs of the family, friends, and society fail to add their modifying influence as a directing force. In consequence new and unforeseen hindrances are added which reduce the mental and physical invulnerability to the minimum, and at such defective periods some physical stress, which at a more favourable time would be quite negligible, appears as the precipitator of the frank disorder.

Essential epilepsy is thus dependent upon a primary congenital defect or inheritable defective instincts of natural and healthful adaptations to reality, the epileptic make-up or constitution, and at successive periods in life, when emotional and physical stresses of an intensive character are encountered, the individual so constituted has epileptic reactions, such as fits, disturbances of temper, lethargies, and various psychic phenomena. The fit is essentially a regressive phenomenon, a flight from undue stress into unconsciousness, the deeper manifestations of which, the convulsive phenomena, are superadded.

The proper treatment of epilepsy is an intensive and persistent educational training, together with the correction of such mental and physical disorders as are remediable by more conscious methods, as occupation, educative play, and healthful interests and pursuits.

During a fit the patient should be laid on the floor. Anything likely to constrict the neck should be removed. Tongue-biting may be prevented by inserting a cork between the jaws. The post-paroxysmal sleep should be encouraged.

Medicinal treatment consists mostly of bromide. The addition of a little arsenic helps to prevent acne. For success it must be persevered in for long periods. In addition, restriction of salt, free purgation, and simple diet with diminution of meat, is helpful. Recently good results have been found in essential epilepsy from luminal. Treatment should be continued for two years after the last fit before recovery can be said to have taken place. The occupation should be one in which there is no risk of life when a fit occurs. Alcohol must be forbidden.

The social position of the epileptic is most unfortunate. Often so impaired mentally that his labour is at a discount, he loses his employment on the occasion of his first fit, even though the work may be suitable. Hence the urgent need for early

care and supervision in an epileptic colony where all such social handicaps are removed.

Epilobium (or WILLOWHERB, from its characteristic habit and silky-tufted seeds), a widely diffused herbaceous perennial genus of Onagraceæ, common in moist places. *E. angustifolium* is one of the most familiar denizens of the cottage garden, and is also common in shrubberies. In arctic regions its young shoots are sometimes eaten in case of need, and in Kamchatka a kind of beer is made from the sugary pith. This species, with several others, is common in North America, where it is sometimes called *fire-weed*, since it often covers the scenes of great forest fires, and sometimes *slink-weed*, from a belief that it causes cows to 'slink' or miscarry. About a score of other species are occasionally seen in gardens.

Epilogue (Gr. *epi*, 'upon' or 'after,' and *logos*, 'a speech') means, in oratory, the summing up or conclusion of a discourse; but in connection with the drama it denotes the short speech in prose or verse which was frequently, in former times, subjoined to plays, especially to comedies, as contrasted with the Prologue at the beginning. The epilogue was always merry and familiar in its tone, and was intended to establish a kindly understanding between the actor and the audience, as well as to conciliate the latter for the faults of the play, if there were any, and to send them away in good humour. One of the neatest and prettiest epilogues ever written, and one which completely realises what an epilogue should be, is that spoken by Rosalind at the conclusion of Shakespeare's *As You Like It*.

Epimenides, a Greek poet and priest, sometimes included among the 'seven sages,' was born in Crete in the 7th century B.C. According to one tradition, during a sleep of fifty-seven years he received the divine inspiration which determined his future career. (Goethe wrote a poem on the subject, *Des Epimenides Erwachen.*) He was reputed to have lived for 299 years. Epimenides went to Athens about 596 B.C., where, by the performance of various mystical rites and sacrifices, he stayed a plague with which the inhabitants were afflicted, and co-operated with Solon in reforming the Athenian constitution. He was the 'prophet' quoted by St Paul in Tit. i. 12. That he wrote the epic poems attributed to him, the longest of which was on the Argonautic expedition, is improbable. Doubt has been cast on his historical existence.

Epinal, capital of the French dep. of Vosges, delightfully situated at the western base of the Vosges Mountains, on the Moselle, 46 miles SSE. of Nancy. It is a clean, well-built town, surmounted by the ruins of an old castle. Among its buildings are the church of St Maurice (*c.* 960), the museum, and a library rich in manuscripts. Épinal manufactures cotton, paper, &c. A fortified town, it was occupied by the Germans in 1870, but in the Great War escaped determined attempts to reach it. Pop. 28,000, largely increased after 1870 by the influx of Alsatians.

Épinay, LOUISE TARDIEU D'ESCLAVELLES, MADAME D' (1726-83), a French writer, born at Valenciennes, at nineteen married her cousin. The union proved an unhappy one, and she struck up liaisons with men of genius—first with Rousseau, for whom in 1756 she built a cottage (the now famous Hermitage) near the valley of Montmorency, and then with Grimm. She spent her last years in comparative solitude. Her *Conversations d'Émilie* (1774), a work on education, was crowned by the Academy. See ROUSSEAU; Perey's *Jeunesse et dernières Années de Mdme. d'Épinay* (1882); and her *Memoir and Correspondence* (trans. 3 vols. 1899).

Epiornis. See ÆPYORNIS.

Epiphanes. See ANTIOCHUS.

Epiphanius, a Christian bishop and writer of the 4th century, was born of Jewish parents in Palestine. He was educated among the Egyptian monks, who imbued his mind at once with a fervent piety and an intolerant bigotry that together led him in after-life into most unchristian excesses. He rose gradually to the rank of Bishop of Constantia (formerly Salamis) in Cyprus, and continued in that office from 367 till his death in 403. His polemical zeal was conspicuously manifested against Origen. He had proclaimed him a heretic in his writings, and in 394 he went to Palestine, the stronghold of Origen's adherents, and called upon John, Bishop of Jerusalem, to condemn him. Both in this instance and in his conduct to Chrysostom afterwards, he displayed a tyrannical and intolerant passion. Among his writings, collected by Petavius (2 vols. Paris, 1622), the most important is his *Panarion*, or catalogue of all heresies (80 in number), a work which strikingly shows his unfitness for the task of a historian. See a monograph by Lipsius (Vienna, 1865).

Epiphany (Gr. *Epiphaneia*, 'manifestation') denoted, among the heathen Greeks, the appearance of a god to a worshipper. The word was subsequently used to designate the manifestation or appearance of Christ upon earth to the Gentiles, with especial reference (in the Western Church) to his adoration by the Magi (q.v.). This occasion is commemorated on 6th January, the 12th day after Christmas, and hence the Epiphany is also called Twelfth Day (q.v.). Until the latter end of the 4th century, the 6th January was a festival in honour of Christ's nativity and baptism. See BEFANA.

Epiphytes (Gr. *epi*, 'upon,' *phyton*, 'a plant'), often and popularly, but less correctly, called Air-plants, are plants which are not rooted in the ground, but are attached to trees, &c. Mosses and lichens themselves, growing upon trees, may be called epiphytes, but the term is generally used of phanerogamous plants. It is chiefly in warm and moist climates that phanerogamous epiphytes are found, and in those which are also moist, although many exhibit considerable endurance of drought. Most of them prefer shady situations. Within the tropics, they often form an interesting and remarkable feature of the vegetation. Some of the Bromeliaceæ (as *Tillandsia*), Cactaceæ, Araceæ, Gesneraceæ, and other orders are epiphytes; most frequently, however, the Orchidaceæ. See ORCHIDS, TILLANDSIA, &c.; and Kerner's *Pflanzenleben*.

Epirus ('mainland'), the ancient name of a part of Greece, extending between Illyria and the Ambracian Gulf, and from the Ionian Sea to the chain of Pindus. It was a wild and mountainous region, heavily wooded, and producing but little corn, though celebrated for its cattle and horses, and for its breed of Molossian dogs. The principal rivers were the Aous, Arachthus, Thyamis, and Acheron (q.v.); the chief towns, Dodona (q.v.) and Ambracia (q.v.). Anciently, as to-day, the inhabitants were only half Hellenic, the Greek colonies being confined to the coast and southern portion. Of the Molossian kings of Epirus, the most famous is Pyrrhus (q.v.), who long waged successful war against the Romans. On the conquest of Macedonia by the Romans (168 B.C.), the most revengeful measures were put in force against the Epirotes, who had assisted Perseus, the Macedonian king. Æmilius Paulus, the Roman general, plundered and razed to the ground seventy towns of Epirus, and sold into slavery 150,000 of the inhabitants. From this period, Epirus shared the vicissitudes of the Roman and Byzantine empires,

until 1204, when one of the Comneni made himself independent. Petty princes ruled the country until the 15th century, when it was conquered by the Turks (see SCANDERBEG). Peopled largely since the 14th century by Albanians (see ALBANIA), the strip of territory east of the river Arta was, under pressure from the great powers, ceded by Turkey to Greece in 1881, while after the wars of 1912–13 the western portion fell to Greece and Albania.

Episcopacy. See BISHOP.

Episcopius, SIMON (properly *Biscop*), the leader of the Arminian party after the death of its founder, was born at Amsterdam in 1583, and studied (from 1600) at Leyden. Arminius and Gomarus were his teachers in theology, and on the death of the former in 1609 Episcopius was obliged, on account of his known attachment to Arminius' views, to leave Leyden for Franeker. In 1610 he became pastor at Bleyswich, a village near Rotterdam, and in the following year he was one of five 'Remonstrants' appointed by the government to meet five 'Contra-Remonstrants' at a conference at the Hague. When Gomarus resigned his chair at Leyden, Episcopius was appointed his successor (1612). Called with twelve other Arminian theologians to the bar of the Synod of Dort (1618), Episcopius (with the rest) was condemned and banished from the country. He removed to the Spanish Netherlands, where he wrote his famous Arminian *Confessio* (published in 1622). On the renewal of the war between Spain and Holland, he found refuge in France, where he lived mostly at Paris and Rouen, and published a series of able controversial treatises. Permitted in 1626 to return to his native country, he was for several years a preacher at Rotterdam, where he wrote his *Apologia pro Confessione* in 1629. From 1634 he was professor at the Arminian College at Amsterdam, and here he produced his *Institutiones theologicæ* and *Responsio ad Quæstiones Theologicas*, two works which are mutually complementary, and which, though the former was left incomplete at his death in 1643, present an ample apology not only of Arminian theology, but of the Christian revelation itself. Episcopius everywhere lays the utmost stress on the personal responsibility of man in relation to divine grace, denies the doctrine of original sin, and treats Christian faith not as a doctrinal theory, but as the potentiality of right moral conduct. Yet it cannot be denied that, in his view of the Trinity, the Son and the Holy Spirit are partakers of divine power and glory *non collateraliter sed subordinate*, and that he held it enough to believe that the Holy Spirit proceeds only from the Father, and is the spirit of the Son. This rationalistic development of Arminian doctrine by Episcopius went far beyond the famous Five Articles of 1610, but in the next generation was generally adopted by the Arminian party. His works were collected in 2 vols. (Amst. 1650–65). The best Life is Philip Limborch's *Historia vitæ Simonis Episcopii* (Amst. 1701). See ARMINIUS, CALVINISM; and Sepp, *Het godgeleerd onderwijs in Nederland* (1873).

Epistles. See BIBLE.

Epistolæ Obscurorum Virorum ('Letters of Obscure Men') is the title of a collection of satirical letters which appeared, in dog-Latin, at the commencement of the 16th century, and professed to be the composition of certain ecclesiastics and professors in Cologne and other places in Rhenish Germany. They were directed against the scholastics and monks, and lashed with merciless severity their doctrines, writings, morals, modes of speech, manners of life, follies, and extravagances, and thus helped in no small degree to bring about the Reformation. The controversy of Reuchlin with the baptised Jew, Pfefferkorn, concerning Hebrew books, gave the first occasion to the *Epistolæ*, and it is probable that their title itself was suggested by the *Epistolæ Clarorum Virorum ad Reuchlinum* (1514). On the first appearance of the work, it was fathered on Reuchlin; afterwards it was ascribed to Reuchlin, to Erasmus, and to Hutten. By many it has been held that Hutten was the chief author, and Crotus Rubianus (q.v.) his chief assistant in the work, which appeared at Hagenau in 1515 or 1516 (but professedly at Venice). But though Hutten certainly wrote the second part (1517), it cannot be said to have been proved that he had any share in the first, of which Crotus Rubianus would accordingly be the chief author, as he certainly was the suggester of the scheme. Inclusion in the *Index Expurgatorius* by a papal bull helped to spread the *Epistolæ* not a little. The numerous editions include Böcking's, with commentary, in his edition of Hutten's works (1869), and F. G. Stokes's, with translation (1909). See D. F. Strauss, *Ulrich von Hutten* (Eng. trans. 1874), Mark Pattison, *Essays* (2 vols. 1889), and W. Brecht, *Die Verfasser der Epist. Obsc. Vir.* (1904).

Epitaph (Gr. *epi*, 'upon,' and *taphos*, 'a tomb'), any commemorative inscription upon a monument. Naturally, brevity and point are the principal things to be aimed at in such memorials, and, as the elemental human emotions are ever the same, we find a striking similarity between ancient and modern epitaphs. The oldest we have are those of the Egyptians, written on the sarcophagi, but these are brief and formal, being merely a record of the name and condition of the deceased, with a prayer to Osiris or Anubis. Quite different are the early Greek epitaphs, which often both in form and substance evince fine literary skill. The earlier examples are mostly in elegiac verse. None are better than those of heroes who have fallen in battle, and of these the classical example is that on the three hundred martyrs to patriotism at Thermopylæ, ascribed to Simonides:

> Go tell the Spartans, thou that passest by,
> That here obedient to their laws we lie.

The Roman epitaphs usually contain a more or less bare record of facts. On the urns the letters D. M. or D. M. S. (*Diis Manibus* or *Diis Manibus Sacrum*) are usually followed merely by the name of the deceased, his age, and condition, with the name of the person who caused the urn to be made. These characters were often adopted from mere conservatism by Christians, and we find them conjoined with purely Christian sentiments in the catacombs at Rome. The ashes of the dead were usually placed along the sides of the great highways leading into Rome, hence the appropriateness of the common commencement, *Siste Viator*—the 'stop passenger' to be seen in so many of our English churchyards. One feature not uncommon in Roman inscriptions was an execration upon the disturber of the sepulchre—the reader will remember that on Shakespeare's tomb at Stratford-on-Avon, most probably from the pen of the great dramatist himself.

Long after the Roman empire had crumbled into ruins, the Latin tongue continued to be used for inscriptions, but in England we occasionally find French used as early as the 13th century. It was hardly, however, till the time of Elizabeth that epitaphs became really literary; then and after we find them written in admirable epigrammatic form by Ben Jonson, Milton, and many others. Pope's English epitaphs were long famous, and also those by Dr Johnson in Latin. The latter's answer to the famous round-robin signed by Gibbon, Burke, Sir Joshua Reynolds, Sheridan, Warton, and others,

requesting that he should write the epitaph for Goldsmith in English, was that 'he would never consent to disgrace the walls of Westminster Abbey with an English inscription.' It is no doubt true that no language lends itself so well to dignity in brief simplicity as the Latin, but the argument from its stability and universality becomes weaker with every generation.

The naturally epigrammatic turn of the French mind peculiarly adapts it for the epitaph, and in French collections very felicitous examples are to be found both in Latin and in French, such as the 'Tandem felix!' of the Count de Tenia; the touching epitaph to a mother, 'La première au rendez-vous;' and that written by Piron for himself after his rejection by the Academy:

Ci-gît Piron, qui ne fut jamais rien,
Pas même Académicien.

A large number of the earlier monuments, and consequently of the epitaphs of this country, were destroyed by unfortunate iconoclastic zeal at the Reformation, and after the triumph of the Puritan revolution. The epitaphs to be found in our parish churchyards display every variety of taste, from pure pathos, simplicity, and dignified eulogy to painful would-be wit and even vulgar buffoonery.

See Weever's *Ancient Funerall Monuments* (1631; ed. by Tooke, 1767); Philip Labbe, *Thesaurus Epitaphiorum* (Paris, 1666); De la Place, *Recueil d'Épitaphes* (3 vols. Paris, 1782); Pettigrew's *Chronicles of the Tombs* (1857); Northend, *Book of Epitaphs* (N.Y. 1873); Kippax, *Churchyard Literature: a Choice Collection of American Epitaphs* (1876); Andrews, *Curious Epitaphs* (1883); Unger, *Epitaphs* (1906); Suffling, *Epitaphia* (1300 British; 1909).

Epithalamium, a species of poem which it was the custom among the Greeks and Romans to sing in chorus near the bridal-chamber (Gr. *thalamos*) of a newly-married pair. Sappho, Anacreon, Stesichorus, and Pindar composed poems of this kind, but only scanty fragments have been preserved. The epithalamium of Peleus and Thetis by Catullus is one of the finest specimens of Latin poetry extant; but probably the most splendid epithalamium in all literature is that of our own poet Spenser. Latin examples are extant by Statius, Ausonius, Claudianus, and other poets. A collection of Latin epithalamia is to be found in Wernsdorf's *Poetæ Latini Minores* (4th vol. part 2, Helmst. 1789).

Epithelium is the term applied in anatomy to the cell-tissue which, in layers of various thickness, invests not only the outer surface of the body, and the mucous membranes connected with it—as, for example, those of the nose, lungs, intestinal canal, &c.—but also the closed cavities of the body, such

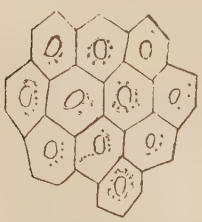


Fig. 1.
Epidermis (still soft like the epithelium of internal parts) of a two months' human embryo. Mag. 350 diam.

Fig. 2.
Epithelial cells of the vessels; the longer one from the arteries, the shorter ones from the veins.

as the great serous membranes, the ventricles of the brain, the synovial membranes of joints, the interior of the heart and of the blood-vessels proceeding to and from it, the ducts of glands, &c. The thickness of this tissue varies extremely with the position in which it occurs. In some parts it consists of numerous strata of cells, collectively forming a layer of more than a line in thickness; in other parts it is composed of only a few strata, or often of only a single stratum of cells, and can only be detected by the microscope. The cells of which the epithelium is composed are usually soft nucleated cells; they may be rounded, polygonal, fusiform, cylindrical, or conical in shape, and sometimes they possess vibratile cilia. No blood-vessels exist in epithelial tissues, although minute channels may be found between the cells, by means of which the plasma derived from subjacent blood-vessels may pass for the nutrition of the cells. In many cases nerve fibrils are abundant.

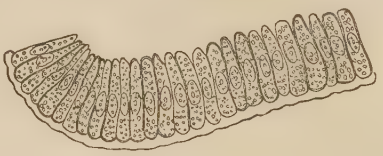


Fig. 3.
Epithelium of the intestinal villi of the rabbit. Mag. 300 diam.

Epithelia may be classified (*a*) according to the embryonic layer from which they are developed; (*b*) according to their function; (*c*) according to their shape and arrangement. Following the latter method, we have (*a*) *simple epithelium*, consisting of a single layer of cells which may be: (1) *Pavement*, consisting of polygonal plates or scales joined together by their edges. They constitute the variety known as pavement or tessellated epithelium, and occurring as an investment of the serous membranes, of most synovial membranes, of the lining membrane of the heart and of the veins, of the canals of glands, &c. (2) *Columnar or cylinder epithelium*, as in the intestine from the stomach to the termination of the alimentary canal, in the excretory ducts of all the glands opening into the intestine, &c. Illustrations of this cylinder epithelium are given in the article DIGESTION. (3) *Spheroidal or glandular epithelium* is chiefly characteristic of the terminal recesses of secreting glands. (4) *Ciliated epithelium* consists of cells which bear on their free ends spontaneously moving filaments called *Cilia* (q.v.). (*b*) *Stratified epithelium* consists of cells arranged in many layers, and the individual cells present every variety of shape. As a rule the deepest cells are columnar, and those on the surface flattened and scale-like, but overlapping one another at their margins. It occurs on the anterior

Fig. 4.
Ciliated cells from the finer bronchial tubes. Mag. 350 diam.

Fig. 5.
Stratified pavement epithelium investing a simple papilla (with blood-vessels in the interior) from the gums of a child. Mag. 250 diam.

surface of the cornea of the eye, in the mouth, pharynx, œsophagus, &c., but its most extensive distribution is in the Epidermis (q.v.). (*c*) *Transitional epithelium* is intermediate between the forms already described, and may be grouped under the three terms columnar, ciliated, and scaly transitional, according to the kind of cell which is most superficial. In the case of the columnar and ciliated varieties there are smaller cells irregularly disposed between the fixed ends of the large ones, and this constitutes the only difference between these and the columnar and ciliated cells already described.

Scaly transitional epithelium is found lining the urinary Bladder (q.v.) and ureters. The superficial cells are flattened scales when the bladder is distended, but cubical when empty. Moreover, the free surface of the cells is smooth, but on the deep aspect they are moulded over the rounded ends of the pear-shaped cells beneath. Irregular cells fill up the intervals between the tapering ends of the pyriform cells.

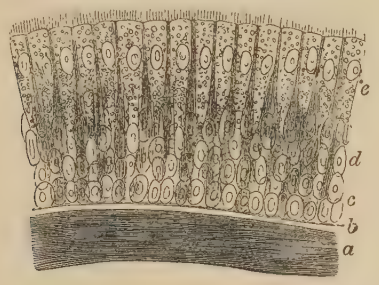


Fig. 6.

Ciliated epithelium from the trachea of a man. Mag. 350 diam. *a*, outermost part of the elastic longitudinal fibres; *b*, homogeneous outermost layer of the mucous membrane; *c*, deepest round cells; *d*, median long cells; *e*, outermost conical ciliated cells.

In all the varieties of epithelium the layer of external cells is being constantly disintegrated and replaced by the layer immediately beneath. The polygonal or pavement epithelium mainly acts like the epidermis, as a protecting medium to the soft parts beneath. The cylindrical epithelium additionally takes an active part in the process of secretion. Illustrations of the function of the cells forming this variety of epithelium are given in the articles Cell, Cilia, Digestion; and the subject will be further noticed under the head Secretion.

Epizoa, animals that live on the bodies of other organisms in various degrees of parasitism. See Parasitic Animals, Bug, Flea, Lice, &c.

Epizoötics (Gr. *epi*, 'upon,' and *zōon*, 'an animal') are diseases of animals which manifest a common character, and prevail at the same time over considerable tracts of country. A curious circumstance in connection with them is that they usually follow the same line of route as the diseases of the human race; and, as a rule, when there has been a great epidemic, it has been followed or accompanied by an equally destructive pestilence among animals.

Epoch, in Astronomy, is an abbreviation for 'longitude at the epoch;' it means the mean heliocentric longitude of a planet in its orbit at any given time—the beginning of a century, for instance. The epoch of a planet for a particular year is its mean longitude at mean noon, on January 1, when it is leap-year, and on December 31 of the preceding year, when it is a common year. The epoch is one of the elements of a planet's orbit. For epoch in chronology, see Chronology.

Epode is the last part of the chorus of the ancient Greeks, which they sang after the strophe and antistrophe, when the singers had returned to their original place. The name was applied also to a species of lyric poem invented by Archilochus, in which a longer verse is followed by a shorter one, as the *Epodes* of Horace. See Chorus.

Eponym (Gr. *epi*, 'on,' and *onyma*, 'a name'), a mythical personage created to account for the name of a tribe or people; thus Tros is the eponymous hero of Troy, Italus was assumed as ancestor of the Italians, &c. For the Assyrian eponym canon, see Assyria.

Epping, an urban district of Essex, in a pleasant healthy situation, at the north end of Epping Forest, 16 miles NNE. of London. It is noted for its cream, butter, sausages, and pork. Population, 4200.—Epping (formerly Waltham) Forest, where kings hunted in olden days, once covered all Essex, and extended almost to London. Inclosures gradually curtailed it from 60,000 acres to 12,000 in 1793, and to less than 4000 in 1871, when (the government refusing to stir in the matter) the corporation of London undertook the preservation of all that was left, and the recovery of the more recent inclosures. As an outcome of their exertions, and at a cost of about half a million, 5600 acres of Epping Forest were declared free to the public by Queen Victoria on 6th May 1882. Reached easily from Loughton, Chingford, and other stations, Epping Forest is still a glorious place alike for naturalist and mere holiday-maker. Its 9 square miles of almost unbroken woodland, which at High Beech or Queen Victoria's Wood attain a height of 379 feet above sea-level, form one of the finest pleasure-grounds in Europe. Separated by a stream from Epping Forest is Hainault Forest (the 'garden fair' of Sir W. Besant), disafforested in 1851, and added to Epping Forest for public use in 1906. Here, till 1820, stood Fairlop Oak, the scene of a July fair, as famous in its way as the old Epping stag-hunt on Easter Monday. See E. N. Buxton, *Epping Forest* (1884; new ed. 1911); and works by Fisher (1887), Perceval (1909), and Southern (1916).

Éprouvette is a machine for proving or testing the strength of gunpowder. The *gun* éprouvette does this by measuring the amount of recoil produced on a small gun swung like a pendulum; the *mortar* éprouvette by measuring the distance to which a ball is projected. A third pattern is shaped like a small pistol, with an extremely short barrel, closed by a flat plate connected with a strong spring. On firing, the plate is driven back to a distance indexed according to the strength of the powder.

Epsom, an urban district of Surrey, on the margin of the Banstead Downs, 15 miles SSW. of London. The sulphate of magnesia springs, which made Epsom so fashionable a resort in the later half of the 17th century, gave name to the Epsom salt, formerly manufactured from them. The church, rebuilt in 1824, contains monuments by Flaxman and Chantrey. The Royal Medical College (1851), on the Downs, provides education for the sons of medical men and others, and affords a home to decayed members of the profession and their widows. Population, about 20,000. On the Downs, 1½ mile S. of the town, the famous horse-races are held yearly (see Derby Day, Horse-racing). The grand stand (1830, enlarged 1886) accommodates 7500 spectators.

Epsom Salt, or Sulphate of Magnesia, $MgSO_4 7H_2O$, was originally obtained by evaporating the waters of the springs at Epsom. It was soon found that sea-brine also contained large quantities, and the manufacture at Epsom was therefore given up. It is found native in various

parts of America and elsewhere. In England, as well as in America, varieties of magnesian limestone are extensively treated with sulphuric acid for its production.

Epsom salt forms small needle-like crystals, which have a bitter saline taste and neutral reaction. It is a well-known useful purgative medicine, acting as a refrigerant, and sometimes as a diuretic. Its disagreeable bitter taste may be relieved by the addition of a little sulphuric acid (as in Henry's solution) or syrup of lemon. It is of importance that plenty of water be drunk along with it (one or more tumblerfuls). See MAGNESIUM.

Epstein, JACOB, sculptor, was born at New York, of Russian-Polish parents, on 10th November 1880. Educated in Paris, he settled in England in 1904, and in 1907 first gained prominence by his much-discussed figures for the new buildings of the British Medical Association in the Strand. His busts are now almost universally recognised as masterpieces of the first quality, but storms of criticism have raged round his symbolic work. In this last kind are his 'Oscar Wilde Tomb' at Père Lachaise, Paris; his 'Sun God,' 'Venus,' 'Mother and Child,' 'Maternity,' and his 'Christ.' See B. van Dieren, *Epstein* (1920).

Epworth, a market-town of Lincolnshire, in the 'Isle' of Axholme, 10 miles NNW. of Gainsborough. The great John Wesley was a native, as well as Alexander Kilham, founder of the Methodist New Connection. Pop. 2000.

Equations. The statement in symbols of the relationship of equality existing between two algebraic expressions is termed an equation. Such expressions generally contain at least one unknown quantity. Thus $x - 2 = 4 + 3$ is an equation denoting that if 2 be deducted from some unknown quantity denoted by x, the remainder will be equal to $4 + 3$, that is 7; therefore the value of x in this equation is evidently $7 + 2$, or 9. Any equation in one variable x may be reduced to a form such as $F(x) = 0$, where $F(x)$ is a function of x, and this may be considered as the standard form of all equations. When written fully in the most general manner, this may be said to be equivalent to the equation

$$a_0x^n + a_1x^{n-1} + a_2x^{n-2} + \ldots + a_{n-2}x^2 + a_{n-1}x + a_n = 0.$$

This is said to be an equation *in* x, the variable involved; a_0, a_1, a_2, $\ldots$ a_n are the coefficients, either numerical or algebraical quantities. Any quantity which, when substituted for x, reduces the left-hand side to zero—i.e. any quantity which *satisfies* the equation, is termed a *root* of the equation. The main problem in equations is that of finding all the possible roots; this done, a *complete solution* is obtained. The theory of equations is a most important branch of algebra.

Identical equations are those which are always true, whatever be the value of the quantities involved; *conditional* equations are satisfied only by certain values for x. Equations are usually classified according to their *degree*, which is defined as being the highest degree of the involved variable. The equation written above as the standard form is, for example, of the nth degree. Simple equations, or equations of the first degree, are those in which x or the unknown quantity appears only in the first power; when x appears in the second power, the equation is quadratic; when x is in the third power, cubic, and so on. Equations of the first, second, third, fourth, fifth, &c. degrees are sometimes called linear, quadratic, cubic, quartic (or biquadratic), quintic, &c. equations.

Equation in astronomy means the corrections or reductions which must be applied to observations in order either to free them from error or otherwise to reduce them to some form more suitable for purposes of calculation. For the *Equation of Time*, see the article DAY. *Personal equation* is a correction which has to be applied to astronomical (or other) observations in order to remove relative error due to some peculiar mode of observation on the part of the observer. In astronomical observatories it is the practice to find this personal equation for all the observers with reference to one single observer, and the observations are all reduced by its application, so that finally they are tabulated as if made by one observer. The phrase has passed into common language, and is often used to denote that modification which is requisite in the statements or judgments of any person who in such matters is not free from bias or idiosyncrasy. There are also *equations to the centre*, allowing for the difference between the place of a planet as supposed to move in a circle and its actual place in an ellipse; and *equations of equinoxes*, between mean and apparent equinoxes. *Equation of payments* is an arithmetical rule for ascertaining at what time it is equitable for a person to pay a whole debt which is due in different parts, payable at different times. Equations are constantly used in Chemistry (q.v.).

Equator. The Terrestrial Equator is the great circle on the earth's surface dividing the earth into the northern and southern hemispheres, and halfway between the poles.—The Celestial Equator is the great circle in the sky corresponding to the extension of the equator of the earth.

Equatorial, an important instrument for observing and following a celestial body in any part of its diurnal course. It consists, in the usual form, of two axes, one fixed square across the end of the other, thus ⊤. The cross axis (called the *declination axis*) revolves in bearings fixed to the upright one (called the *polar axis*), which again turns in bearings supported by a fixed pillar, resting on a solid foundation. Across one end of the cross axis is rigidly fixed a telescope, and on the other end slides a counterbalancing weight. Thus the telescope can be turned freely in any direction, and clamped by suitable mechanism. As erected for use, the upright axis is fixed to point directly to the pole of the heavens. It being then revolved, the other axis will trace with its ends the line of the celestial Equator (q.v.). By this motion the telescope sweeps the sky from east to west, and by rotating the cross axis it sweeps from north to south. The amount of rotation of each axis is measured by a graduated circle fixed to it, and thus the position of any heavenly body observed is known. Conversely, by setting the circles and observing the time, the telescope may be set so as to point to any star, even if it be one invisible to the naked eye. The hour circle, on the polar axis, measures the right ascension of the star, and the other, or declination circle, its declination. The equatorial can hardly be called an astronomical instrument. It is rather a convenient method of mounting large astronomical telescopes. For if the telescope be pointed to any star and clamped, while the *polar* axis is regularly revolved by clockwork, the star remains steadily in the field of view. See TELESCOPE.

Equerry, an official under the Master of the Horse (see HORSE, MASTER OF THE), who accompanies the sovereign when riding in state.

Equestrian Order, or EQUITES. This body originally formed the cavalry of the Roman army, and is said to have been instituted by Romulus, who selected from the three principal Roman tribes 300 equites. This number was afterwards gradually increased to 3600, who were partly of patrician and partly of plebeian rank, and required to

possess a certain amount of property. Each of these equites received a horse and 'barley-money' from the state; but about 400 B.C. a new body of equites began to make their appearance, who were obliged to furnish a horse at their own expense, although they received regular pay. These were probably wealthy *novi homines*, men of equestrian fortune, but not descended from the old equites. Until 123 B.C. the equites were exclusively a military body; but in that year a measure was carried transferring the judicial functions from the senate to the equestrian body, which now became a distinct order or class in the state, and was called *Ordo Equestris*. In 70 B.C. Sulla deprived them of these powers; but their influence did not then decrease, as the farming of the public revenues had fallen into their hands (see PUBLICANI); and after Sulla's death they shared their former privilege with the senate. In Diocletian's time the civil and military power in the provinces passed from the senate to the equites. Under later emperors, when the requisite fortune of an eques seems to have been about £3230, the state still furnished horses for what was no longer the national cavalry; but as the honour, indiscriminately conferred, fell into contempt, foreign auxiliaries took the place of the old knights, and the body gradually became extinct. See Clinton Walker Keyes, *The Rise of the Equites in the 3rd Century of the Roman Empire* (1915).

Equidæ. See HORSE.

Equilibrium, the state of rest or balance of a body or system, solid or fluid, acted upon by various forces. See STATICS, and HYDROSTATICS.

Equinia. See GLANDERS.

Equinoctial is the same as the celestial Equator (q.v.). The equinoctial points are those in which the equinoctial and the Ecliptic (q.v.) intersect. Equinoctial time is time reckoned from the moment in each year when the sun passes the Vernal Equinox (see EQUINOXES). This instant is selected as a convenient starting-point of a uniform reckoning of time for the purposes of astronomical observers.

Equinoctial Gales. One of the most widespread beliefs in, at least, the British Islands is that there occurs an unusual frequency of gales and storms about the times of the spring and autumn equinoxes. This belief is, however, unsupported by the records of carefully conducted observations. Thus at Gordon Castle, in Strathspey, upwards of fifty years' observations show, on the contrary, fewer storms on the five days from the 21st to the 25th of March and September than on the five days preceding and the five days following these dates. Long-continued observations at other places are equally decisive against the popular belief.

Equinoxes. Sometimes the Equinoctial Points (see EQUINOCTIAL) are called the equinoxes. More commonly, by the equinoxes are meant the times when the sun enters those points —about 21st March and 22d September, the former being called the Vernal or Spring Equinox, and the latter the Autumnal. When in the equinoxes, the sun, through the earth's rotation on its axis, seems to describe the circle of the equator in the heavens, and the days and nights are of equal length all over the world. At the vernal equinox, the sun is passing from south to north, and in the northern hemisphere the days are lengthening; at the autumnal, he is passing from north to south, and the days are shortening. As the earth moves more rapidly when near the sun, or in winter, the sun's apparent motion is not uniform, and it happens that he takes eight days more to pass from the vernal to the autumnal equinox than from the latter to the former. The equinoctial points are not stationary. See ECLIPTIC, PRECESSION.

Equisetaceæ. See HORSE-TAIL.

Equity, EQUITABLE RIGHTS, &c. Equity (Lat. *æquitas*) signifies moral justice, of which laws are the imperfect expression; or the spirit of justice which enables us to apply and interpret laws rightly. Thus, the equity of a statute means the fair and wise construction of it, according to the intention of parliament, as distinguished from the literal and technical construction of the words used. It is impossible that any system of positive law should provide a rule suited to every case that arises; even good laws may work injustice, unless they are interpreted by men having discretion and authority to control their rigour and supply their deficiences. In the Old Testament and in the New, we constantly meet with the distinction between form and substance, between the letter which killeth and the spirit which maketh alive. The early Roman law was, like that of Moses, a system of forms and ceremonies; but the prætors, who had jurisdiction in commercial cases, soon found it necessary to go beyond the limits of custom and tradition. They assumed the *nobile officium* of deciding in accordance with equity; and their decisions formed the *jus honorarium* (magistrate's law, as distinguished from the customary law of the people). Courts of equity do not exercise an arbitrary discretion; they proceed on principles. The prætor, on entering upon his office, published an edict, setting forth the principles by which his judicial conduct would be guided; and as each prætor naturally adopted what was sound in the edicts of his predecessors, a system of equity was gradually developed. Ultimately, in the reign of Hadrian, the edicts of the prætors were consolidated in a single document called the Perpetual Edict.

In England, all the courts apply equitable principles in construing statutes and formal instruments; but the term equity has acquired a peculiar importance, by reason of the part which the Court of Chancery (q.v.) took in supplementing and controlling the rules of the common law. The common lawyers protested against the arbitrary nature (as it seemed to them) of equitable jurisdiction; they said that equity meant only the length of the chancellor's foot. But before the end of the 17th century this reproach was removed; the rules of equity were reduced to a system; and the Chancery jurisdiction was firmly established. The powers of the court were of three kinds: 1. Exclusive, as in the administration of trusts. When the legal ownership of property was conveyed to a trustee, he was the only person whom a court of law could recognise as owner; but a court of equity would protect the equitable estates of the persons beneficially entitled (see TRUST and USE). 2. Concurrent, in cases where law and equity both provided a remedy. Thus, in a case of breach of contract, the law would give damages to the party wronged; but equity could, in a proper case, go further, and compel specific performance of the contract. 3. Assistant, where equity only interfered to make legal process more effective. Courts of law, for example, formerly refused to allow a party to be called as a witness; a court of equity would order a party to make discovery to his opponent of such facts as the opponent had a right to know.

The principles of equity, as applied by the Court of Chancery, are summed up in certain maxims of wide significance: 'Equity follows the law'—i.e. equity will not set aside a rule of law (such as the rule of primogeniture), but will seek to apply

existing rules in a spirit of justice. 'Equity assumes that to be done which ought to be done:' when, for example, a man sells his land, equity treats the purchaser as owner, even before the formal conveyance has been executed. When a man deposits the title-deeds of his land with a banker, in consideration of a loan, this is a good Equitable Mortgage; the borrower is not allowed to plead the absence of a written agreement as an excuse for withdrawing from the transaction; equity will even compel him to execute a formal mortgage, if the lender requires it. 'Equity looks to the substance, and not to the form:' a legal mortgage of land, for example, is, in form, an absolute conveyance; but equity treats it as a security for money. The mortgagee is legal owner; but the mortgagor retains his Equity of Redemption—i.e. his right to have the estate again on paying principal and interest of the loan. 'He who seeks equity must do equity'—e.g. a mortgagor seeking to redeem must pay off all incumbrances held by the mortgagee who has the legal estate.

It is difficult to overestimate the advantages gained by the application of equitable principles to the law of property and contract. But these advantages were counterbalanced in England by the defects of Chancery procedure, and the inconvenience caused by the existence of two sets of courts, applying different rules to the same subjects. Chancery reform has now removed the scandals of the old system. Equitable powers were conferred on the courts of common law by Acts for the improvement of procedure. Finally, the Judicature Acts, which came into force in 1875, effected a fusion of law and equity, so that in every branch of the Supreme Court equitable claims may be made, and equitable defences pleaded. Law and equity are administered concurrently; where they conflict, the rules of equity prevail. Certain classes of business, relating to trusts, mortgages, property of infants, &c., are reserved to the Chancery Division of the High Court of Justice.

In America, and in the British dominions, the distinction between law and equity is or has been recognised as in England. In Scotland, the *nobile officium* of the Roman prætor is exercised by the Court of Session. For an outline of the English system, see Snell's *Principles of Equity*.

Equivalents, in Chemistry. See ATOMIC THEORY.

Era. See CHRONOLOGY.

Eradicated, in Heraldry, is said of a tree, or part of a tree, torn up by the roots.

Érard, SÉBASTIEN, French musical instrument-maker, chiefly famous for his improvements and inventions in connection with the pianoforte and harp, was born at Strasburg on 5th April 1752. Proceeding to Paris when sixteen, he shortly afterwards started business as a pianoforte-maker in that city, constructing his first pianoforte, one of the earliest made in France, in 1776 or 1777. The outbreak of the Revolution drove him to London; but in 1796 he returned to Paris. From 1808 to 1812 he was again in London. He died near Passy on 5th August 1831. He was the inventor of the harp with double pedals, and he also improved the sound-body of the instrument. The pianoforte with double escapement was likewise invented by Érard.

Erased.

Erased, in Heraldry, signifies violently plucked or torn off, and showing a ragged edge; as opposed to couped or cut, which shows a smooth edge. The term is chiefly applied to the heads and limbs of animals.

Erasi'stratus, one of the most famous physicians and anatomists of ancient times, was born in the island of Ceos about 300 B.C., settled in Alexandria, and died in Asia Minor. He founded a school of medicine, wrote several works on anatomy—in which branch he was most celebrated—on practical medicine, and pharmacy. He believed that the heart was the origin both of the veins and arteries. Of his numerous writings only some obscure fragments and titles have been preserved. See the article ANATOMY; and Hieronymus, *Erasistrati et Erasistrateorum Historia* (Jena, 1790).

Erasmus, DESIDERIUS, was born at Rotterdam, probably in the year 1467, the date given on the pedestal of his statue in his native town. A reference in his own works, however, as also his epitaph at Basel, assigns the date 1466. He was the son of one Gerhard, and Margaret, the daughter of a physician. As of illegitimate birth, he had no surname; and the name by which he is known, Desiderius Erasmus, is but the rendering in Latin and Greek of *Gerhard* ('the beloved'). Erasmus first attended school at Gouda, but while still a mere child he was sent to Utrecht, to fill a place in the choir of the cathedral of that city. He was next removed to a famous school of that time—that of the 'Brothers of the Common Life,' at Deventer, where, by his own account, he was exercised mainly in composing, repeating, and learning the silliest Latin verses. The study of Greek had as yet made but slight progress out of Italy; but Erasmus was fortunate in receiving some little instruction in that language from Alexander Hegius, the head of Deventer school, and a scholar of considerable reputation. An outbreak of the plague, of which his mother died, led to his quitting this school and retiring to Gouda, the residence of his father. Gerhard dying soon after, Erasmus and his only brother were left to the care of three trustees, who grossly neglected their charge. One of the three was bent on the brothers' entering a monastery, and with this in view, instead of sending them to a university, for which they were now ripe, placed them at another school of the Brothers of the Common Life at Bois-le-Duc. Again the plague drove Erasmus to Gouda, where his guardians tried every means to persuade him and his brother to become monks. As a compromise, Erasmus agreed to enter the Augustinian college of Sion, near Delft, on the condition that it should be left to him to leave the college if he saw fit. Here, accordingly, for the next six years he lived the life of a monk, though in his case the discipline was somewhat relaxed in the hope of his being induced eventually to adopt the monastic life. It was undoubtedly this personal experience of the ways of living and thinking of the monks that made Erasmus their relentless and lifelong enemy.

Deliverance at length came to him from the Bishop of Cambrai, who engaged him as his private secretary, and undertook to provide him with means to prosecute his studies. A few months later, and after having taken priest's orders, Erasmus went to Paris, supplied, though not overliberally, with funds by the bishop. The Collège Montaigu, where he pursued his studies, was notorious among all the colleges of Paris for the severity of its discipline, the scantiness and wretchedness of its fare, and the general squalor of its domestic arrangements. The new studies of the Renaissance had as yet made but little way in Paris; but Montaigu above every other college was still fast in the bonds of scholasticism. To Erasmus, therefore, whose constitution was delicate to fragility, and who from the very outset seems to have been awake to the intellectual revolution that had come upon Europe, all his surroundings in

Paris at this time were in the highest degree distasteful. To the end of his life he never forgot his experiences at Montaigu; and not the least important of his subsequent achievements was the service he did in helping to discredit the frivolous dialectic which he had there seen in its most absurd form.

With the exception of a visit to the Bishop of Cambrai on account of his health, Erasmus resided mainly in Paris till 1498, gaining a livelihood by instructing private pupils. Of these pupils, Lord Mountjoy deserves special mention, as he always remained one of Erasmus's best friends and most generous patrons. It was on the invitation of Mountjoy that Erasmus, probably in 1498, paid his first visit to England. This visit is one of the most important epochs in the life of Erasmus. Oxford was the chief place of his residence, and there he not only had in Linacre a better teacher of Greek than he could have found in Paris, but in his intercourse with Colet, a man of nobler stamp than himself, he received an impetus, which if it did not actually give a new bent to his studies, at least lifted his life to a higher plane of endeavour. Through the influence of Colet, his contempt for the schoolmen was intensified, and his thoughts set on the consecration of his studies to a more rational conception of religious truth. During this visit, also, began his famous friendship with Sir Thomas More, through whom on the present occasion he was introduced to Prince Henry (afterwards Henry VIII.), then only a boy of nine.

In 1500 Erasmus was again in France, and for the next six years he made his abode mainly in Paris, with occasional visits of longer or shorter duration to Orleans, and in the Low Countries. To these years belong his *Adagia* (afterwards published in greatly enlarged form in 1515), a collection of Greek and Latin proverbs, with running commentaries, and his *Enchiridion Militis Christiani* (The Christian Soldier's Dagger). A second short visit to England in 1506 cemented still more closely his friendship with More, and gained him a valuable friend in Warham, Archbishop of Canterbury and Lord Chancellor of England. During the same year he carried out a journey to Italy, which for long had been his passionate desire. At Turin he received the degree of Doctor of Divinity; at Bologna he witnessed the military triumph of the bellicose Pope Julius II.—a spectacle which Erasmus always spoke of as a disgrace to Christian Europe; and at Venice he made the acquaintance of the famous printer Aldus Manutius. During his sojourn in Italy he acted for some time as tutor to Alexander, Archbishop of St Andrews, natural son of James IV. of Scotland, who afterwards fell with his father at Flodden. His visit closed with a short stay in Rome, where he was received in a manner that proves the great reputation he had already won in letters. Altogether, as was to be expected from the different temper and aims of the two men, Erasmus carried away from Italy a far more friendly impression than Luther after his memorable visit about the same date. The accession of Henry VIII., of whom great things were expected as a patron of learning, and the special invitation of Lord Mountjoy, induced Erasmus once more to make his home in England. On his journey from Italy to that country he conceived the plan of his *Encomium Moriæ* (Praise of Folly), which on his arrival he threw upon paper in the course of a week. In this satire, written in the full maturity of his powers, we have Erasmus in his happiest and most distinctive vein, as the man of letters and the general critic of men and things. While its general tone is that of playful banter, it is yet inspired by the most serious purpose, as specially appears in its biting sarcasm at the expense of kings and churchmen. Seven editions of this work were issued within a few months.

During this his third and longest visit to England, Erasmus resided chiefly in Cambridge, where he acted as Margaret professor of Divinity, and professor of Greek. After 1514 Erasmus's changes of abode for the next few years are so frequent that it becomes puzzling to follow him. In 1514 he was in Basel, back in England the same year, again in Basel in 1515, and once more in England —the last of his visits to that country. From 1517 to 1521 he lived at Louvain, taking a keen interest in the progress of the new studies at the famous university of that place. Meanwhile, his literary labours were unceasing. In 1519 appeared the first edition (afterwards greatly enlarged) of his *Colloquia*, the most famous of all his works, and usually regarded as his masterpiece. It consists of a series of familiar dialogues on the everyday topics of the time—social, religious, and political; and the audacity and incisiveness with which it handles the abuses of the church in large measure prepared men's minds for the work of Luther. In 1516 his edition of the New Testament, virtually the first of the Greek text, was published at Basel; and in 1519 his edition of St Jerome in nine folio volumes. In both of these works the dominant aim of Erasmus was to introduce a more rational conception of Christian doctrine, and to emancipate men's minds from the frivolous and pedantic methods of the scholastic theologians. By such labours, as by his *Adagia* and *Encomium Moriæ*, Erasmus had shown the need for a general reform in the church. When the Lutheran revolution came, therefore, Erasmus found himself in the most embarrassing position. The upholders of the old order fell upon him as the author of all the new troubles, and the followers of Luther, on the other hand, bitterly assailed him for what they deemed his cowardice and inconsistency in refusing to follow up his opinions to their legitimate conclusions.

From the date of Luther's final breach with Rome, the life of Erasmus was one long controversy, which seriously marred the honour and happiness of his declining years. In 1521 he left Louvain, where the champions of the old faith had made his stay unendurable, and took up his abode at Basel. In this city, with the exception of a sojourn in Friburg from 1529 to 1535, Erasmus spent the rest of his life. To Basel he had always been attracted as the home of the great printer Froben, as well as by the excellence of its climate, and he now found it the quietest spot in the general din of religious strife. To the very last his labours were incessant and almost incredible. In addition to the toil of editing a long succession of classical and patristic writers, he was engaged in controversies which would have incapacitated most men for peaceful study. The most important of these controversies were those with Ulrich von Hutten, with Luther, and with the Sorbonne. In accordance with his fiery character, Hutten judged Erasmus with the greatest severity for not taking his place by the side of Luther. With the great Reformer himself, Erasmus, after long hesitation, crossed swords in his *De Libero Arbitrio* (1523), in which he assailed one of the fundamental positions of the Lutheran theology—that all human action is determined by divine necessity. Attacked by men like Hutten on the one side, he was as fiercely assailed on the other by the Sorbonne, the great surviving stronghold of obscurantism alike in theology and secular studies. By his *Ciceronianus*, a satire on the pedantic imitation of Cicero, Erasmus raised against himself a new set of adversaries—those humanists, namely, who set style above matter. Yet in spite of all these contro-

versies, Erasmus during his last years enjoyed fame and consideration beyond that of any man of letters before or since. Letters and presents came to him from all the crowned heads of Europe; and churchmen in the highest position deemed it an honour to be among his correspondents.

Erasmus's health had never been robust even in youth, and from a comparatively early age he had been afflicted with the stone. As he advanced in life, his sufferings grew upon him, and it was only by the most careful ordering of diet, and by his overpowering instinct for study, that he accomplished the work he did. From 1534, a disease resembling gout in its symptoms subjected him at times to excruciating pain. On 12th July 1536, after nearly a month's attack of dysentery, he died, retaining to the last his gay and genial humour.

Erasmus stands as the supreme type of cultivated common sense applied to human affairs. In his latter years he fell upon a time when other qualities were needed in the best interests of humanity; but such as he was, few men have done more to advance truth, and to prepare men's minds for its acceptance. No man of letters has ever attained to anything approaching the influence wielded by Erasmus during his own century. Yet Erasmus was no creative genius, and he produced no single work which has a place in the first rank of the world's masterpieces. He owed his position to the wonderful range of his activity, to his astonishing productiveness, to the breadth and sanity of his views, and to the delightful qualities of wit, humour, and unfailing vivacity which distinguish all his work. He has himself indicated his services to Europe with exactness and precision. He rescued theology from the pedantries of the schoolmen, and referred it to its original sources; he did more than any other single person to advance the cause of the new studies of the Revival of Learning; he exposed the abuses of the church, and he protested in the interests of the people against the thoughtless tyranny of their rulers. His attitude towards the Lutheran revolution has exposed him to the obloquy of Protestants and Catholics alike. By both he has been accused of cowardice and insincerity, because he insisted in maintaining his neutral position. But this is merely to say that Erasmus had the defects of his qualities. Constitutionally, he was averse to all extremes, as he distinctly showed in his antagonism to the excesses of humanism in its neo-pagan developments, not less than to what he considered the excesses of the German Reformation. If he had not the energy to head a revolution, he had at least in eminent degree the courage of the scholar, as the long catalogue of his works, produced in chronic weakness of health, amply proves. As to his personal qualities, it should be sufficient to say that he enjoyed the friendship and esteem of men of so different, yet each in his own way of so high a type, as Bishop Fisher, Colet, and More. His personal appearance corresponded to his mental and moral qualities. He was slightly under the middle height, but of graceful figure; his features were delicate and mobile; and he spoke in tones low but beautifully clear and distinct.

An edition of his works was published at Basel in 9 vols. in 1540; the standard edition is that of Le Clerc (Lyons, 10 vols. 1703-6). See Lives by Knight (1726), Jortin (1748), Burigny (1752), Durand de Laur (1874), Drummond (1873), Feugère (1874), Froude (1894), Allen (1914), Huizinga (1924), Preserved Smith (1924); a book by Amiel (1889); his Letters (ed. Allen, 1906 *et seq.*; trans. Nichols, 1918).

Erastus, THOMAS (properly *Liebler* or *Lieber*), theologian and physician, was born in 1524, probably at Baden in Switzerland, but possibly at Auggen, near Mühlheim in Württemberg. He studied theology at Basel (where he Grecised his name), and philosophy and medicine at Bologna and Padua. After nine years in Italy he was appointed physician to the counts of Henneberg, then (from 1558) professor of medicine at Heidelberg, and court-physician to the Elector Palatine. He removed from Heidelberg to fill the chair of Medicine at Basel in 1580, and died there, January 1, 1583. Shortly before his death he had been appointed professor of Ethics. Erastus was a skilful physician and a man of upright character, an equally vigorous writer against 'the new medicine of Philip Paracelsus' (1572) and in favour of the burning of witches (1577 *et seq.*). In theology he was a follower of Zwingli, and represented his view of the Lord's Supper at the conferences at Heidelberg in 1560 and Maulbronn in 1564. The fame of Erastus now rests on his strenuous opposition to Calvinist discipline and Presbyterian order. For ten years (from 1560) he resisted successfully the Calvinist party under Caspar Olevian at Heidelberg; but in 1570 Presbyterianism was introduced by the Elector Frederick III. Erastus was excommunicated on a false suspicion of heresy, founded on a correspondence with Unitarians of Transylvania, but was restored in 1575. He had carried on a private exchange of views on the subject of church discipline with his friend Beza, and after his death his widow's second husband, Castelvetro, published at London (1589), with the concurrence of Archbishop Whitgift and with a fictitious imprint, a treatise on excommunication entitled *Explicatio gravissimæ quæstionis utrum Excommunicatio . . . mandato nitatur divino, an excogitata sit ab hominibus.* This was answered by Beza in his *De verâ Excommunicatione et Christiano Presbyterio* (1590). A translation of Erastus's treatise was published with a preface by Dr Robert Lee (Edin. 1844). Erastus maintained that no member of the church should be excluded from her communion as a punishment for sin. Punishment is 'the special duty and office' of the civil magistrate. He was familiar with the system of Zurich, where the Christian magistrate administered ecclesiastical discipline in the name of the Christian community, and he dreaded that Presbyterianism, unchecked, might exercise a tyranny over men's consciences as absolute as that of the Spanish Inquisition.

In England, the name of Erastians was applied to the party that arose in the 17th century, denying the right of autonomy to the church—a right neither maintained nor denied by Erastus. The Erastian controversy broke out at the time of the Westminster Assembly. The leading Erastians in that assembly were Lightfoot and Coleman, who were supported by Selden and Whitelocke in the House of Commons. Since the time of the Reformation the controversy has been confined chiefly to the church in Scotland.

See on the one side, Gillespie, *Aaron's Rod Blossoming* (1646), Sam. Rutherford, *Divine Right of Church Government* (1646), and Cunningham's *Historical Theology*, vol. ii. chap. xxvii. (1863); and on the other, Selden, *De Synedriis* (1650-53), and Du Moulin, *Of the Right of Churches* (1658).

Erasure, or RAZURE, as it is more commonly called in England, from the Latin *rado*, 'I scrape or shave,' is the scraping or shaving of a deed or other formal writing. In England, except in the case of a will, the presumption, in the absence of rebutting evidence, is that the erasure was made at or before execution. If an alteration or erasure has been made in any instrument subsequent to its execution, that fact ought to be mentioned (in the abstract, or epitome of the evidences of ownership), together with the circumstances under which

it is done. A fraudulent alteration, if made by the person himself taking under it, would vitiate his interest altogether. It was formerly considered that an alteration, erasure, or Interlineation (q.v.) would void the whole instrument, even in those cases where it was made by a stranger; but the law is now otherwise, as it is clearly settled that no alteration made by a stranger will prevent the contents of an instrument from retaining its original effect and operation, where it can be plainly shown what that effect and operation actually was. To accomplish this, the mutilated instrument may be given in evidence as far as its contents appear; and evidence will be admitted to show what portions have been altered or erased, and also the words contained in such altered or erased parts; but if, for want of such evidence, or any deficiency or uncertainty arising out of it, the original contents of the instrument cannot be ascertained, then the old rule would become applicable, or, more correctly speaking, the mutilated instrument would become void for uncertainty. If a will contains any alterations or erasures, the attention of the witnesses ought to be directed to the particular parts in which such alterations occur, and they ought to place their initials in the margin opposite, before the will is executed, and to notice this having been done by a memorandum, added to the attestation clause at the end of the will. For the English law on this subject, see Taylor, *Law of Evidence*.

In Scotland, the rule as to erasure is somewhat stricter than in England—the legal inference being that such alterations were made after execution. As to necessary or *bonâ fide* alterations which may be desired by the parties, corrections of clerical errors, and the like, after the deed is written out, but before signature, the rule in Scotland is that 'the deed must show that they have been advisedly adopted by the party; and this will be effected by mentioning them in the body of the writing. Thus, if some words are erased and others superinduced, you mention that the superinduced words were written on an erasure; if words are simply delete, that fact is noticed; if words are added, it ought to be on the margin, and such additions signed by the party, with his Christian name on one side, and his surname on the other; and such marginal addition must be noticed in the body of the writ, so as to specify the page on which it occurs, the writer of it, and that it is subscribed by the attesting witnesses.' See Menzies's *Lectures on Conveyancing*. The Roman rule was that the alterations should be made by the party himself, and a formal clause was introduced into their deeds to this effect, 'Lituras, inductiones, superinductiones, ipse feci.' As a general rule, alterations with the pen are in all cases to be preferred to erasure; and suspicion will be most effectually removed by not obliterating the words altered so completely as to conceal the nature of the correction. 'The worst kind of deletion,' says Lord Stair, 'is when the words deleted cannot be read (but if they are scored that they can be read, it will appear whether they be *de substantialibus*), for if they cannot be read, they will be esteemed to be such, unless the contrary appear by what precedes and follows, or that there be a marginal note, bearing the deletion, from such a word to such a word, to be of consent.' The law of the United States follows that of England in this matter.

Eratosthenes OF CYRENE, born 276 B.C., was an eminent mathematician, astronomer, and geographer. Among his teachers were Lysanias the grammarian and Callimachus the poet. By Ptolemy Euergetes he was called to Alexandria to superintend his great library. Here he died of voluntary starvation, at the age of eighty, having become blind, and wearied of life. Eratosthenes measured the obliquity of the ecliptic with an accuracy wonderful for his time, drew up a catalogue of the fixed stars, amounting to 675, which is now lost, and made an attempt to measure the magnitude of the earth in the method used at the present day. He found the circumference of the earth to be 252,000 stadia, which, according to Pliny, is 31,500 Roman miles. His most important work was a systematic treatise on geography, which was used by Strabo. He wrote also on moral philosophy, history, and grammar. Such fragments of his writings as are still extant have been collected by Bernhardy in his *Eratosthenica* (Berlin, 1822). See also Berger, *Die geographischen Fragmente des Eratosthenes* (Leip. 1880).

Erbium (Er; atom. wt. 168) is a rare metal, the compounds of which are present in the mineral *ytterbite* or *gadolinite*, found at Ytterby in Sweden. It is also believed to be present in the sun's vapour. Its salts exhibit signs of radioactivity. The ytterbite metals include erbium, ytterbium, and others, the existence of some of which was till recently in doubt. It is chiefly of interest because the compounds of the three metals mentioned resemble each other so closely, and have such similar properties, that the processes of separation and purification are difficult and tedious in the extreme, a single research with the object of obtaining absolutely pure salts requiring years of patient work.

Ercildoune. See EARLSTON.

Ercilla y Zuñiga, ALONSO, a Spanish poet, was born at Madrid, August 7, 1553. He became page to the Infante Don Philip, son of Charles V., and accompanied him on his early travels, and in 1554 to England, on the occasion of Philip's marriage to Queen Mary. Shortly after he joined the expedition against the Araucanians on the coast of Chili. The arduous difficulties that had to be overcome, and the heroism of the natives, suggested to Ercilla the idea of making it the subject of an epic poem. He began his poem on the spot, about the year 1558, occasionally committing his verses, in the absence of paper, to pieces of leather. An unfounded suspicion of his having plotted an insurrection involved him in a painful trial, and he had actually ascended the scaffold before his innocence was proved. Deeply wounded, the brave poet-soldier turned to Spain, but Philip treating him with great coldness and neglect, he made a tour through France, Italy, Germany, Bohemia, and Hungary. For some time he held the office of chamberlain to the Emperor Rudolf II., but in 1580 returned to Madrid, where he struggled with poverty till his death, about 1595. Cervantes in *Don Quixote* compares the *Araucana* with the best Italian epics, and it has undoubtedly not a little of the epic style and spirit. The first part is the freshest in character, and was published in 1569; the second part followed in 1578, the third in 1597. A very elegant reprint appeared at Madrid in 1776. Facsimiles of the original editions were published at New York in 1902–3. There is a French translation by Nicolas (1870). See Royer's *Étude* (Dijon, 1880).

Erckmann-Chatrian, the compound name of two French romancists, Lorrainers both, whose stories of Alsatian peasant life are known the whole world over. Émile Erckmann, born 20th May 1822, at Phalsbourg, studied law in Paris from 1842 to 1858; whilst Alexandre Chatrian, born 2d December 1826, in the village of Soldatenthal, from glass-blowing took to teaching in Phalsbourg, and afterwards got a railway clerkship. Their literary partnership dates from 1848; but for ten or eleven

years they had little success beyond getting some of their stories printed in various newspapers and journals. It was not till 1859 that *L'Illustre Docteur Mathéus* (1859) gave a certain éclat to the collective name of Erckmann-Chatrian. *Le Fou Yégof* (1862) is one of a series of novels which give graphic pictures of the invasion of 1813–14, to which series also belong *Histoire d'un Conscrit de 1813* (1864) and *Waterloo* (1865). *Le Joueur de Clarinette* (1863), a simple story of a village musician; *Les Amoureux de Catherine*, another tale of village life in the same volume; *L'Ami Fritz* (1864); *Madame Thérèse, ou les Volontaires de '92* (1863); *Le Blocus* (1867; Eng. trans. *Blockade of Phalsbourg*, 1870); *Histoire d'un Paysan* (1868); and *Contes Populaires*, most of which have been translated into English, count amongst the best they wrote. Three plays by them also achieved success —*Le Juif Polonais* (1869; well known as *The Bells*), the dramatic version of *L'Ami Fritz* (1876), and *Les Rantzau* (1882). See MASCAGNI. After the German annexation of Alsace-Lorraine (1871) a strong anti-German feeling appeared in their books—the best of these *L'Histoire d'un Plébiscite* (1872). They had quarrelled, when Chatrian died 4th September 1890. Erckmann died at Lunéville, 14th March 1899. Edmond About thus described their partnership: 'The two friends see one another very rarely. When they do meet, they elaborate together the scheme of a work. Then Erckmann writes it, Chatrian corrects it, and sometimes puts it in the fire.'

Erdmann, JOHANN EDUARD, German philosopher, was born in 1805 at Wolmar in Livonia, studied at Dorpat and Berlin, coming under the influence of Hegel, and became professor of Philosophy at Halle in 1839. He died 12th June 1892. His principal work was a *Grundriss der Geschichte der Philosophie* (3d ed. 1877), besides which he also wrote a work on Logic and Metaphysics, two books on Psychology, two collections of essays (one entitled *Ernste Spiele*), and works on *Nature and Creation*, *Body and Soul*, *Belief and Science*, and *The State*.

Erebus, the name of one of the sons of Chaos, signifies darkness, and is used specially to denote the dark and gloomy cavern beneath the earth, through which the shades pass in going to Hades.

Erebus, MOUNT, an active volcano in MacMurdo Sound, off Antarctica (q.v.), rising 13,350 feet above the sea. It was discovered in 1841 by Ross, who named it after one of his vessels, and was ascended by Professor David with a party in 1908.

Erechtheus, or ERICHTHONIUS, an Attic hero, is said to have been the son of Hephæstus and Atthis, daughter of Cranaus, the son-in-law and successor of Cecrops. He was brought up by Athena, who placed him in a chest, which was intrusted to the three daughters of Cecrops. In defiance of orders they opened the chest, and discovering a child entwined with serpents, were seized with madness, and threw themselves down the most precipitous part of the Acropolis. Erechtheus instituted the Panathenæa, and in his honour was erected the Erechtheum, burnt by the Persians, and rebuilt as a noble Ionic temple. See Swinburne's great tragedy of *Erechtheus*.

Eregli (anc. *Heracleia Pontica*), the only port on the Black Sea coast between the Bosporus and Sinope. See HERACLEIA. There is another Eregli on the Bagdad railway, 120 miles ESE. of Konia.

Eremacausis is a kind of slow Combustion (q.v.) with Fermentation (q.v.).

Eretria, a town on the SW. coast of Eubœa, which, destroyed by the Persians in 490 B.C. and rebuilt by the Athenians, never afterwards regained its former prosperity and importance. The modern town, Nea Pesara, is a small, unwholesome place, surrounded by swamps.

Erfurt, a city of Prussian Saxony, anciently capital of Thuringia, stands in a highly cultivated plain, on the Gera, 13 miles W. of Weimar by rail. Till 1873 it was strongly fortified. Its two citadels, the Petersberg and the Cyriaksburg, were formerly monasteries. Erfurt has several churches, chiefly Gothic, the cathedral and the church of St Severus being the finest. The cathedral, one of the most venerable Gothic buildings in Germany, possesses, besides a very rich portal, sculptures and bronze castings dating from the 13th to the 16th century, especially a Coronation of the Virgin, by Peter Vischer (1521). In the northern tower is the bell called *Maria Gloriosa*, cast in 1497, and weighing 13½ tons. The Regler Church contains an altarpiece by Wohlgemuth. The monastery of St Augustine, famous as the residence of Luther, whose cell was destroyed by fire in 1872, was converted in the year 1819 into an asylum for deserted children. From 1378 to 1816 Erfurt was the seat of a university, of which the academy of sciences and the library alone remain. The growing of flowers and vegetables, and an extensive trade in flower-seeds, are carried on. The principal manufactures are woollen, silk, cotton, and linen goods, lamps, machines, shoes, beer, malt, &c. Pop. (1871) 43,616; (1880) 53,254; (1900) 85,190; (1910) 111,461; (1919) 129,646.

Erfurt, originally called Erpesford or Erpesfurt, was made a bishopric in 741, and in 805 the capital of the Sorbs by Charlemagne. In the 15th century its woollen and linen manufactures raised it to the position of one of the foremost cities of Germany. All through, the town has had a stormy history, being either the bone of contention between the electors of Mainz and of Saxony, or the object of attack by foreign invaders. Since 1803 (except the period from 1806 to 1814) it has belonged to Prussia. At the Congress of Erfurt (September–October 1808) Napoleon met the Emperor of Russia and several of the minor sovereign princes of Germany.

Ergasteria, or Laurium, a mining-town in the Greek nomarchy of Attica, near Cape Colonna, with ancient lead and silver works, reopened in 1864; pop. 10,000.

Ergot, a diseased condition of the ovary of grasses and sedges, due to the presence of species of Claviceps, a Pyrenomycete fungus (see FUNGI), whose filamentous mycelium ramifies through the tissue of the ovary, which becomes deformed and enlarged. Multitudes of spores are formed and embedded in a sweet fluid ('honey-dew'), and are carried by insects to other plants. The mould now withers on the surface, but the deeper mycelium within the ovary becomes denser and harder, forming the so-called sclerotium, and lies dormant until the grain is sown in early spring, when it bears globular heads which contain depressions or perithecia, containing the ascospores, which again recommence the cycle. The medicinal 'ergot of rye' is that formed by *Claviceps purpurea*.

Ergot of Rye.

Producing rapid contraction of the uterus, it is often employed in midwifery; but its use in unskilled or unscrupulous hands is attended by the most serious risks. It has also been used in dysentery, epilepsy, whooping-cough, and as a styptic. Several powerful alkaloids, obscure in their mutual relations, are got from ergot. The continued eating of bread made of ergotised rye produces a specific disease called *Ergotism*. This is a terrible form of poisoning, in which not only convulsions appear, but often also gangrene of the extremities, resulting in mutilation or death, even recovery from less serious doses being slow and difficult. Many dreadful epidemics in rye-consuming countries (as in Lorraine and Burgundy in 1816), the causes of which were not understood, are now supposed to have been due to ergotism. See also RAPHANIA.

Eric, the name of several Danish and Swedish kings.—ERIC VII., king of Denmark, born in 1382, the son of Duke Wratislaw of Pomerania, was selected as her successor by Queen Margaret of Denmark, and in 1412 mounted the throne of Denmark, Norway, and Sweden, united according to the treaty of Calmar. Cruel and cowardly in his character, he lost Sweden in 1437 through a revolt of the peasants of Dalecarlia, and in 1439 was deposed also in Denmark. He died in Rügenwald in 1459.—ERIC VIII., the Saint, became king of Sweden in 1155, did much to extend Christianity in his dominions, and to improve the laws, and fell in battle with the Danes in 1160.—ERIC XIV., the last of the name who reigned in Sweden, succeeded in 1560 to the throne of his father, the great Gustavus Vasa, and at once began to exhibit the folly that disgraced his reign. His flighty matrimonial schemes reached even Elizabeth of England and Mary of Scotland, until at length (1567) his roving fancy found rest in the love of a Swedish peasant-girl, who acquired an influence over him which was ascribed by the superstitious to witchcraft, since she alone was able to control him in the violent paroxysms of blind fury to which he was subject. His capricious cruelties and the disastrous wars that followed on his follies at length alienated the minds of his subjects, who threw off their allegiance in 1568, and solemnly elected his brother John to the throne. Nine years later the unhappy Eric ended his miserable life half voluntarily by a cup of poison. This crazy madman had a genuine love of letters, and solaced his captivity with music and the composition of psalms. His story has been worked into dramatic form by Swedish poets; in German by Kruse in his tragedy, *König Erich* (1871).

Erica'ceæ, or HEATHS, a large, widely distributed order of sympetalous dicotyledons, chiefly small shrubs, frequently evergreen and social in growth, covering large areas, especially in mountainous regions and on tablelands. See HEATH, RHODODENDRON, AZALEA, ANDROMEDA, ARBUTUS, CRANBERRY, KALMIA, &c.

Ericht, LOCH, a lonely lake between Perth and Inverness shires, 1 mile from Dalwhinnie station, and 60 miles NW. of Perth. Lying 1153 feet above sea-level, it stretches 14¾ miles south-south-westward, varies in width between ¼ and 1⅓ mile, is overhung by Ben Alder (3757 feet), abounds in salmo-ferox and trout, and sends a stream 6 miles to Loch Rannoch. The maximum depth is 512 feet.

Ericsson, JOHN, engineer, was born at Langbanshyttan, in the Swedish province of Vermland, 31st January 1802. After serving for some time as an officer of engineers in the Swedish army, he removed in 1826 to England, and continued to occupy himself with improvements chiefly on steam machinery and its applications. In 1829, for the Liverpool and Manchester railway race, he built within six weeks (so it is said) the *Novelty*, a steam-engine which, had not the fan broken down at the last moment, might have proved a formidable competitor to Stephenson's *Rocket*. In 1836 he took out a patent for the screw-propeller (see SHIPBUILDING). In 1839 he went to the United States, where he furnished designs for the warship *Princeton*, the first steamer that had her engines and boilers entirely below the water-line, and brought out his improved caloric engine (see AIR-ENGINE) and numerous other inventions. In 1861, during the civil war, he designed and finished in one hundred days the ironclad *Monitor* (see the article NAVY), and in 1862 built a number of similar vessels for the American navy. The *Destroyer*, a vessel with under-water guns, from which projectiles enclosing 300 lb. of gun-cotton were to be fired into an enemy below her armour-plating, was tried in 1881, but failed to satisfy the requirements of the navy board. In 1883 he erected a 'sun motor' in New York: his earlier experiments for developing power from the direct rays of the sun are described in his magnificent volume, *Contributions to the Centennial Exhibition* (1876). He died in New York, 8th March 1889. By his own wish he was buried in the place of his birth, a United States man-of-war conveying his body in 1890 to Langbanshyttan; and it was decided to erect his statue in Stockholm. His inventions covered nearly the whole field of mechanical engineering, and revolutionised both the navigation and the navies of the world. His great services to science were recognised by the governments of the United States, Sweden, Denmark, Spain, and Austria, as well as by many learned societies in America and Europe. See his Life by W. C. Church (1891).

Erid'anus. See PO.

Erie, one of the five great lakes which empty themselves by the St Lawrence, separates the province of Ontario, in Canada, on its left, from Michigan, Ohio, Pennsylvania, and New York on its right. It is the most southern of the five, receiving at its western extremity the waters of Lakes Superior, Michigan, and Huron by the river Detroit, and discharging them at its north-east by the Niagara into Lake Ontario. With a length of 240 miles, Erie has a breadth varying from 30 to nearly 60 miles, with an area of 9960 sq. m. It is 8¾ feet below the Huron, and 326 and 573 respectively above the Ontario and the Atlantic. The shores are for the most part low and of a clayey nature. At its south-western extremity are several wooded and partly cultivated islands, the largest of which is about 14 miles in circumference. It is by far the shallowest of the five great lakes. Its mean depth is 100 feet, its maximum 210 feet; this comparative shallowness and the consequent liability to a heavy ground-swell, together with a lack of good harbours, and a frequency of severe storms, renders navigation peculiarly difficult and dangerous. The chief harbours on the United States shore, besides the natural harbour of Erie itself or Presque Isle, are those of Buffalo, Dunkirk, Cleveland, Sandusky, and Toledo; and on the north or Canadian shore, Ports Dover, Burwell, Colborne, and Stanley. Lake Erie receives no rivers of any consequence, except the Detroit and Maumee. Its commercial importance, however, has been largely increased by art. It is connected by one canal with the Hudson (see CANAL), and by more than one with the Ohio; while, on the Canadian side, it communicates with the Ontario by means of an important work, the ship-channel of the Welland Canal. Its navigation generally closes in the beginning of December, and the lake remains more or less frozen till March or April.

The commercial importance of this lake has been greatly enhanced within recent years by the establishment of numerous lines of railway connecting its ports with the interior. The amount of traffic on the lake and on these railways is enormous. Lake Erie was the scene of a naval engagement between the British and Americans, September 10, 1813, in which the latter were victorious.

Erie, the capital of Erie county, Pennsylvania, on Lake Erie, 88 miles SW. of Buffalo, and 95 NE. of Cleveland, is a port of entry, an important centre of trade, and connected by rail with New York, Philadelphia, Pittsburg, and other cities. Its harbour, one of the largest and best on the lake, is formed by an island of 4 miles in length, which, under the appellation of Presque Isle (Fr., 'peninsula'), still preserves the memory of its having been once connected with the mainland. The belt of water thus sheltered is known as Presque Isle Bay, and forms a natural harbour for the city; it is now protected by a breakwater, is 3 to 4 miles long and 1 mile wide, and varies in depth from 9 to 25 feet. It has a number of attractive buildings, but its chief interest is commercial, there being a large lake commerce in which coal, oil, iron, and manufactured goods are exported. Its industries comprise oil-refineries, tanneries, iron-foundries, planing, paper, and flour mills, and manufactures of engines, boilers, farming implements, &c. Electrical supply works have been introduced. Natural gas supplies the city with domestic fuel. Pop. (1870) 19,646; (1890) 40,634; (1910) 66,525; (1920) 102,093.

Erigena, JOHANNES SCOTUS (earlier known as Scotigena, Jerugena, or Eriugena), a famous philosopher of the 9th century, came, according to his friend Prudentius, from Ireland. He must have been born there between 800 and 815. His residence, from 847 or earlier, at the court of Charles the Bald, in France, where he is said to have been the head of the 'court school' (*schola palatina*), is the only part of his history that is certainly known. He came (851) to the help of Hincmar in the Predestination controversy with the doctrine, hitherto unknown in the West, that evil is simply that which has no existence, and that therefore damnation is not a positive punishment by God, but only consists in the consciousness of having failed to fulfil the divine purpose. The Council of Valence condemned this *pultes Scotorum* ('Scots' porridge') as 'an invention of the devil.' The tradition is that, after the death of Charles the Bald (877), Erigena was forced to leave France under the suspicion of heresy, was called to England by Alfred the Great, and about 880, as abbot of Malmesbury, was stabbed to death with their pens by his scholars. Erigena translated only too literally, into Latin (860), the writings of the pseudo-Dionysius the Areopagite, and afterwards the Greek scholia of Maximus to the writings of Gregory Nazianzen. His chief work, *De Divisione Naturæ*, lib. v. (perhaps *c.* 865–870), was condemned by a provincial council at Sens, and by Pope Honorius III. (1225), who described the book as 'swarming with worms of heretical perversity.' It was published by Gale (Oxford, 1681), and was placed on the *Index librorum prohibitorum* by Gregory XIII. in 1685. In this work Erigena's aim was to reconcile authority with reason. His system is not so much Pantheism as Monism. God and the world are merged in the higher unity of 'Nature.' Nature—to Erigena the sum of all being and not-being (the necessary complement of being)—has a fourfold form of existence: (1) *Natura creans non creata*—i.e. God, as the uncreated Creator of all things; (2) *Natura creata creans*—i.e. the Word from God, by whom all things are made (the Son); (3) *Natura creata non creans*—i.e. the world, creation, or nature in the narrower sense; (4) *Natura non creans et non creata*—i.e. God, as the final goal of all creation, to whom everything created returns in a universal Apocatastasis (q.v.). One of the last scholars in the West who could read Greek, Erigena shows strong leanings to the East. His thought comes, partly through pseudo-Dionysius, Maximus, Gregory of Nyssa, and Augustine, from the Neo-Platonists and Plato himself. His influence, slender in the Middle Ages, has been traced in Maimonides, Spinoza, Hegel, and the modern idealists. Mr Bett declares him 'the greatest thinker of his own day, and one of the greatest metaphysicians of all time.'

The works of Erigena (some spurious), edited by H. T. Floss, form vol. cxxii. (Paris, 1853) of the *Patrologia* of Migne. His Life has been written by Staudenmaier (1834) and Hermens (1868). See the monographs by Taillandier (1843), Christlieb (1860), Huber (1861), Hoffmann (1876), and Buchwald (1884); R. Lane Poole, *Illustrations of the History of Mediæval Thought*; and works by Gardner (1900), Rand (1906), H. Bett (1925).

Eri'geron, a genus of composite weeds, allied to Aster. The British *E. acre*, sometimes called Fleabane, has been used as a source of potash, and was formerly in medicinal repute. *E. canadense* has become a common weed in Europe.

Erin (O. Ir. *Erinn*, dat. sing of *Eriu*), an ancient name for Ireland.

Erinna, a Greek poetess, the intimate friend of Sappho, born at Rhodes, or on the little island of Telos, to the west of Rhodes. The hypothesis of a second poetess of the same name, in the 4th century B.C., which is based on a statement of Eusebius, is generally rejected. Though she died at the early age of nineteen, Erinna acquired such celebrity by her epics, that her verses were compared with those of Homer. Of her principal poem only four lines are extant; and, of the three epigrams preserved in Schneidewin's *Delectus Poesis Græcæ Elegiacæ* (Göttingen, 1839), two at least are not genuine.

Erinyes. See EUMENIDES.

Eriobo'trya. See LOQUAT.

Eriocaula'ceæ, a small order of monocotyledons, allied to Restiaceæ, of grassy or rushy aspect, of marsh or aquatic habit, and unimportant properties. The 300 species are chiefly tropical; the North American *Eriocaulon septangulare* (Pipewort), however, occurs in muddy lake bottoms in West Ireland and the Hebrides.

Eriodendron (Wool-tree), a genus of Bombacaceæ (q.v.), East and West Indian trees with woolly seed. The wool (kapok) is used for stuffing pillows, &c. The seeds yield oil, and are edible. See SILK-COTTON.

Eriophorum. See COTTON-GRASS.

Eris, in Greek mythology, the sister of Ares, and personification of strife.

Erith, a town of Kent, on the right bank of the Thames, 15½ miles by rail E. of Charing Cross. A summer-resort for Londoners, and the headquarters of several yacht clubs, it has a number of fine villas, and a much-restored church, rich in brasses; whilst in the Erith and Plumstead Marshes are large powder magazines. At Erith the *Grace de Dieu* was built in 1515. Pop. (1881) 9812; (1921) 31,568.

Eritrea, or ERYTHREA, an Italian colony (45,400 sq. m.) in Africa, between Abyssinia and the Red Sea, consists of a northern tableland, a continuation of that of Abyssinia, whose highest parts reach about 10,000 feet, and a narrow southern coastal plain diversified by volcanoes and other hills. The Dahlak Islands form part of the colony. The climate is very hot on the plains, warm temperate on the plateau, approaching to alpine on

the highest hills. The inhabitants (Arabs, Abyssinians, Somalis, and others) number over 400,000. They are partly pastoral nomads, with great herds of camels, oxen, sheep, and goats. Hides are exported. Pearls are got at Massawa and the Dahlak Islands, gold near Asmara. Cereals are raised in the higher regions by help of irrigation; and there is a trade in palm-nuts. There is a railway (75 miles) from the port of Massawa to Asmara, the capital, and one (65 miles) from Asmara to Cheren.

Erivan' (Persian *Rewán*), a town of Armenia, formerly capital of a Russian government, lies on the elevated plain to the north of Ararat, 3432 feet above the level of the sea. It has Russian and Armenian churches, and mosques, besides a citadel and a large bazaar. Close by resides the head of the Armenian church (see ECHMIADZIN). The town dates probably from the 7th century A.D.; in later years it was held alternately by Persians and Turks. Population, 90,000. In 1827 it was stormed by the Russian general, Paskevich, who received the surname of Erivanski; and by the treaty of peace concluded at Turkmanshai, 22d February 1828, both town and province were given up by Persia to Russia. The province (area of 10,000 sq. m., pop. 1,000,000), along with Kars, proclaimed itself a republic in 1918, as a nucleus of an Armenian republic. See ARMENIA.

Erlangen, a town of Bavaria, on the Regnitz, 12 miles N. of Nürnberg. As old as the 10th century, it owes its prosperity to the settlement of French Huguenots after the revocation of the Edict of Nantes (1685), and to its university (1743), which is celebrated as a school of Protestant theology. A statue of its founder, the Margrave Frederick of Brandenburg-Baireuth, was erected in the market-place in 1843. Brewing is the staple industry; and besides its extensive stocking and glove manufactories, which provide the greater part of Germany with their goods, Erlangen has great mirror and tobacco factories. Burnt in 1449 and 1632, Erlangen came to Bavaria in 1809. Pop. 24,000, of whom four-fifths are Protestants.

Erlau (Mag. *Eger*), a city of Hungary, on the river Erlau, 89 miles NE. of Budapest by rail. The archiepiscopal cathedral, built since 1837, is a domed cruciform building, 328 feet long. The lyceum (1761–99) has a valuable library and an observatory; and there is a richly-endowed hospital (1830). Two warm baths are much resorted to. The Erlau wine is the best red wine of Hungary. The population is over 28,000. Dating from 1010, Erlau suffered much at the hands of the Turks, who held it from 1596 till 1687.

Erlkönig, a German mistranslation ('alder king') of the Danish *Ellerkonge* ('king of the elves'). It was first used by Herder instead of *Elfenkönig;* and Goethe followed in his famous ballad (consummately set to music by Schubert), in which a human child summoned by the Erlking dies in his father's arms.

Ermeland, or ERMLAND, one of the eleven districts of the old province of Prussia, extending inland from the Frisches Haff, was created in 1250 one of the four bishoprics of the country of the Teutonic Knights. In 1354 the Bishop of Ermeland, who hitherto had been subject to the Archbishop of Riga, was made directly dependent upon the pope, and elevated to the position of a prince of the empire. When, in 1466, West Prussia was transferred to Poland, the Bishop of Ermeland became a member of the Polish senate, with sundry privileges. Since 1772 Ermeland and its bishop have again been Prussian. The name is still borne by a portion of the Prussian district of Königsberg, with sandy soil, but well wooded, in which a large quantity of flax is grown.

Ermenonville, a village in the French department of Oise, 18 miles NNE. of Paris. It was the death-place of Rousseau (q.v.).

Ermine, or STOAT (*Putorius ermineus*), a well-known carnivore in the Polecat and Mink section of the weasel or marten family (Mustelidæ). The lithe and slender body has a length of about 11 inches in the male, 9 in the female, and to that must be added a length of tail of about 6½ and rather less than 5 inches respectively. The colour of the stoat is ruddy brown in summer, yellowish beneath; but in winter, in the more northern

Ermine (*Putorius ermineus*): Summer and Winter Fur.

parts of its distribution, the ermine changes its fur into a beautiful white, sometimes with a tinge of lemon-yellow near the tail. There is a hereditary tendency to this seasonal change, to which the lowered temperature supplies the necessary stimulus. In milder regions the colour of the summer coat may persist through the year. The change to white, all but the black tip of the tail, is mainly due to a new growth of white hairs, but individual brown hairs may also become white. The protective value of the white fur in snowy regions is obvious. Like related species, the ermine is a very lithe, restless, brave, and blood-thirsty animal; it moves rapidly, and can both climb and swim well; it is terrestrial in its general habit, and finds a home among rocks and stones, in walls and the like. It sucks the blood of small mammals and birds, and, while valuable in destroying rats and mice, is sometimes a troublesome poacher on the poultry-yard. It is a singularly playful animal, and sometimes gambols in an extraordinary way in the presence of rabbits. It sometimes migrates in determined bands. It breeds at the end of the winter season.

The ermine occurs in Britain, especially in the north, is generally distributed in the northern parts of Europe, Asia, and America, but is common as far south as the Pyrenees and the Italian Alps. It is represented in Ireland by a smaller species (*P. hibernicus*). The white fur has long been used for trimming or lining the robes of dignitaries. The skins are usually imported from Norway, Lapland, Siberia, and the Hudson Bay regions. The yellow and black tails are inserted to contrast with the white fur. Ermine is the fur of most frequent use in Heraldry (q.v.). See FERRET, MARTEN, POLECAT, WEASEL.

Erne, a river and lake of Ireland. The river rises in Lough Gowna, on the borders of Longford and Cavan counties, flows 72 miles north-west through Loughs Oughter and Erne, and then through Donegal county into Donegal Bay. Lough Erne, one of the finest lochs in the kingdom, extending for 40 miles through Fermanagh county,

consists of two lakes, the Upper and Lower, joined by a network of channels 10 miles long. Both divisions are studded with green hilly islands, and contain abundance of salmon, trout, and other fish.

Erne (*Haliaëtus albicilla*), or White-tailed Sea-eagle, is one of the 'bare-legged' eagles, widely distributed in north Europe and Asia, and migrating in winter to North Africa, the Canary Islands, China, and Japan. Its breeding-places in Britain

Common Erne (*Haliaëtus albicilla*).

are now restricted to a few remote spots in the north and west; and it is a very rare bird compared with the Golden Eagle (*Aquila chrysaëtus*), from which it may be distinguished by its unfeathered lower metatarsal region, its longer bill, and its white tail. In Britain the eyrie is now on a sea-cliff, but elsewhere, as previously in Britain, trees and other sites may be used. The diet is heterogeneously carnivorous; the cry is a shrill yelp. The general colour is brown, but the tail is white, and there is much white about the head and neck of old birds.

Another notable species is the White-headed or Bald Eagle (*H. leucocephalus*), the emblem of the United States. This erne is common in North America, both by the coasts and by inland lakes, from the north to California and Mexico. The general colour is again brown, but the head and neck of the adults are milky-white, and the same is true of the rounded tail. The size is slightly less than that of the British species. It feeds like other eagles, but is very fond of fish, which it gets for itself by wading, or obtains by theft from other birds. See EAGLE.

Ernest, the name of several German princes, for whom see HANOVER, SAXONY, SAXE-COBURG, ALTENBURG.

Ernesti, JOHANN AUGUST, a celebrated classical and biblical critic, was born at Tennstädt, in Thuringia, 4th August 1707. He studied (from 1726) at Wittenberg and Leipzig, and, devoting himself to classical studies, became rector of the Thomas School at Leipzig in 1734, a post which he held till 1759, along with first a chair of Humanity (from 1742), and then that of Rhetoric (from 1756) in the university. Becoming professor of Theology in 1759, he resigned the chair of Rhetoric in 1770, and died 11th September 1781. He prepared editions of Homer, Callimachus, Polybius, Suetonius, and Tacitus, and of Xenophon's *Memorabilia* and Aristophanes' *Clouds*, and an excellent edition of Cicero (3d ed. 5 vols. 1776–77), to which he added a valuable *Clavis Ciceroniana*, often re-edited. He was the founder of a true exegesis of Scripture by the laws of grammar and history, independent of dogmatic prepossessions. Of his *Institutio Interpretis Novi Testamenti* (1761) there are translations by Moses Stuart (1824) and Terrot (1833). His *Anti-Muratorius* (1755) is a polemic against Roman Catholicism. His Latin speeches (published as *Opuscula Oratoria*) gained him the name of the 'German Cicero.'

Ernulphus, or ARNULF (1040–1124), a French Benedictine, appointed prior of Canterbury by Anselm, was subsequently abbot of Peterborough (1107) and bishop of Rochester (1114). He was equally remarkable for skill in canon law and personal saintliness; and compiled a great collection of documents about his own church, laws, papal decrees, &c., which from the old name of the see (*Hrofe-ceaster*) was known as the *Textus Roffensis:* and it is to an extract from this that he owes the invidious distinction given him in *Tristram Shandy.* Sterne makes the pious bishop the supreme authority on cursing on the strength of the excerpt called *The Pope's Dreadful Curse: being the Form of Excommunication of the Church of Rome: taken out of the leger-book of the Church of Rochester, now in the custody of the Dean and Chapter there: writ by Ernulphus the bishop* (1681, in the Harleian Miscellany, vol. vi.).

Eros. See CUPID.

Erosion. See COLORADO, DENUDATION, GEOLOGY, MOUNTAINS, RIVERS.

Erostratus, or HEROSTRATUS. See EPHESUS.

Erotic Poetry (Gr. *erōs*, 'love'), poetry in which love is the main subject.

Erotomania, a term used for morbid and extravagant love-passion either melancholic or maniacal (see INSANITY). In the latter case it is closely akin to the still more aggravated satyriasis (in men) and nymphomania (in women).

Erpenius (Thomas van Erpen), Orientalist, was born at Gorkum, in Holland, 7th September 1584, studied at Leyden, and at Paris learned Arabic from an Egyptian. In 1613 he became professor of Oriental Languages at Leyden, where he erected an Arabic press in his own house. As oriental interpreter to the government, he read and wrote replies to all official documents coming from the East. He died of the plague, 13th November 1624. Arabic studies owe much to his labours. In spite of his poverty of materials, his famous grammar (*Grammatica Arabica*, Leyden, 1613) enjoyed undisputed supremacy for two hundred years; his *Rudimenta* (1620, often re-edited) had an even longer vogue. He also edited Lokman (q.v.); *Proverbiorum Arabicorum Centuriæ Duæ* (1614); and El-Mekîn's *Historia Saracenica* (1625).

Errata, the list of errors with their corrections placed at the beginning or end of a book. From greater carefulness in correcting the sheets in passing through the press, errors in sense or typography are now much more rare than formerly; but few books are without *some* typographical errors. See PROOFS (CORRECTION OF).

Erratics. See BOULDERS, GLACIAL PERIOD.

Erromango, one of the New Hebrides (q.v.), on which the missionary John Williams (q.v.) was murdered and eaten by the savage natives.

Error, in English law, is any mistake in fact, in law, or in the form of process, requiring to be set right by the court before which an action is tried, or by a court of review. If the error was in fact, the case, under the old system, was heard before the court in which the action was originally tried; if the error was in law, proceedings had to be taken before the Court of Exchequer

Chamber (see EXCHEQUER). Where a party disputed the ruling of the judge, the form was by Bill of Exceptions (q.v.). According to the former practice, it was necessary, in order to obtain a review on the ground of error, that an original writ, called a Writ of Error, should be issued. The writ, if the error was in fact, was styled *coram nobis*, where the case was in the King's Bench, the sovereign being presumed to preside in that court; if in the other courts, the writ was *coram vobis*. Writ of error in civil cases in the High Court is abolished by the Judicature Acts, and so is Bill of Exceptions. Since 1875 all appeals are to the Court of Appeal by way of rehearing, and are brought by notice of motion in a summary way, and no petition or other formal proceeding other than such notice of motion is now necessary. The appellant may by the notice of motion appeal from the whole or part of any judgment, and this does not usually stay proceedings. Nearly all the judgments of the Divisional Courts of the High Court are subject to appeal to the Court of Appeal and thence to the House of Lords. The jurisdiction was transferred to the High Court of Justice in 1875, which used formerly to be vested in the Common Pleas at Lancaster and at Durham, and which used to be by writ of error to the Queen's Bench. Writs of error used formerly also to be brought on judgments of inferior courts. But since the establishment of County Courts and the changes introduced by the Judicature Acts, the analogous proceeding is an appeal by way of a case stated for opinion of the High Court, and sometimes by motion in a summary way. In criminal cases, error did not lie for formal defects in the indictment; these had to be objected to before the jury was sworn, and might then be amended. A writ of error lay for a defect in substance appearing in the indictment, as in the case of Bradlaugh *v.* the Queen, where an indictment for publishing an obscene book was held defective because it mentioned the book by title only, instead of setting out the passages alleged to be obscene. A prisoner had therefore three opportunities of taking legal objections; he might demur to the indictment, or move in arrest of judgment, or sue out a writ of error. This was abolished by the Criminal Appeal Act of 1907.

In the United States, the procedure of the State Courts follows the analogy of the English common law; in the Federal Courts the term error is also known; for further details reference may be made to the Acts of Congress and of the several State legislatures.

Errors. In all observations errors must be made. The best instruments have imperfections; and no man, however equable his temperament, can always rely on his making a proper use of his senses. As in astronomy numerical correctness in the results of instrumental measurements is of the first consequence, it is the constant care of the observer to detect and make allowance for errors. The three principal sources from which they may arise are—(1) External or incidental causes, such as fluctuations of weather, which disturb the amount of refraction; changes of temperature, affecting the form and position of instruments, &c.; (2) Errors of observation, being such as arise from inexpertness, defective vision, slowness in seizing the exact instant of an occurrence, atmospheric indistinctness, &c.; and such errors as arise from slips in clamping and momentary derangements of the instrument; (3) Instrumental defects, owing to errors in workmanship, and such as arise from the instrument not being properly placed—called errors of adjustment. The first two classes of errors, so far as they cannot be reduced to known laws, vitiate the results of observations to their full extent; but being accidental, they necessarily sometimes diminish and sometimes increase them. Hence, by taking numerous observations under varied circumstances, and by taking the *mean* or *average* of the results obtained, these errors may be made to destroy one another to a great extent, and so far may be subdued. With regard to the third class, it is the peculiarity of astronomical observations to be the ultimate means of detection of all defects of workmanship and adjustment in instruments, which by their minuteness elude every other mode of detection. It may be mentioned, however, that the method of subduing errors of the first two classes by the law of average is not applicable in all cases. In certain cases recourse must be had to the Method of Least Squares. See SQUARES, and PROBABILITY.

Ersch, JOHANN SAMUEL, a great German bibliographer, was born at Grossglogau, in Lower Silesia, 23d June 1766; studied theology, next history, at Halle; and after some years of journalism at Jena and Hamburg, became in 1800 librarian to the university of Jena. Three years later, he was called to Halle as professor of Geography and Statistics; and in 1808 was also appointed principal librarian. He died at Halle, 16th January 1818. Ersch was long engaged in miscellaneous bibliographical work for other scholars; but in 1818, along with Gruber, commenced the publication at Leipzig of the famous yet unfinished *Allgemeine Encyklopädie der Wissenschaften und Künste* (see ENCYCLOPÆDIA). By his *Handbuch der Deutschen Litteratur seit der Mitte des 18 Jahrh.* (4 vols. 1812–14) he first established modern German bibliography in the technical sense of the word.

Erse (a corruption of *Irish*), a name given less frequently now than formerly to the Gaelic (q.v.) of both Ireland and the Scottish Highlands.

Erskine, EBENEZER, the founder of the Secession Church in Scotland, was the son of the minister of Chirnside, in Berwickshire, a scion of the noble family of Mar (q.v.), and was born June 22, 1680. He studied at Edinburgh, and, after acting as tutor and chaplain in the family of the Earl of Rothes, was licensed by the presbytery of Kirkcaldy in 1703. His abilities soon brought him into notice, and in the same year he was appointed minister of Portmoak, in Kinross-shire; and here the unction and piety which marked his discourses became exceedingly attractive to the people accustomed to the chilling 'legalism' which then predominated in the Scottish pulpit. He took a deep interest in all public questions, both in church and state, and consequently, on the rise of the Marrow Controversy (q.v.), he was one of the most prominent on the evangelical side. After having discharged the pastoral office in Portmoak for about twenty-eight years, Erskine was in 1731 translated to Stirling. Just then the patronage dispute arose, and Erskine distinguished himself by his powerful advocacy of the right of the people to choose their own pastors. Declining to receive censure for certain statements made by him on this question in a Synod sermon which had given offence to the prevailing party in the church, he, with other three ministers who adhered to him, was in 1733 suspended and then deposed from the ministry. The sentence, however, was recalled in the following year, and Erskine was invited to return. But this he declined to do unless the evils he contended against were removed. The invitation remained open until 1740, when, finding further effort hopeless, the Assembly again deposed Erskine, and ejected him from his church. On the first deposition, Erskine and those adhering to him stated a formal secession from the judicatories of the Established Church, and at Gairney Bridge, near Kinross, erected themselves into the 'Associate Presbytery.' This was

the origin of the Secession Church (see UNITED PRESBYTERIANS). In the division in 1747 of the Seceders into Burghers and Anti-burghers, Erskine took the leading part on the side of the Burghers. He was twice married, and had fifteen children. He died 2d June 1754. His *Sermons and Discourses* fill 4 vols. (Glasgow, 1762). See Lives by D. Fraser (1831) and Harper (1849); and *The Erskines: Ebenezer and Ralph*, by John Ker, D.D., and J. L. Watson (Edin. 1882).

Erskine, HENRY, second son of the tenth Earl of Buchan, was born in Edinburgh, 1st November 1746, and was educated at the universities of St Andrews, Glasgow, and Edinburgh. He joined the Scottish bar in 1768. His rise was immediate, and commenced, like that of his rival Henry Dundas, from his appearances in the debates of the General Assembly. Under the short-lived coalition ministry of Fox and North, he became Lord Advocate (1783), an office to which he was again appointed in 1806. In 1785 he was elected Dean of the Faculty of Advocates, but in 1796 was deposed in favour of Robert Dundas of Arniston. This mark of professional censure was intended by the Faculty to stigmatise Erskine's conduct in attending a public meeting and supporting a resolution protesting against the 'Seditious Writings Bill' proposed by the government. Lord Cockburn justly says, 'It was the Faculty of Advocates alone that suffered.' Erskine was elected member for the Haddington burghs in March 1806, and in the following November for the Dumfries burghs. He died at Amondell, his seat near Midcalder, 8th October 1817. During his second tenure of the office of Lord Advocate, Erskine practically carried into effect some of the legal reforms for which a pamphlet, published in London in 1807, and attributed to him on good authority, pleaded forcibly—viz. the introduction of jury trial in civil cases, and the abolition of the rule by which the fifteen judges of the Court of Session sat together. He was the author of several metrical translations from the classics, and other poems, of which the best known is *The Emigrant* (1773), inspired by the depopulation of the Highlands. Erskine's forensic style was the delight of his contemporaries, and the recorded fragments of his speeches justify his high reputation as an orator and a wit, and warrant the conclusion that, had Henry Erskine, in his own witty language, 'played at the guinea tables' in London, instead of 'at the shilling tables' in Edinburgh, he would have been no unworthy rival to his distinguished brother, Lord Erskine. See Colonel Alexander Fergusson's *Henry Erskine* (1882).

Erskine, JOHN, of Dun, Scottish Reformer, was born in 1509. All through the reign of Mary Queen of Scots, and through part of that of her son James, Erskine took an active share in public affairs, lending steadfast support to the reformed preachers, especially to Wishart and Knox, whilst at the same time his moderate and conciliatory temper not only secured him against the enmity of the leaders of the Catholic party, but gave him considerable personal influence in the country. He was frequently chosen to negotiate between the Reformers and the representatives of the sovereign, and to mediate between the different sections amongst the Reformers themselves. From 1560 down to about 1589, two years before his death, he held the office of superintendent for the reformed district of Angus and Mearns. Although a layman, he was elected on at least five separate occasions moderator of the General Assembly, and was one of the compilers of the *Second Book of Discipline* (1578).

Erskine, JOHN, Scottish jurist, was born in 1695, the son of the Hon. Colonel Erskine of Carnock, Fife. He was called to the bar in 1719, but did better as a lecturer than a practitioner, having in 1737 been appointed to the chair of Scots Law in Edinburgh University. He resigned it in 1763, and died on 1st March 1768 at Cardross, near the Lake of Menteith, which estate he had purchased in 1746. His two works are still held in deserved repute—*Principles of the Law of Scotland* (1754; 17th ed. 1886), and the more important *Institutes of the Law of Scotland* (1773; 9th ed. 1871). As a legal writer, indeed, he is second only to Stair, the sterling merits both of the *Principles* and of the *Institutes* being their plainness and sound common sense.

Erskine, JOHN, D.D., son of the preceding, was born June 2, 1721. He studied at the university of Edinburgh, and, licensed to preach in 1743, was appointed minister successively of Kirkintilloch (1744), Culross (1753), New Greyfriars Church, Edinburgh (1758), and the collegiate charge of Old Greyfriars (1767), where he had for his colleague Dr Robertson. In 1766 the university of Glasgow conferred on him the honorary degree of D.D. In the General Assembly he was for many years the leader of the popular or evangelical party; and between him and Principal Robertson, the leader of the Moderate party, there was a courteous and honourable friendship. Erskine's twenty-five publications are of a high order of ability. They consist of essays, letters, sermons, dissertations, and pamphlets, &c., mainly of a religious character, even when dealing with the political American controversy, on which he wrote largely. He also edited a number of British editions of works of American divines. He died 19th January 1803. Sir Walter Scott, in *Guy Mannering*, describes his powers as a preacher. See Life by Sir H. Moncrieff Wellwood (1818).

Erskine, RALPH, brother of Ebenezer, was born at Monilaws, in Northumberland, March 18, 1685, and, after studying at Edinburgh, was ordained to the parish church of Dunfermline in 1711. Like his brother, he took part on the evangelical side in the Marrow Controversy (q.v.); and, after the formation of the Associate Presbytery, he withdrew from the communion of the Established Church, and joined the former in 1737. In the controversy concerning the burgess oath he also took part with the Burghers, and wrote several pamphlets in defence of their position. He was, however, less a controversial than a practical writer. Being a very popular preacher while he lived, his sermons were greatly prized after his death, and many of them were translated into Dutch and widely circulated in Holland. His *Gospel Sonnets* and *Scripture Songs* are well known. He died November 6, 1752. See the Life by James Fisher, prefixed to his *Practical Works* (2 vols. 1764).

Erskine, THOMAS, LORD ERSKINE, the youngest son of Henry David, tenth Earl of Buchan, was born in Edinburgh, 21st January 1750, and was educated at St Andrews. In 1764, much against his will, he was sent to sea in the *Tartar* man-of-war, under Sir David Lindsay. After cruising about for four years in the West Indies and on the coast of America, he obtained an ensign's commission in the 1st Royals, at a price which absorbed his whole patrimony (1768), and was for some time stationed at Minorca, where he employed his leisure time in a minute and devoted study of Shakespeare, Milton, Dryden, Pope, and other masters of English literature. On his return to London in 1772, Erskine mingled freely with the best social and literary circles, and acquired a distaste for military life, which an accidental visit to an assize court, and an interview with Lord Mansfield, turned into a determination to

prosecute the study of law. He was admitted to Lincoln's Inn, 26th April 1775; and in 1776 entered Trinity College, Cambridge, where he took an honorary M.A. in 1778, just before being called to the bar. His professional career was one of immediate and unprecedented success. Accident threw in his way a retainer in the case of Captain Baillie, lieutenant-governor of Greenwich Hospital, who was threatened with a criminal prosecution for libel, at the instance of Lord Sandwich, the First Lord of the Admiralty. Erskine's advocacy secured the discharge of the rule for leave to file an information (24th November 1778), and as he left Westminster Hall from the scene of this signal victory the attorneys flocked round him with their retainers to the number, as he afterwards used to tell, of sixty-five. The next year saw an equally successful defence of Admiral Lord Keppel against charges of professional misconduct and incompetence. In 1781 Erskine secured the acquittal of Lord George Gordon, indicted for high-treason in connection with his conduct during the notorious riots, and on this occasion delivered his first assault upon the doctrine of *constructive* treason, by which it was sought to make persons who aimed at effecting a change in the sovereign's constitutional character and position guilty of the capital offence of 'compassing the king's death.' In 1783 Erskine was appointed a King's Counsel on the special recommendation of Lord Mansfield, and at the same time was returned as member of parliament for Portsmouth. The high expectations of his friends were rudely disappointed by his first political appearance in the House of Commons, and, although he subsequently made effective and eloquent speeches, he never became a parliamentary orator. 'I'll tell you how it happens, Erskine,' said Sheridan, 'you're afraid of Pitt; and that is the flabby part of your character.' Erskine's sympathy with the French Revolution, aroused by a visit to Paris in 1791, led him to join the 'Society of the Friends of the People'—whose object was to bring about parliamentary reform—and to undertake the defence in the principal political prosecutions of 1793–94. His courageous acceptance of a retainer from Tom Paine resulted in his removal from the office of Attorney-general to the Prince of Wales, to which he had been appointed in 1786. But his speeches for this unpopular defendant, and for Frost (1793), Hardy (1794), and Horne Tooke (1794), are among the finest specimens of forensic skill, and, in the language of Hardy, 'will live for ever.' Erskine's defence of Hadfield (April 26, 1800), indicted for shooting at George III. in Drury Lane Theatre, was a powerful and logical analysis of a theory of criminal responsibility in mental disease, which had hitherto done bloody duty in English courts of law. In 1802 Erskine was appointed Chancellor to the Prince of Wales, an office which had lain dormant since the time of James I., but was now revived in his favour. In 1806 he was raised to the peerage and the woolsack, but soon retired into private life. He died at Amondell, Linlithgowshire, 17th November 1823.

Erskine had married first, in 1770, Frances, daughter of Daniel Moore, M.P. for Marlow; and secondly, at Gretna Green, when he must have been about seventy, a Miss Mary Buck. He published a pamphlet on the abuses of the army in 1772; a view of the causes and consequences of the war with France in 1797; a political romance, *Armata;* a pamphlet in favour of the Greeks; and some poems.

Erskine's decisions as Lord Chancellor were styled by his contemporaries the 'Apocrypha,' and have added nothing to his permanent fame. His reputation is purely forensic, and in this respect is unrivalled in the history of the English bar. The charm of voice and presence and gesture may have contributed something to his unique influence over judges and jurymen; but the careful student will not fail to note in his speeches the enduring qualities of genuine sentiment, profound acquaintance with life and character, singular fertility in illustration, and powers of exposition and reasoning to which the history of advocacy hardly offers a parallel. See Campbell's *Lives of the Chancellors*, vol. viii.; Fergusson's *Henry Erskine* (1882); and Duméril's *Lord Erskine, a Study* (Paris, 1883).

Erskine, Thomas, of Linlathen, was born in 1788, and educated at Edinburgh High School, at Durham, and at the university of Edinburgh. He was admitted advocate in 1810, but ceased to practise after his elder brother's death gave him the family estate of Linlathen, near Dundee, and devoted himself for the remainder of his uneventful life to his favourite theological studies. He died 20th March 1870. Erskine was brought up an Episcopalian, but in later life was at least nominally a member of the Church of Scotland. His theological opinions and religious sympathies hardly fell within the lines of the usual creed definitions, while a belief in the ultimate universal salvation of mankind and the worthlessness of miracles as evidence for inspiration were in his day scarcely consistent with formal citizenship within any church. He published several religious works. See his Letters (ed. W. Hanna, 1877–78), and his Life by H. F. Henderson (1900).

Erubescite, a copper ore consisting of sulpho-ferrite of copper (Cu_3FeS_3), occurs crystallised in cubes, often twinned, or massive. It has a bronzy colour with a bluish tarnish.

Eruptive Rocks. See Igneous Rocks.

Ervine, St John Greer, Irish dramatist and novelist, was born in Belfast, 28th December 1883. Forsaking business in 1913 for literature, in which he had earlier won successes, he became in 1915 manager of the Abbey Theatre, Dublin. His plays, as *Jane Clegg* (1911), *John Ferguson* (1914), *The Ship*, &c., are mostly tragedies; his novels, as *Changing Winds* (1917) and *The Foolish Lovers* (1920), are much lighter in tone.

Eryngo (*Eryngium*), a genus of Umbelliferæ, but of curiously thistle-like aspect, since the sessile flowers of the umbel form what is practically a capitulum. The large, spiny leaves recall those of holly, but have a glaucous bloom, which in some species gives the foliage an opalescent blue colour. These especially are cultivated in flower-gardens, but the young leaves of *E. maritimum* (Sea-holly) are occasionally eaten as a salad; the Mediterranean species were also valued by the ancients. Many Elizabethan writers mention the use of the candied root. An American species is also used in domestic medicine.

Sea-holly (*Eryngium maritimum*).

Ery'simum, a genus of Cruciferæ allied to Hedge-mustard (Sisymbrium) and Dame's Violet (Hesperis). The seeds of *E. cheiranthoides* were formerly employed as an anthelmintic, hence the name of Worm-seed. It is also called Treacle Mustard, because an ingredient in the famous *Venice Treacle.* The seeds of *E. perfoliatum* are used as a source of oil in Japan.

Erysipelas (Gr., 'red skin'), an inflammatory and febrile disease of the skin, attended by diffused redness, pain, and swelling of the part affected, and in the end by either desquamation or vesication of the cuticle, or scarf-skin, in the milder forms, and by suppuration of the deeper parts in the severer varieties of the disease (*phlegmonous* erysipelas). It is characterised by a marked tendency to spread over the skin from the place where it arises. Erysipelas affects, in a large proportion of instances, the face and head; it is apt to be attended with severe fever, and often with great disorder of the nervous system, arising in some instances from inflammation of the membranes of the brain. In other parts of the body, severe or phlegmonous erysipelas is apt to be succeeded by protracted and exhausting suppurations, and sometimes by diseases of the bones, or inflammations of the internal organs. Erysipelas in its severer forms usually commences in a wound or sore, and is extremely apt to be communicated to any one with a breach in the continuity of the skin who comes in contact with a case of the disease. Epidemic outbreaks of erysipelas used therefore to be common and disastrous in surgical and lying-in hospitals; but since the general introduction of antiseptic treatment they have almost disappeared. Erysipelas is very apt to recur in a person who has been attacked once or oftener; and this is especially true of the form which affects the face. It is due to the presence of a streptococcus in the affected tissues. The bowels should be well cleared out in most cases, and large amounts of fluid given to drink. For local application, if the skin be unbroken, ichthyol in glycerine, tincture of iodine, or other astringent, and antiseptic applications are used; when sloughing is in progress, strong antiseptic dressings are employed. In some cases iron is used as a specific remedy in the form of large doses of steel drops. It is of course important that no one liable to the disease should be exposed to the infection. St Antony's Fire (see ANTONY) and Rose are common names for erysipelas.

Erysiphe. See OIDIUM.

Erythema (Gr. *erythainō*, 'I redden'), a name applied to certain skin diseases, but scarcely used by any two writers on the subject in exactly the same sense. It is used, generally speaking, of eruptions where there is circumscribed or diffuse redness, without any break in the skin surface, with or without elevation of the affected part. The chief forms described under the name are rashes like a persistent blush occurring in the course of some fevers, in consequence of drugs, or without ascertainable cause, but usually of short duration: *E. multiforme*, where the eruption is raised, and generally in the form of papules, rings, or irregular lines; *E. nodosum*, consisting of dark-red, painful swellings, usually on the front of the leg, and believed to be connected with various rheumatic manifestations; and cases closely resembling erysipelas, except that the symptoms, both local and constitutional, are very much less severe.

Erythræa. See CENTAURY, ERITREA.

Erythronium, a genus of Liliaceæ. *E. dens canis*, the Dog-tooth Violet, so called because of the resemblance of its little white bulbs to dogs' teeth, is a well-known ornament of English flower-borders in spring. It is a native of southern Europe and Siberia, where it is used as a source of food, and also medicinally.

Erythrophlœum, a genus of leguminous trees (sub-order Mimoseæ). The red juice of the bark of *E. guineense* is used in ordeals and for arrow-poisoning in Africa. See ORDEAL.

Erythroxylaceæ, a small order of dicotyledonous trees or shrubs, chiefly South American, allied to Linaceæ. *Erythroxylon suberosum* is a red dye-wood of Brazil. *E. hypericifolium* yields the *Bois d'huile* (Oil-wood) of Mauritius. For *E. coca*, see COCA.

Eryx, the ancient name of a mountain in the NW. of Sicily, near Drepanum (mod. Trapani), with a famous temple of Aphrodite *Erycīna.*

Erzberg. See EISENERZ.

Erzberger, MATTHIAS, German politician, born at Buttenhausen, Württemberg, in 1875, became leader of the Centre in the Reichstag. In the Great War he was at first a war-aims propagandist, but came to be regarded as a defeatist. He headed the armistice delegation, and was finance minister in 1919–20. He was assassinated 26th August 1921. See his *Erlebnisse im Weltkrieg* (1920).

Erzerûm, an important town in Turkish Armenia, not far from the Kara-Su, stands on a high but tolerably well cultivated plain, 6200 feet above the level of the sea, surrounded by mountains. The climate is cold in winter, hot and dry in summer. The population is fluctuating, but estimated at about 40,000, mostly Turks, with some Armenians and Persians. The copper and iron wares of Erzerûm have acquired a wide celebrity. Situated at the junction of the important highways leading from Trebizond, Transcaucasia, Persia, Kurdistan, Mesopotamia, and Anatolia, Erzerûm forms an entrepôt of commerce between Europe on the one hand and the interior of Asia, and particularly Persia, on the other. The streets, the houses of which are built chiefly of volcanic stone cemented with mud, are narrow, crooked, and filthy; and ruins of fortifications and of buildings formerly magnificent everywhere meet the eye. The town consists of the fortress, strictly so called, and four suburbs. The fortress, which is inclosed by a high wall, has, on the west, a citadel (El-Kal'a), containing many curious monuments. There are numerous mosques in the town, that of *Ulu Jami* the chief; many churches, both Armenian and Roman Catholic; and various large bazaars and caravanserais. A medreseh, said to have been first erected in the 10th century, but with all its present architectural features of the 14th, is the most beautiful building, an ornamented doorway and two graceful minarets, known as the *Chifteh Minarets*, being its outstanding features. Erzerûm imports shawls, silk goods, cotton, tobacco, rice, indigo, &c., and exports corn, sheep and cattle, horses, mules, and gall-nuts. The principal trades carried on are tanning, dyeing of morocco leather, and blacksmiths' and coppersmiths' work. But since the Transcaucasian railway has provided a safe trade-route to Persia, the prosperity of Erzerûm has greatly suffered. It was first conquered by the Arabs in 700, but retaken by the Byzantines fifty years later. After various vicissitudes, it fell into the hands of the Seljuks; the Mongols took it in 1241; and in 1517 it passed into the possession of the Turks. It still, however, continued to be the most important city in the country, and at the commencement of the 19th century had a population of 100,000 inhabitants. In the war of 1829, between the Turks and Russians, the taking of Erzerûm by Paskievich decided the campaign in Asia. Erzerûm was an important military centre during the wars of 1854–55 and 1877–78, and much hard fighting was done in its neighbourhood. In December 1877 the

Russians closed round the city, already hard pressed, and reduced its defenders to the utmost distress; in February 1878 it was surrendered to Russia, who held it till October, when it was restored. It capitulated to Russia in February 1916, and was reoccupied by the Turks in March 1918.

Erzgebirge ('Ore Mountains'), the name given to the chain of mountains, rich in metals, stretching SW. and NE. for 96 miles on the confines of Saxony and Bohemia, from the valley of the Elbe to the Fichtelgebirge. In the south it rises to a height of from 2500 to 3300 feet, forming a steep wall of rock; in the north it forms broad, slaty plateaus, broken by deep valleys, and gradually slopes down towards the level districts of Altenburg and Leipzig. Many of these valleys are well wooded and romantic, and occasionally fertile and thickly peopled, being watered by the Mulde, the Pleisse, and their numerous tributaries. The chain rises to its highest elevations in the so-called 'Saxon Siberia,' over against Zwickau. Here, in 12° 54′ E. long., stands the town of Gottesgabe, the highest in Germany, at an altitude of 3363 feet; and here, too, are the loftiest peaks of the range (Keilberg, 4052 feet; Fichtelberg, 3980; Spitzberg, 3675). The Erzgebirge is chiefly of the gneiss-granite formation, with argillaceous and micaceous slates, porphyry, and basalt. Silver and lead are the principal metals; next come copper, tin, iron, nickel, cobalt.

Esaias. See ISAIAH.

Esarhaddon. See ASSYRIA.

Esau, son of Isaac. See JACOB, EDOM, JEWS.

Esbjerg, a port of Denmark, 56 miles W. of Fredericia by rail, with a large export trade in cattle, &c., mostly to England. Its harbour, the only one of importance on the west coast of Jutland, was constructed by the state at great expense in 1868–88. Pop. 19,000.

Escalade (Lat. *scala*, 'ladder'), in siege operations, a method of gaining access to the enemy's works; passing ditch, curtain, bastions, by means of ladders. See FORTIFICATION, SIEGE.

Escanaba, a city and port of Michigan, on Green Bay, with a great iron-ore trade; pop. 13,000.

Escarp′. See FORTIFICATION.

Escarpment, a long line of cliff, formed by the outcrop of a relatively hard stratum of rock interbedded amongst more yielding strata, the dip or inclination of which is generally gentle. This structure is the result of denudation—the hard rock projects simply because it has yielded less readily to the agents of erosion. In a country composed of an alternation of such relatively hard and soft rocks, dipping in one and the same direction, we usually meet with a succession of escarpments, with their steep faces all turned towards the direction to which the strata rise, while the ground falls away with a gentle slope in the direction of the dip or inclination of the beds.

Escars. See ÅSAR.

Eschar (Gr. *eschara*), a slough or portion of dead or disorganised tissue, is commonly applied to artificial sloughs produced by the application of caustics. *Escharotic* means causing an eschar.

Eschatology (Gr. *eschatos*, 'last,' and *logos*, 'a discourse'), the doctrine of the last things, a theological term for what Scripture reveals and Christian speculation has concluded about a future state. But although the term is thus limited, an eschatology existed among all the great nations of antiquity, dark and ill defined as in the Greek, or elaborate as in the Egyptian religion. Together with it grows up more or less definitely the idea of retribution. For an account of the more elementary forms of this conception, see TRANSMIGRATION. Protestant eschatology is generally confined in practical discourses to a consideration of these four last things—Death, Judgment, Heaven, and Hell (see IMMORTALITY, RESURRECTION, DEVIL, and HELL). The principal religious parties which do not recognise eternal punishment as a Scriptural doctrine are treated at UNIVERSALISM and CONDITIONAL IMMORTALITY; the question of an intermediate state, at PURGATORY. See also MILLENNIUM, and the bibliography appended to HELL.

Escheat (Fr. *échoir*, from Lat. *cadere*, 'to fall or happen'), an incident of the feudal law whereby, when there was no tenant qualified to perform the services, land reverted to the lord. In England, escheat took place *per delictum tenentis*, as e.g. when the tenant was convicted of a capital felony; this kind of escheat 'with attainder' was abolished in 1870, as also the Forfeiture (q.v.) of land to the crown for high-treason (see ATTAINDER). According to the existing law, a criminal's property is forfeited only in so far as may be necessary for the purpose of making compensation; but the old doctrine of 'corruption of blood' is now entirely done away; no person is barred by the crime of his ancestor from succeeding to property. Escheat still takes place *per defectum sanguinis*, for want of heirs, when the owner (the feudal tenant) of land dies intestate, leaving no heir; in such case the feudal superior (usually the crown) may claim the land. When land falls to the crown, the 'prerogative of grace and bounty' is sometimes exercised in favour of persons having claims on the deceased; subject to this prerogative the land becomes part of the crown-lands, and the profits are carried to public revenue.

Escheat in Scotland is of two kinds: (1) The total forfeiture to the crown of all property heritable and movable belonging to a person who has been convicted of treason. (2) It signifies the forfeiture of goods by a debtor who has failed to make payment of debt in obedience to legal Diligence (q.v.). This species of escheat for debt was abolished by 20 Geo. II. chap. 50. It was of two kinds: single escheat, and liferent escheat. By the former, all the debtor's movables were forfeited to the crown; by the latter, the annual profits of the debtor's estate were forfeited to the superior. Single escheat still exists in Scotland as a punishment of crime. In all capital convictions it is ordered that the prisoner's 'whole movable goods and gear be escheat and inbrought to his majesty's use.' In cases of deforcement, bigamy, perjury, and some others, single escheat is imposed by statute as a portion of the penalty on conviction. Single escheat also falls upon denunciation for outlawry; and, if the rebel continues for a year under denunciation, his liferent escheat falls to his superior.

In the United States, the rules of feudal tenure are, for the most part, obsolete; but all property, real or personal, which is left without a legal owner, is claimed by the state in which it is situated.

Eschenbach, WOLFRAM VON. See WOLFRAM VON ESCHENBACH.

Eschscholtz Bay, the innermost part of Kotzebue Sound, in Alaska, barely outside the polar circle. It was named after the naturalist Johann Friedrich Eschscholtz (1793–1834), who sailed with Otto von Kotzebue.

Eschscholtzia, a genus of Papaveraceæ, of which *E. californica* and other species are common as showy garden annuals.

Eschwege, a town in the Prussian province of Hesse-Nassau, on the Werra, 40 miles ESE. of Cassel by rail. It has manufactures of woollen, cotton, and linen fabrics, of machines, and of

tobacco; also tanneries, and some trade in fruit and pork, and agricultural produce. Pop. 13,000. The town was twice plundered and once burned during the Thirty Years' War.

Eschweiler, an industrial town of Rheinland, 8 miles ENE. of Aix-la-Chapelle, has important iron, zinc, and tin works, machine-shops, manufactories for making copper plates, needles, wire, gas-pipes, and firebricks, besides tanneries and breweries. In the vicinity are productive coal-mines. Pop. 26,000.

Escobar y Mendoza, ANTONIO, Spanish casuist, was born at Valladolid in 1589. Entering the order of the Jesuits in 1604, he became celebrated as a preacher and writer. At his death in 1669 he left more than 40 vols. in folio, mostly in theology and morality, the principal being the casuistical *Liber Theologiæ Moralis* (1646), which has several times been printed.

Escorial, or, less correctly, ESCURIAL, a royal palace, mausoleum, and monastery of Spain, 31 miles NW. of Madrid, on the south-eastern slope of the Sierra Guadarrama, at an altitude of 3700 feet. This immense pile of buildings, built of dark-gray granite, has a stern, austere, forbidding appearance, which is not at all relieved by the bleak, wind-swept, mountainous region in which it stands. It owes its existence to Philip II., who erected it partly to provide a royal burying-place for the kings of Spain, partly to commemorate his victory over the French at St Quentin on St Lawrence's day, 10th August 1557. Its general shape is that of a quadrangular parallelogram, 706 feet long by 550 broad, with a smaller square projecting from the east side. The current belief is that it was planned to represent a gridiron, the object upon which St Lawrence was martyred; but this has been questioned. At anyrate, each corner of the parallelogram is fenced with a tower, about 200 feet high; and above the church, in the centre of the pile, rises a cupola, its summit 312 feet from the floor. The first stone of the edifice was laid in 1563, the architect being Toledo, after whose death in 1567 his pupil Herrera carried on the work to its completion in 1584. The finest individual building is the church, a square basilica, in the shape of a Greek cross, and in the Doric order of architecture. It was formerly rich in paintings; and, although in 1837 a hundred of the best were removed to Madrid, there still remain specimens by Coello, Carbajal, Tibaldi, Zuccaro, Luca Giordano, Trezzo, Zurbaran, Ribera, Tintoretto, Titian, and Veronese. The Pantheon, or royal mausoleum, an octagonal chamber beneath the church, contains the bones of the kings of Spain from Charles V., father of Philip II., onwards (except Philip V. and Ferdinand VI.) to Alfonso XII., with queens, regents, and mothers of kings; the rest of the royal family, with Don John of Austria, are buried in the 'Panteón de los Infantes.' The library, once one of the richest in Europe, but greatly diminished by a fire in 1691, and by thefts by the French soldiery in 1808, contains many valuable MSS., including a large collection in Arabic. In the palace the most interesting apartment is the cell of Philip II., in which he spent his last days. The Escorial was again greatly injured by fire in 1872.

Escort. See CONVOY.

Escrow. See DEED.

Escutcheon (Fr. *écusson*, in contradistinction to *écu*, an ordinary shield), in Heraldry, the shield on which arms are painted; also a small representation of the knightly shield used as an armorial charge, and generally reckoned among the subordinaries. The name inescutcheon in modern heraldry is used where there is more than one such charge. From the escutcheon as a charge must be distinguished the escutcheon *en surtout*, charged with some particular coat, and placed in the centre of a heraldic shield, which is much used in marshalling of arms in regal, continental, and Scottish heraldry. Such an escutcheon, placed with the arms of an heiress in the centre of her husband's coat, is known under the name of an escutcheon of pretence. The escutcheon of pretence used in this way is unknown out of Britain.

Esdraelon, or PLAIN OF JEZREEL, a broad valley of Palestine, constituting the basin of the Kishon, extends from Mount Hermon to the slopes of the Carmel range. A flourishing and fertile region in antiquity, it is once more, after a time of neglect, highly cultivated. Here Gideon defeated the Midianites, and here in 1799 the Turks were defeated by the French.

Esdras, BOOKS OF. The Apocrypha contain two books, ascribed to Esdras, which are variously described. In the Septuagint they are described as 1st and 2d Esdras; in the Vulgate as 3d and 4th Esdras. The first of these books (1st or 3d Esdras, commonly called the Greek Esdras) is a compilation from the canonical book of Ezra, with an introduction taken from 2d Chronicles and a conclusion borrowed from Nehemiah. In the middle of the book, however, there is an original section which has nothing answering to it in our Old Testament. This section tells the story of a literary contest between three pages at the court of Darius. In reply to the question, 'What is the strongest force in the world?' the first answers, 'Wine is the strongest;' the second, 'The king is the strongest;' the third, 'Women are strongest, but above all things truth beareth away the victory.' The third answer is the source of the well-known proverb, 'Fortis est veritas et prævalebit.' The date of the composition of the book is uncertain. It must fall within the limits 160–1 B.C., but cannot be fixed more definitely. There are many chronological difficulties in the statements of the book which rather diminish its historical value, though Josephus attached so much importance to its statement that he used it for the period which it covers in preference to the canonical books.

The second book (2d or 4th Esdras) is much more important. It occupies the same place in the Apocrypha as the book of Revelation in the New Testament, and is the only specimen of apocalyptic (as distinct from prophetic) literature in it. The book exists only in the form of a Latin version, a large fragment of which was missing until it was recovered by the discovery in 1875, by Professor Bensly, of an unmutilated MS. at Amiens. The book consists of seven different visions. In its present form it has been Christianised by the addition of a Christian beginning and ending. There can be little doubt that the book was written in the reign of Domitian (81–96 A.D.), though parts of it may be of earlier origin. It deals with the problem created by the destruction of Jerusalem, 'Why hath God cast off His people?' It cannot be said that any real solution is found, but some suggestions are made in which comfort may be found: (1) We must remember our limitations, and not question the dealings of an inscrutable Providence. (2) We must trust the boundless love of God. (3) This world is not the end of things; the future life will make amends for present suffering. (4) The day of God's redemption is drawing near, when the Messiah will come and restore the kingdom to Israel.

Both books are found in the ordinary editions of the Apocrypha. A new translation, with introduction and notes, is contained in the *Oxford Apocrypha and Pseude-*

pigrapha (1913). There is a critical edition of 4th Esdras by Box. See works on the Apocrypha by Fritzsche (1860); and *The Ezra Apocalypse* (chaps. ii.–xiv. of 2d Esdras), by G. H. Box (1912). The seventy verses of Esdras found by Prof. Bensly at Amiens in a 9th-century MS. are translated in Churton's *Apocryphal Scriptures* (1884), *The Speaker's Commentary* (by Lupton, 1888), and in the Revised Version (1895).

Esher, a pretty village of Surrey, on the Mole, 15 miles SW. of London by rail. Here are Esher Place, a brick gate-tower of Wolsey's palace, and Claremont (q.v.). Pop., with the Dittons, 14,300.

Esk (Cymric *wysg*, Gael. *uisge*, 'water,' akin to *Exe*), the name of several small Scottish rivers. The Dumfriesshire Esk, formed by the Black and White Esks (12 and 14 miles long), runs 22 miles south-south-eastward, next 5 furlongs along the Border, and lastly 8 miles south-south-westward through Cumberland, till it falls into the head of the Solway Firth. It passes Langholm and Longtown, receives the Tarras, Liddel, &c., and affords capital fishing.—The Edinburghshire Esk, formed by the North and South Esks (17 and 19 miles long), flows 4 miles northward to the Firth of Forth at Musselburgh. Its scenery is very pretty, the northern branch passing Habbie's Howe, Roslin, Hawthornden, and Melville Castle; the southern branch Dalhousie Castle and Newbattle Abbey; and the two uniting in Dalkeith Park. The fishing is recovering from the injurious effects of the paper-mills.—Of the two Forfarshire rivers, the South Esk runs 49 miles south-eastward and eastward to the North Sea at Montrose, and the North Esk 29 miles south-eastward (over the last 15 along the Kincardineshire boundary), until at a point 4 miles N. of Montrose it likewise falls into the North Sea. Both traverse fine scenery; both afford first-rate sport; and both give earl's titles to branches of the Carnegie family—Southesk (1633) and Northesk (1662).

Esker. See ÅSAR, and GLACIAL PERIOD.

Eski-Djumna, a town of Bulgaria, 20 miles WSW. of Shumla, with a noted fair in May. Pop. 10,000.

Eskimo, a people inhabiting the whole northern coast of the American continent down to 60° N. lat. on the west, and 55° on the east, with the Arctic Islands, Greenland, and about 400 miles of the nearest Asiatic coast. Only in the southern limits of the American Eskimo region do their abodes touch the northern limit of wooded land, while to the north a tribe inhabiting the north-west of Greenland (82°–83° N. lat.) marks the most northerly limits of Eskimo distribution. The Eskimos prefer the vicinity of the seashore, from which they rarely withdraw more than 20, and hardly ever 80 miles. Their number is not ascertained with exactness, but it may amount to about 40,000. They include (1) The Western Eskimos, inhabiting the Alaska Territory and the Asiatic side of Behring Strait, rated at 20,000 souls; (2) the Mackenzie Eskimos, or Tchiglits, from Barter Island to Cape Bathurst, 2000; (3) the inhabitants of the central regions, including the Arctic Archipelago, 4000; (4) the Labradorians, 2000; (5) the Greenlanders, about 10,000. A side branch, moreover, inhabits the Aleutian Islands, numbering some 2000; their habits and mode of life are almost like those of their Inuit neighbours, but their language, except its grammatical system, differs widely from the Eskimo. They are scattered as the sole native occupants of regions stretching from east to west as far as 3200 miles in a straight line, to travel between the extreme points of which would necessitate a journey of no less than 5000 miles. This distance, taken in connection with their homogeneous nature and manners, makes their small bands the most thinly scattered people of the globe.

As to their bodily form, they resemble the Mongolians and the American Indians, the coast tribes serving as an intermediate link. Their height nearly equals the average of the North-west Indians. They appear comparatively taller sitting than standing. Their hands and feet are small, their faces oval, but rather broad in the lower part; their skin is only slightly brown; they have coarse black hair and very little beard. The skull is high and mesaticephalic, with a tendency in some individuals to the dolichocephalic type. Stefánsson found blond Eskimos in the south of Victoria Island, but these are probably the result of racial intermixture with European peoples, perhaps the 10th-century Scandinavian colonists of Greenland.

Though occasionally they find food by pursuing the chase on land and by fishing, the Eskimos get their subsistence mostly from hunting by sea, using for this purpose their skin-boats where the sea is open, and their dog-sledges on the ice. From the skin, blubber, and flesh of the seal and the cetaceous animals they procure clothes, fuel, light, and food. Their most interesting as well as important invention for hunting is the well-known small skin-boat for one man, called a *kayak*. It is formed of a framework covered with skin, and, together with his waterproof jacket, it completely protects the man against the waves, so that he is able to rise unhurt by means of his paddle, even should he capsize. A Greenlander's kayak is almost 18 feet long and 2 feet broad, and can carry 200 lb. besides the man. The special weapon of the kayak is the large harpoon, connected by a line with an inflated bladder. The hunter throws it when but 25 feet from the seal, and at once drops the bladder overboard, thus retarding the speed of the wounded animal, which runs off with it until finally killed by a lance-thrust.

In winter the Eskimos are undoubtedly stationary in their habits. But during the summer, when enough open water is found, they roam about in their large skin-boats, the *umiaks*, which are from 25 to 37 feet long, 5 feet broad, and 2½ feet deep, and are capable of carrying from 1½ to 3 tons—the tent, with all the necessary implements for the summer household.

The winter dwellings vary with regard to the materials of which they are built, as well as in their form. In the farthest west they are constructed mostly of planks, covered only with a layer of turf or sod; in Greenland the walls consist of stones and sod; in the central regions the houses are formed merely out of snow. In Alaska the interior is a square room, surrounded by the sleeping-places, with the entrance on one side, while a hearth with wood as fuel occupies the middle of the floor. In Greenland the room is heated only by lamps, and the sleeping-places or family stalls are arranged in a row occupying one of its sides. The house for this reason is lengthened proportionally to the number of its inhabitants. Nowadays, however, the houses are not made so long as formerly—a curious fact corresponding to the disuse of the Indian 'long houses,' and like it a result of contact with civilisation. The number of inhabitants at an Eskimo station is most frequently under forty, but in rare cases more than two hundred are found. A funnel-shaped, half-underground passage forms the entrance of the narrow dwellings.

The *dress* is almost the same for women as for men, consisting of trousers or breeches and a tunic or coat fitting close to the body, and covering also the head by a prolongation that forms the hood. For women with children to carry this hood is widened, so as to make it an excellent cradle, the *amaut*. Tattooing has been general among all the

tribes, but only in the west is found the curious custom of wearing labrets, or lip-ornaments of bone or stone, inserted in holes of the lip, pierced for the purpose. The ordinary materials of which clothes are made are the skins of seals, land animals, and birds. Besides these, the intestines of seals are utilised in manufacturing an outer clothing used for waterproof coats.

The Eskimo *language* exhibits in a high degree the polysynthetic structure of the American tongues, characterised by the power of expressing in one word a whole sentence in which are embodied a number of ideas which in other languages require separate words. This is effected by means of radical words, to which affixes or imperfect words are attached. The Greenland dictionary contains 1370 such radicals and about 200 affixes, of which from one to ten, rarely more, can be appended to one of the former. As far as a rough estimate seems to prove, in many cases a radical may in this way be made the foundation of, strange to say, many thousands of derivatives, and a word can be composed which expresses with perfect distinctness what in our civilised languages might require twenty words. In Greenland and Labrador the missionaries have adapted the Roman letters for reducing the native language to writing.

The tribe is divided into groups constituting the inhabitants of the different wintering-places. Finally, in the same station, the inhabitants of the same house are closely united with regard to common housekeeping. In this, and perhaps similar ways, their general communism in living, characteristic of their stage of culture, is governed by rules for partnership in householding, for distribution of the daily game during the winter, and for the possessions of the individual, the family, the housemates, and the place-fellows. One of the oldest and most respectable men, called in Greenland *itok*, in Labrador *angajorkak*, is obeyed as chief of a house or wintering-place, although his authority, perhaps, may rest on tacit agreement only. In a similar way, more or less public assemblies constitute councils, and may be considered the courts of justice. Social organisation has been more highly developed in Alaska than in Greenland, altogether apart from the later European influence.

The Greenlanders, the greater part of the Labradorians, and the Alaska Eskimos are Christianised, but in the central groups the *religion* of the Eskimos is what is generally designated as Shamanism. According to the traditions of the Greenlanders, their heathen ancestors had a very distinct belief in the existence of the soul as independent of the body, and able to continue its existence after death. The souls of the deceased were venerated as guardian spirits of their surviving offspring, but besides them numbers of invisible rulers, called *inue*, or owners of things, filled the universe. The religious observances, with the aim of propitiating or calling for assistance on these supernatural powers, consisted of *serranek* ('prayer'), *kernainek* ('invoking'), and the use of amulets. Moreover, many regulations were observed concerning modes of life, fasting, abstinence, and sacrifices (*aitsuinek*). Some people were endowed with a peculiar skill (*nalussaerunek*, 'clairvoyance') in discerning the spiritual beings and influencing them. The highest stage of this kind of knowledge was that of the *Angakoks*, or Shamans, who invoked their guardian spirits (*tornat*) by means of *torninek* ('conjuring'). A supreme being, *tornarsuk*, ruler of the *tornat*, is also spoken of, but in very indistinct terms. In Alaska religious festivals, performed by large assemblies, and with the use of masks, were held in high esteem as a means of propitiating the invisible powers. The opposite of religious actions and angakok wisdom was *iliseenek* ('witchcraft'), also consisting without doubt in an application to supernatural powers, but that secretly, for selfish purposes, to the detriment of others.

The Christianised natives still preserve their ancient folklore. It represents at the same time their original poetry, religious ideas, and history, praising the deeds of their great men in braving the dangers to which their race has been continually subjected. Of this folklore considerable collections have been made, and by its study much light has been thrown on the language and on the daily life of the Eskimos, while material of the same kind has also been employed in helping to determine the difficult question of Eskimo ethnology.

The name Eskimo is said to be formed by corruption out of an Indian word signifying 'eaters of raw meat.' They call themselves *Inuit* (pl. of *inuk*, 'human being'), in Greenland partly *Kaladlit*. Their origin has been derived at different times from Europe of the glacial period, from Asia by way of the Behring Strait, but now most generally from the American continent, though the issue as between the last two can by no means be regarded as finally settled. Supporters of an American origin are at one in supposing the Eskimos to have been originally an inland people, pushed outwards by way of the river courses to the Arctic seas, where they developed their abilities as an Arctic coast people. But as to the earliest home of a peculiarly Eskimo culture, much diversity of opinion exists; some place it in the interior of Alaska, tracing a progressive development eastwards along the Arctic coast to Greenland; others find it in the district south of Hudson Bay, with a movement into Labrador, and by the west coast of Hudson Bay to the north; others, again, locate it in the Arctic Archipelago, with a movement to east, west, and north, allowance being made at the same time for the later introduction of influences from without, more especially Asiatic influences, developed first in the region of the Behring Strait.

As to the influence of the Europeans, the missionary work is mentioned above. In Greenland much care has been bestowed by the Danish government to avert the hurtful influence of contact with civilised strangers. But communism forms as essential an element in the native life as does even hunting, and, since the traditional obligations which counterbalanced its ill effects have fallen gradually into desuetude, the general result has been impoverishment. The curtailment of the houses mentioned above is owing to a rather ineffectual attempt by the natives themselves to escape this calamity.

See the article GREENLAND; also Pilling, *Bibliography of the Eskimo Language* (1888), especially for books by Beachy, Craws, Dall, H. Egede, C. F. Hall, Parry, Petitot, Ray, J. Richardson, H. Rink, and J. Ross. Besides these may be mentioned *Memoirs of Hans Hendrik, the Arctic Traveller*, translated from the Eskimo original by Dr H. Rink (Lond. 1878); Rink, *The Eskimo Tribes* (1887), and *Tales and Traditions of the Eskimo* (1875); Nansen, *Eskimo Life* (1893); Rasmussen, *People of the Polar North* (1909); Peary, *The North Pole* (1910); the Reports of the American Bureau of Ethnology; Thuren and Thalbitzer, *Eskimo Music* (1911); Stefánsson, *My Life with the Eskimo* (1913); Steensby, *An Anthropogeographical Study of the Origin of the Eskimo Culture* (1916); Rasmussen and Worster, *Eskimo Folk-tales* (1921).

Eskimo Dog, a half-tamed variety widely distributed in the Arctic regions, and much used for drawing the sledges. They are strong and powerful, like shepherds' dogs in form, with long black and white, brown, or dingy white hair. Often ill-fed and overworked, they retain much of

the original ferocity of their wolf ancestry, and are subject to fatal epidemics and to hydrophobia. Dangerous and unmanageable, they are not to be

Eskimo Dog.

compared with reindeer as aids to man, and polar explorers prefer Samoyede dogs. Yet under favourable conditions they can do 40 miles a day at 7 miles an hour, drawing over 50 lb. for each dog. The Americans have brought reindeer from Siberia to supersede the dogs in Alaska.

Eski-Zagra, or ESKI-SAGRA. See STARA-ZAGORA.

Esmeraldas (Span., 'Emeralds'), the most northerly maritime province of Ecuador, with a climate hot, moist, and on the coast unhealthy, and still largely covered with dense forest. Area, 5200 sq. m.; pop. 14,600. — The capital, Esmeraldas (pop. 5000), stands 10 miles from the mouth of the river of the same name, which is navigable to this point for ships drawing 16 feet of water.

Esné (hieroglyphic *Sne*, Gr. *Latopolis*, 'the city of the *Latus nobilis*' — the fish there worshipped) is a considerable town of Upper Egypt, and is situated on the left bank of the Nile, in 25° 15′ N. lat., 36 miles above Luxor. It contains about 17,000 inhabitants, including many Copts and a large colony of dancing-girls, and has manufactories of fine cotton, shawls, and pottery. Indigo dyeing is a staple industry, and until the Egyptian troubles of 1881 and following years there was a considerable trade with the Sudan. The climate is considered particularly healthy, and invalids are frequently ordered there by the native doctors. The ancient temple, dedicated to the god Khnum, is buried beneath the accretions of the modern houses, except the noble portico or hypostyle hall, of 24 columns, four deep, which was excavated to the pavement by Mohammed Ali to serve as a gunpowder cellar. Of the older temple behind nothing is known, but Champollion ascribed it to Thothmes III. The back of the portico of the temple of Khnum presents the name of Ptolemy Philometer; but the rest is more modern, and belongs to the time of the Cæsars. The sculptures are poor in design and execution. It has a Roman zodiac like that of Dendera, formerly thought to be of the most remote antiquity. At Esné is also a stone quay bearing the name M. Aurelius, while in the neighbourhood are the remains of several Coptic buildings, including a subterranean church, and a convent, perhaps the oldest in Egypt. Esné was the capital of a nome, and the coins struck in it in the reign of Hadrian, 127–128 A.D., represent the fish latus.—Champollion, *Not. Descr.;* Wilkinson, *Anc. Egyptians;* Mariette, *Mon. of Upper Egypt;* Lane-Poole, *Egypt.*

Esop. See ÆSOP.

Esote'ric (Gr.) is a term derived from the ancient mysteries, in which it was applied to those doctrines that were designed for the initiated, in contradistinction to those that were imparted to the uninitiated, which were termed *exoteric.* It is now used in various relations of an analogous kind. For Esoteric Buddhism, see THEOSOPHY.

Espalier, a term borrowed from the French, and signifying a railing on which fruit-trees are trained as on a wall. Such railings are very variously constructed—sometimes of wood, sometimes of iron, sometimes of upright rails held together by a horizontal rail at top, sometimes chiefly of horizontal rails with upright posts for their support. Espaliers may be very conveniently and cheaply made of strong iron wire, sustained by upright iron or wooden posts, as in ordinary wire-fences. They vary in height from 4 to about 8 feet, according to situation and the size of the garden. On the Continent they are often constructed horizontally or at a more or less oblique angle to the sun at a few feet above the ground; but, although their introduction in this form into British gardens has been recommended by some writers, they have only been adopted here and there experimentally and with no satisfactory result. They have the advantage of securing the fruit in a great measure from the effect of winds, which often shake off great part of the crop of standard trees whilst still unripe; and owing to the full exposure to sun and air excellent fruit is produced, although there is no reflected heat as from a wall, which is therefore still superior. Espaliers are very common in gardens in Britain, and add at once to the beauty and the productiveness of a garden, the ground not being overshadowed as by standard trees, although, of course, the roots of the trees render it unsuitable for many crops to some distance on both sides of the espalier. Espaliers are often used to separate flower-borders from plots occupied by culinary vegetables. Apples and pears are considered more suitable for espaliers than any other kinds of fruit-trees commonly cultivated in Britain. The treatment is generally similar to that of wall trees, but the training is usually by horizontal branches. It is not unusual, when trees have become old and their branches thick and firm, to dispense with great part of the rails necessary in their earlier training.

Espartero, BALDOMERO, Duke of Vittoria, was born 27th February 1792, the son of a cartwright at Granátula, in La Mancha. He was intended for the priesthood, but in 1808, on the invasion of Spain by the French, he volunteered into the *Batallón Sagrado* ('Sacred Battalion') of students, and after the close of the war of independence in 1814 went to South America, where he fought against the insurgents, until Bolivar's great victory at Ayacucho in 1824 put an end to the Spanish rule on the American continent. In 1833 he declared for the succession of the daughter of Ferdinand VII., became in 1836 general-in-chief of the army in the north, viceroy of Navarre, and captain-general of the Basque provinces. Next year he drove the Carlists from before Madrid across the Ebro, defeated their forces at Lluchana and Burgos, and drove Don Carlos across the frontier into France. For his success Espartero was made Grandee of Spain and Duke of Vittoria. In 1840 the queen-mother Christina was compelled to resign her office of regent, and next year Espartero was appointed by the Cortes to supply her place until the queen (Isabella) should have reached her majority. He guided the helm of the state through socialist and Carlist troubles with energy, firmness, and ability, until a combination of the Republicans and the Moderados brought about his fall in 1843.

He resided for four years in England, then, returning to Spain, lived quietly at Logroño from 1847 till 1854, when they again called Espartero to the head of the government. For two years he conducted the affairs of the nation; but in 1856 was supplanted by O'Donnell, and in 1857 resigned his dignity as senator. After the revolution of 1868, which resulted in the expulsion of Queen Isabella, Espartero gave his full and hearty support to the provisional government, though he took no part in their proceedings. In 1870 his name was put forward for the throne of Spain; but he soon withdrew it, and in 1875 tendered his adhesion to Alfonso. He died at Logroño, 9th January 1879. There is an elaborate Life by Florez (Madrid, 1843–45).

Esparto (*Stipa tenacissima*), a grass nearly allied to the well-known and beautiful Feather-grass (q.v.), a native of the south of Europe (especially Spain, between Alicante and Málaga) and North Africa (between Oran and Tripoli). From very ancient times it was used on both sides of the Mediterranean for the making of carpets, sandals, ropes, baskets, nets, and sacks, and as a substitute for horse-hair; but its chief application is now as a material in paper-making (see PAPER). The grass grows wild, requires little rain, and is pulled once a year; but two crops are taken in some parts of Spain, where it has also been the practice to pluck, not cut, the plant. It covers large areas from the seashore up to a considerable altitude, and accustoms itself to the poorest rocky and sandy soils. Some species of *Stipa* are valued as fodder in the drier parts of the United States, though the ripe awns are apt to be troublesome to stock.

Esparto Grass (*Stipa tenacissima*).

The name esparto, the Spanish form of the Latin *Spartum*, as well as the Arabic name *halfa* now naturalised in French, is also applied, especially in Tunis and Tripoli, to another somewhat similar and related grass, *Lygeum Spartum*, more accurately known, however, in French as *Albardine* and in Arabic as *Sennoc*. A third grass, also of similar habit, uses, and distribution, is the Byss (*Ampelodesmos tenax*). In Egypt the name halfa is applied to *Eragrostis cynosuroides*.

Esperanto. Among the numerous attempts which have been made during the past 300 years to establish an international or universal language, the greatest measure of success has attached to the project of Dr L. L. Zamenhof, author of 'Esperanto,' a language which seems likely to realise in great part the hopes of its inventor. The reason of the success of Esperanto, after the failure of so many attempts, lies in the soundness of the principles on which it is compiled, which may be summarised in the words, simplicity and internationality. Nearly every element in Esperanto is drawn from the natural languages, and the roots are so chosen that a great majority of them are common to several of the principal languages of Europe; on the other hand, grammar and phonetics are reduced to the simplest and easiest form.

The foundation of the language consists of some 2000 roots, about 30 affixes (which are also regarded as independent roots), and 16 grammatical terminations. The affixes are so chosen as to allow a great reduction in the number of necessary roots; for example, the prefix 'mal-' which reverses the meaning of a root, has a great effect in reducing the vocabulary (*malgranda*, small; *malfidi*, mistrust; *malofte*, seldom). They can be used in conjunction with any roots as required, and on the agglutinative principle, producing such words as *en-ir-ej-o*, place of entrance; *mal-jun-ul-in-o*, old woman. All nouns end in -o, adjectives in -a, derived adverbs in -e (*amo*, love; *ama*, loving; *ame*, lovingly). Nouns and adjectives take -n for the objective case, -j (pronounced y) for the plural. The verb has 11 forms, including six participles.

The vowels are reduced to five, *a e i o u*, pronounced approximately as in *father*, *very*, *pique*, *glory*, *rule*. Consonant sounds are rather plentiful, as they include practically all those found in English, except th, dh, and include Scots ch (*loch*) in addition. Six of them are represented by accented letters, ĉ ĥ ĝ ĵ ŝ ŭ. Every letter has one sound, which is, so far as is practicable, invariable, and there are no digraphs.

In addition to the fundamental roots, the language includes all such words as telephone, photograph, which are already international, and a number of roots which have gradually been introduced in the course of everyday use. Scientific terms, for the most part, are already international, and only need adapting to the esperanto phonetic system. The result is a language of remarkable richness and flexibility, as well as of extreme simplicity and regularity. The following are simple examples:

1. La instru-isto mal-permes-is la uzon de tiu
   The instruct-or dis-allow-ed the use of that
   danĝera gaso.
   dangerous gas.
2. Por esti sukcesa politikisto, oni ne devas
   To be a successful politician, one must not
   esti timema.
   be timorous.

Esperanto was first published by its author, at the age of twenty-eight, in the year 1887, and its nucleus has remained practically unaltered since that date. The author, whose purpose was purely idealistic, gave up all right to personal profit from his invention; but his constant advice and strenuous work guided its development along conservative lines until his death in 1918.

Esperanto has proved itself capable of fulfilling the purposes for which it was designed, as it is used by a large and increasing number of persons for practical purposes, whether for commerce, study, or recreation. Its practical usefulness as a spoken language has been amply shown at the many congresses which have been held, representing some thirty nationalities. It also has a growing literature, of which the most important part consists of translations. Those of Dr Zamenhof himself, consisting of classical prose or poetical works from six languages, are the best known. Its headquarters are in Geneva.

See R. J. Lloyd, *The Esperanto Language;* B. E. Long, *The Passing of Babel;* Major-General G. Cox, *Grammar and Commentary.*

Espinasse. See LESPINASSE.

Espinel, VICENTE DE (1551–1624), poet and musician, was born at Ronda in Granada, studied at Salamanca, and as a soldier in Flanders met with some of the adventures related in his *Vida y*

Aventuras del Escudero Marcos de Obregon (1618; trans. 1816), largely drawn upon by Lesage (q.v.). Taking holy orders, he became — nominally — chaplain to a hospital. His poems are chiefly lyrics.

Espirito Santo, a small maritime state of Brazil, lying immediately to the north of the state of Rio de Janeiro. Area, 17,000 sq. m.; pop. 210,000. The surface is mostly flat and swampy, the climate moist and hot, and the vegetation luxuriant.

Espiritu Santo. See NEW HEBRIDES.

Espy, JAMES POLLARD, meteorologist, born in Pennsylvania in 1785, for a time practised law and taught classics. His theory of Storms (q.v.) was embodied in the *Philosophy of Storms* (1841). Appointed in 1843 to the Washington observatory, Espy there laid the basis of the Weather Bureau. He died 24th January 1860.

Esquimalt, a port at the south end of Vancouver Island, on Juan de Fuca Strait, 3 miles from Victoria (q.v.). It has a magnificent harbour, is a Canadian naval station, and is strongly fortified. Pop. 5000.

Esquimaux. See ESKIMO.

Esquire (Old Fr. *escuier*, 'a shield-bearer'), originally the shield-bearer or armour-bearer of a knight. A knight fully equipped was in the days of chivalry attended by two esquires, whose spurs were of silver, not of gold, like the knight's. And when the sovereign created esquires, silver spurs were placed on their heels, and collars of SS round their necks. Blackstone quotes with approval Camden's definition of four classes of esquires: (1) 'The eldest sons of knights, and their eldest sons in perpetual succession. (2) The eldest sons of younger sons of peers, and their eldest sons in like perpetual succession. (3) Esquires created by the king's letters-patent or other investiture, and their eldest sons. (4) Esquires by virtue of their offices, as justices of the peace, and others who bear any office of trust under the crown.' To these Blackstone added the esquires of Knights of the Bath, no longer appointed. Camden's third class no longer exists. Christian, in his notes to Blackstone, would limit the holders of 'offices of trust under the crown' to those who are styled esquires by the king in their commissions, and he remarks Blackstone's omission of barristers, who have been held by law to be esquires by office. In common usage the designation of esquire is very widely and very loosely applied.

Esquirol, JEAN ÉTIENNE DOMINIQUE (1772–1840), born at Toulouse, was appointed physician to the Salpêtrière at Paris in 1811. He lectured and wrote on the diseases of the brain and their cures, and in 1825 he became first physician to the *Maison des Aliénés*, while managing his private asylum at Charenton. His influence on the treatment of the insane was very powerful for good.

Esquiros, HENRI ALPHONSE, a French poet and politician, was born at Paris, 24th May 1814. At twenty he made his début with a volume of poems, which was followed by two romances, *Le Magicien* (1837) and *Charlotte Corday* (1840). His *Évangile du Peuple* (1840), a democratic commentary on the life of Jesus, cost him eight months' imprisonment and a fine of 500 francs, but gave him leisure and inspiration for his *Chants d'un Prisonnier*. His *Vierges Folles*, *Vierges Martyres*, and *Vierges Sages* (1841–42) showed further his socialistic sympathies. After the revolution of February 1848, Esquiros was elected a member of the Legislative Assembly, but the *coup d'état* of 1851 drove him to England, where he gathered the materials for his *English at Home*, *Cornwall and its Coasts*, and *Religious Life in England*. Permitted by the amnesty of Napoleon III. to return to France, he engaged in administration and in politics, but died at Marseilles, 12th May 1876.

Essad, Albanian chief, born about 1875 at El Bassan, was sprung from the house of Toptani, a family of powerful, semi-independent chiefs. Essad was throughout life consistent only in his desire for power, the rulership of Albania being his dearest aim. Having enriched himself and become a pasha in the political service of Abdul Hamid, he later turned firm supporter of the Young Turks, until the Albanian revolt assured him that his continued adhesion was hardly likely to further his ends. In the war of 1912 he championed the Turkish cause, occupied Scutari, but later relinquished it by stealth to Montenegro, on condition of subsequent recognition as ruler of a small central Albanian state. But the Albanians, mindful of Essad as exploiter and trimmer, unhesitatingly rejected his rule. Essad first supported William of Wied, but later openly and covertly opposed him. During the Great War he placed with prescience his stake on the Allies, and on the departure of the Prince of Wied, he ruled for a time in Durazzo and Central Albania; to the Serbians and Montenegrins, in their retreat before the Austrian advance, he lent his aid; and later, when not absent in Paris as president of the Albanian delegation, commanded troops in Salonika and elsewhere on the Eastern front. On the conclusion of peace he contrived that a self-styled National Assembly should proclaim him king of Albania, but apprehension at the prospect led to his assassination in Paris at the hand of an Albanian nationalist, 13th June 1920.

'Essays and Reviews,' the title of a remarkable volume published in 1860, containing the following seven papers: (1) 'The Education of the World,' by Dr Temple; (2) 'Bunsen's Biblical Researches,' by Dr Rowland Williams; (3) 'On the Study of the Evidences of Christianity,' by Professor Baden Powell; (4) 'The National Church,' by H. B. Wilson; (5) 'The Mosaic Cosmogony,' by C. W. Goodwin; (6) 'Tendencies of Religious Thought in England, 1688–1750,' by Mark Pattison; (7) 'The Interpretation of Scripture,' by Professor B. Jowett. All the writers, except Mr Goodwin, were clergymen of the Church of England, and their work, which was censured for its heterodox views by nearly all the bishops, and formally condemned by convocation in 1864, caused much excitement and controversy. Dr Williams and Mr Wilson were sentenced by the ecclesiastical courts to suspension for a year, but on appeal the sentence was reversed by the Privy-council; and Dr Temple's election to the see of Exeter in 1869 was also ineffectually opposed. The most important replies to the *Essays and Reviews* were those edited by Bishop Thomson (afterwards Archbishop of York) and by Bishop Wilberforce.

Essek (Croat. *Osijek*), the capital of Slavonia, on the right bank of the Drava, 12 miles above its confluence with the Danube, and 189 S. of Budapest by rail. The Roman *Mursia*, and the seat of a bishopric since 335 A.D., it has a prosperous trade in corn, live-stock, wood, &c. Pop. 40,000.

Essen, a town in Rheinland, 22 miles by rail NE. of Düsseldorf, stands in the midst of a rich coal and iron district. It possesses numerous establishments for manufacturing iron, chief among them being the celebrated Krupp works. See KRUPP, CANNON. Besides this great establishment there are also manufactures of tobacco, walking-sticks, and vinegar, with dye-works and breweries. Pop. 440,000. Although the industrial activity of Essen is recent, the town itself dates from the foundation of the Benedictine nunnery in 873.

The town was governed by the abbess, who had the rank of a princess of the empire from 1275. After the Peace of Lunéville it was secularised, and it became Prussian in 1803. It was united with the grand-duchy of Berg in 1807, but returned to Prussia in 1814. One of the churches of the place, also founded in the year 873, presents several architectural features of interest.

Essence (Lat. *essentia*, from *esse*, 'to be'), as a philosophical term, the equivalent of the Greek *ousia*, was originally used in the same sense as *Substance* (q.v.). Later, substance came to be used for the undetermined substratum of a thing, essence for the qualities expressed in the definition of a thing; or, as Locke put it, 'Essence may be taken for the very being of a thing, whereby it is what it is.'—In Chemistry, and in popular parlance, essences are solutions of the essential oils in alcohol, and may be prepared (1) by adding rectified spirit to the odoriferous parts of plants, or to the essential oils, and distilling; or (2) simply by adding the essential oil to the rectified spirit, and agitating till a uniform mixture is obtained. Thus the essence of lemons is merely a solution of the volatile oil of lemons in rectified spirit. The term has, however, received a wider significance, and is applied to any liquid possessing the properties of the substance of which it professes to be the essence. Thus essences of coffee, beef, and rennet contain in a concentrated form the virtues of coffee, beef, and rennet, and in some circumstances may be substituted for them. See PERFUMERY.

Essenes (*Essēnoi*, *Essaioi*), a small religious fraternity among the Jews, whose name and origin, as well as character and history, are alike involved in obscurity. The Essenes bore one of the most momentous parts in the development of Judaism. Christianity stands in so close connection with them that John the Baptist and Christ himself have by some been pronounced to have issued from their ranks; and Islam still bears traces of an original connection. Josephus, Philo, Pliny, Eusebius, and the Fathers generally were long considered the sources, and the only sources, from which the genuine history of this fraternity could be deduced. Strange that for so many centuries the real and genuine sources—the Talmudical writings—should never have been thought of. These, together with Josephus and Philo, Pliny, Makrisi, and Abulfaraj, better enable us to form an idea of the real state of this community. Exception must be taken to the opening statement of Josephus, that there were three different 'sects' among the Jews—the Pharisees, the Sadducees, and the Essenes. The Sadducees were a political party, nothing more or less; and the Pharisees, forming as they did the bulk of the nation, cannot rightly be called a *sect*. Least of all were the Essenes such. They were Pharisees of stronger convictions, and carried out the Pharisaic views with a consistency which made them ridiculous even in the eyes of their own mother-party. The comparatively modern name of Essenes may be derived either from a Chaldee word *sacha*, meaning 'bathers' or 'baptists,' or from *asa*, meaning 'healers.' The Mishna, Beraitha, and Talmud speak of these advanced Pharisees in general as Chasidim (*Assidaioi*, 'pious men'), Nazirim ('abstinents'), and Toblé Shachărith ('hemerobaptists').

The Nazirim, a kind of voluntary priesthood, enjoining abstinence from wine, flesh, and other sensual enjoyments, had in the troublous times of anti-Syrian agitation, and the general upheaving of society, found numerous adherents; and gradually there sprang up a host of men calling themselves 'Nazirs for ever' (*Nazire olam*). Pharisees of a spiritual and contemplative bias took this vow of Nazirship for life, and constituted themselves into a sort of religious club. Levitical purity in its strictest and highest sense made them draw closer and closer the innumerable 'fences' which the traditional law had erected round the Biblical law. Thus it became necessary, or at least expedient, that those among them who could break all ties of friendship and family should retire into a solitude not easily approachable by a stranger to their community. Food, again, could not be prepared save by those of the brethren who knew and strictly obeyed the hyper-traditional injunctions. Their dress, every implement of daily use, had to be made under similarly stringent laws of purity. A natural consequence of this their exalted notion of outward priesthood was their general celibacy. In this state of voluntary isolation, trading was out of the question: they tilled the ground, and lived on the fruits of the earth. Taking their meals, and these of the coarsest and plainest description, in common, they idealised the table into an altar, and, prayer having been said, they remained standing silently round it during the repast. That they had no individual property follows of course, and their communistic motto, which the Mishna (Aboth) has preserved to us—'Mine is thine, and thine is mine'—explains itself. We need not enlarge further on their small eccentricities—on the white linen garment, the apron, the scoop or shovel; they are one and all signs and symbols of Levitical purity. Every morning they bathed, like the priests who ministered in the temple, in pure spring-water. They abhorred blood as a source of impurity, and for this reason, probably, some of them abstained also from going up to the temple, where sacrifices were daily offered; others we find present at a festival in the temple (Succah, 51, 53). But these were but outward signs of purity, stepping-stones to inner piety, to communion with God, which was only to be acquired, according to their notion, by solitude and an ascetic life. The belief in the efficacy of the most rigid simplicity and willing self-sacrifice they held in common with the Pharisees; their horror of oaths, their frequent prayers, their occupation with mystical doctrine were their own. Untroubled by the noise of war or the strife of parties, leading a life divided between ablutions, contemplation, and prayer, despising the body and bodily wants—what more natural than that by degrees they should be led into a kind of mystical enthusiasm and fanaticism? They allegorised, they symbolised; and their efforts culminated in seeing the unseen.

Angelology, derived from the Magi, formed a prominent feature of their creed. In course of time, they were looked upon by the vulgar as saints and workers of miracles: they cast out demons, and healed the sick. Jehovah is the original light; from him proceed a number of spirits, and at their head stands the Wisdom, or *Logos*, into which, after death, the soul is again absorbed. Their code of ethics was threefold—the love of God, of virtue, and of man, their scale of perfectibility reaching its acme in the communion with the Holy Spirit—*Ruach Hakodesh* (Mishn. Sota, 99). In fine, mixing up, in the strangest manner, the most exalted and the most puerile notions, they became the forerunners of the Christian Gnostics and of the Jewish Cabbalists. One fragment of their literature alone remains; it is quoted in the Talmud (Jerusch. Berachoth) in the following words: 'It is written in the book of the *Chasidim*, If thou leavest it (the divine law) for one day, it will leave thee for two.'

They seem never to have numbered more than four thousand, including even those Nazirs or Essenes who remained in their own families. Their colony

appears to have been established chiefly near the Dead Sea, and it is undoubtedly this colony which has served Josephus as a basis for his romantic Essene republic. But, however distant from each other they might be, a constant intercommunication was kept up through a body of delegates, or angels (Malachim). As they had sprung from the Pharisees, so they again merged in them; the remaining part became Therapeutæ, or Christians. The Talmud reports their extinction as a separate community (Bechorot, 27).

See the Talmud, the Midrash, Josephus, Philo; Ewald, Grätz, Wellhausen, Reuss, Holtzmann, and Schürer in their relevant works; Kohler in *The Jewish Encyclopædia* (vol. v. 1903); Keim, *Jesus of Nazara;* Lightfoot on the Colossians; Zeller, who, in his *Philosophie der Griechen*, makes them indirectly influenced by non-Jewish, neo-Pythagorean doctrines; Lucius, *Der Essenismus* (Strasburg, 1881).

Essequi'bo, the most westerly of the great rivers of British Guiana, rises in the Acarai Mountains, 46 miles N. of the equator, and after a course of 620 miles enters the Atlantic, forming an estuary 15 miles wide, in which lie numerous fertile islands. The entrance to the river is rendered difficult owing to the sand and mud collected at its mouth; its course, which is through magnificent forest scenery, is much broken by cataracts, and it is navigable for 35 miles only. It receives a number of large tributaries, as the Rupununi, and the united Cuyuni and Mazaruni; on the Potaro, another affluent, is the grand Kaieteur Fall, 741 feet in sheer descent, discovered in 1870. The county of Essequibo, lying to the west of the river, has a coast-line of about 120 miles, nearly to the Orinoco. For frontier disputes, see VENEZUELA.

Essex, a maritime county in the east of England, washed by the North Sea, and separated from Kent by the Thames estuary, from Suffolk by the Stour. Measuring 57 miles from east to west, and 44 from north to south, it has an area of 1530 sq. m. The low flat sea-board is close on 100 miles long, deeply indented by shallow creeks, and much of it fringed by the desolate salt-marshes described so well in Baring-Gould's *Mehalah.* Inland the surface becomes gently undulating or even hilly, the principal eminences being Danbury Hill (317 feet), Laindon Hill (378), and High Beech (350). The rivers are the Thames, Stour, Lea, Stort, Colne, Blackwater, Crouch, Roding, and Chelmer—rivers that sometimes flood the low-lying lands. Chiefly occupied by the stiff London Clay, but with chalk in the north-west, and crag near Harwich, Essex offers a great variety of soil. Almost four-fifths of the entire area is in cultivation; and as Essex is more than most counties purely agricultural, so it has suffered more than most through agricultural depression. Near London are suburban and manufacturing towns. Epping Forest (q.v.) is a mere remnant of the once wide woodlands, whose total area throughout the whole county is now reduced to less than 44 sq. m. Fishing is prosecuted, though not very actively; and the Colne has long been famous for its oysters. Brewing is an important industry, especially at Romford; but outside of the metropolitan area there are no great manufactures. Since 1885 Essex has returned one member to parliament for each of its eight divisions (rearranged in 1918). Chelmsford is the county town; and other towns are Colchester, West and East Ham, Walthamstow, Harwich, Southend, Leyton, Woodford, Grays Thurrock, Romford, Maldon, Saffron Walden, Stratford, Barking, Braintree, Brentwood, Coggeshall, Dunmow, Halstead, Harlow, Ilford, Ongar, Witham. Harwich is in daily communication with the continent. 'Police London' extends into Essex; hence a recent rapid growth of population. Pop. (1801) 227,682; (1841) 344,979; (1881) 576,434; (1921) 1,468,341. Essex, named after the East Saxons, has little history apart from Colchester (q.v.); its battlefields are Ashingdon and Maldon. The palaces of Havering and Theobalds are no more; but the Norman keep of Castle Hedingham still stands, and Audley End, a splendid Jacobean mansion. Old halls too are plentiful; and there are ruins of more than a dozen monastic houses. Essex worthies include Tusser, John Ray, Quarles, Sydney Smith, and Isaac Taylor. See histories by Morant (2 vols. 1768), Suckling (1845), the 'Victoria History' (1903 *et seq.*), the Historical Monuments reports (1921–23), and Gepp, *Essex Dialect Dictionary* (1923).

Essex, EARL OF, a title conferred in 1572 on Walter Devereux (1541–76), scion of a very old Herefordshire house, the daring but luckless coloniser of Ulster. The title had been previously borne by the Mandevilles, the Bohuns, the Bourchiers (Devereux's ancestors), and by Thomas Cromwell (q.v.).

ROBERT DEVEREUX, Walter's eldest son and successor, was born at Netherwood, near Bromyard, on 10th November 1567, at nine was sent by Burghley, his guardian, to Trinity College, Cambridge, and at thirteen got his M.A. He had been taken to court the Christmas of 1577; in 1580 Leicester had become his step-father; and under Leicester he first saw service in the Netherlands (1585-86), for his valour at Zutphen being made a knight-banneret. Back at court, the young gallant quickly won the 'singular countenance' of the elderly queen. In the words of his college-friend Bagot, 'when she is abroad, nobody near her but my L. of Essex; and at night my Lord is at cards or one game or another with her, that he cometh not to his own lodging till birds sing in the morning.' There were tiffs between them, over his bickerings with Raleigh, his duel with Blount, his stealing off to fight in Portugal, moneys lent by Elizabeth, his favouring of Puritanism, and, worst of all, his clandestine marriage in 1590 with Walsingham's daughter, Sir Philip Sidney's widow. Ere long, however, he was once more 'in very good favour,' and in 1591 commanded the forces despatched to help Henry IV. in Normandy against the League; in 1593 was sworn a privy-councillor; and by 1594, thanks to Bacon, who made him his stalking-horse, was acting as a sort of foreign secretary. His was the principal glory of the brilliant capture of Cadiz (1596); but his, too, largely the failure next year of the 'Islands Voyage' (see RALEIGH). In 1597 Essex became Earl Marshal, in 1598 Chancellor of Cambridge; but meanwhile occurred his great quarrel with Elizabeth, when he turned his back on her, exclaiming that her conditions were as crooked as her carcass. A box on the ear and 'Go and be hanged' was her answer; and, clapping hand to sword, Essex vowed he would never put up with so great an indignity. They never were properly reconciled. His six months' lord-lieutenancy of Ireland proved an utter fiasco; his army of sixteen thousand dwindled to barely four; and, concluding a truce with the arch-rebel Tyrone, he hurried back to England, and burst into Elizabeth's bedchamber. She received him not ungraciously at first; still, imprisonment followed, and deprivation of all his dignities. And now he formed the mad plot for removing Elizabeth's counsellors, in pursuance of which, on Sunday, 8th February 1601, he attempted vainly to raise the city of London. On the 19th he was found guilty of high-treason, on the 25th beheaded in the Tower. Elizabeth signed his death-warrant reluctantly; but the story of the ring, given him by the queen for a safeguard, but kept back by the Countess of Nottingham, is an invention of fifty years afterwards. A patron of letters, Essex was himself a

sonneteer; and Cooper's *Athenæ Cantabrigienses* (1861) gives a longish list of his writings. See the authorities cited there and in our articles BACON and ELIZABETH.

ROBERT DEVEREUX, eldest son of the preceding, was born in January 1591, and in 1604, soon after James I.'s accession, was restored in blood as third Earl of Essex. When just fifteen he was married to a daughter of the Earl of Suffolk, but during his two years' travels on the Continent (1607–9) she and Carr fell in love, and on getting a divorce she married him (1613). See OVERBURY. Essex's own second marriage (1631) was almost as unhappy as the first. From 1626 he had attached himself to the popular party, and the Long Parliament brought him to the front; in July 1642, withstanding all Charles's blandishments, he received the command of the parliamentary army. A dull, worthy soul, a striking contrast to his brilliant sire, he was brave enough personally, but a very poor general; and to his hesitancy and inactivity the prolongation of the war was largely due. The drawn battle of Edgehill, the capture of Reading, and the relief of Gloucester were followed by his blundering march into Cornwall, whence he himself fled by sea. On 2d April 1646 he resigned the command, and on 14th September he died. The title died with him; but in 1661 it was revived in favour of Arthur, second Lord Capel (1631–83). See works cited at CHARLES I., and Walter Bourchier Devereux's *Lives of the Devereux, Earls of Essex* (1853).

Esslingen, a manufacturing town of Württemberg, on the Neckar, in the centre of a pleasing and fertile district, 9 miles by rail ESE. of Stuttgart. It consists of the inner town, which retains much of its old walls and towers, and of several suburbs, embosomed in gardens and vineyards. The chief buildings are the old citadel, the Liebfrauen Church (1440)—a splendid Gothic edifice, with a beautiful spire 246 feet high—the old (1430) town-house, and the new (1742). It has the greatest machine-shops in the state, a lithographic establishment, and manufactures of a wine called Esslingen champagne, of woollens, of cotton and woollen yarns, lackered iron, silver-plate, and tin wares, with a good trade in wine and fruit. Pop. (1875) 19,602; (1919) 37,814. Esslingen was founded in the 8th century, and received in 1209 the rights of a free city of the German empire. During the 15th century it was engaged in a bitter contest with the counts and dukes of Württemberg. In 1802 the town, with its territory, was assigned to the duchy of Württemberg.

Essouan. See ASSUAN.

Established Church. See ENGLAND (CHURCH OF); SCOTLAND (CHURCH OF); STATE RELIGION; VOLUNTARYISM.

Estaing, CHARLES HECTOR THÉODAT, COMTE D', naval officer, was born in Auvergne in 1729, became brigadier in 1756, and afterwards served in the East Indies with Lally. In 1778, as vice-admiral, he sailed with sixteen vessels to co-operate with the colonists against the British. He captured St Vincent and Grenada in 1779, but his efforts on the mainland were uniformly unfortunate; and in 1780 he returned, severely wounded, to France, where he persuaded the ministry to send 6000 men to the colonists' aid. His loyalty to the royal family, and especially to the queen, outweighed his services to his country, and he was guillotined in Paris, 28th April 1794.

Estate, in the law of England, is the state or legal relation in which a person stands to his property, or, in other words, the quantity of interest he has in it. The first division of estates is into legal and equitable. By the former is signified the estate which a man has by the common law; by the latter, the interest which has been created by the operation of a court of equity (see EQUITY, USES, TRUST). Estates in land may be considered with reference to the quantity of the estate, the time of enjoyment, and the number of persons who may unite in the enjoyment. Under the first head, estates are either freehold or less than freehold. Freehold estates, again, are divided into freeholds of inheritance, or Fees (see FEE), and freeholds not of inheritance, or for life. An estate for life may be for the life of the person to whom it is granted, or for that of another person, or for more than one life. A person holding an estate for the life of another is called tenant *pur autre vie.* An estate *pur autre vie* granted to a man and his heirs descends, in case of the death of the tenant intestate, during the life for which he holds to his heir. An estate by the courtesy of England, and an estate in dower, are estates for life. A conveyance by deed to A. B., without words giving him an estate of inheritance, makes the grantee tenant for life. An estate to a woman during her widowhood, or to a man until the occurrence of a specified event, as till he receive a benefice, will be construed to be an estate for life, but the estate is determinable on the event happening. Tenants for life are entitled to take Estovers (q.v.), but they must not commit Waste (q.v.). The representatives of a tenant for life are also usually entitled to take the emblements on the expiry of the term. Estates less than freehold are called also chattels real. This species of estate, on the death of the tenant, passes, like other Chattels (q.v.), to the executor, and not to the heir. They are divided into estates for years, estates at will, and estates on sufferance (see LEASES). Estates, with reference to the time of their enjoyment, may be either in possession or in expectancy. An estate in possession comprehends not only an estate in the actual occupation of the tenant, but one from which he has been wrongfully ousted. In this latter case the law regards the rightful tenant as having the actual estate, to which is attached the right of entry. An estate in expectancy may be either in Reversion (q.v.) or Remainder (q.v.). Estates of this character form a large portion of the rights to land in England, and are the subject of some of the most subtle learning of the English law. With reference to the number of persons entitled to the enjoyment, estates may be in severalty, in joint-tenancy, in co-parcenary, or in common. An estate in severalty is where the sole right to the estate is in a single person. See CO-PARCENARY, LAND-LAWS, REAL, TENURE.—For the Estate Duty as now levied, see DEATH DUTIES.

Estates of the Realm, not King, Lords, and Commons, as is often said, but the Lords, the Clergy or Spiritualty, and the Commons, which estates, together with the king or queen, form the parliament of the United Kingdom of Great Britain and Ireland. (For an apology for the common error, see Lister's *Life of Clarendon*, vol. i. p. 190–196; see also the article PARLIAMENT.) The ancient parliament of Scotland consisted of the king and the three estates of the kingdom, by which latter was meant—(1) the archbishops, bishops, abbots, and mitred priors; (2) the barons, under which head were comprehended not only the nobility, but the commissioners of shires and stewartries; and (3) the commissioners from the royal burghs. In Sir David Lindsay's *Satire of the Thrie Estaitis*, it is before Spiritualitie, Temporalitie (landholders), and Burgesses that Johne the Common Weile makes his complaint. The expression *Fourth Estate* for the newspapers is ascribed by Carlyle to Edmund Burke, who said that in the reporters' gallery there

was a fourth estate more powerful than any of the other three. In France the nobles, the clergy and the third estate (*tiers état*) remained separate down to 1789 (see FRANCE); in England the greater clergy became Lords Spiritual, the lesser clergy became, for political purposes, part of the Commons, and parliament was organised in two houses. In Sweden there were, till 1866, four estates or houses—nobles, clergy, citizens, and peasants.

Estate Tail. See ENTAIL.

Es'te (ancient *Ateste*), a town of Italy, on the southern slope of the Euganean Hills, 17 miles SSW. of Padua. It is an old place, with a decidedly Lombard appearance, many of the houses being supported by arches. Its most interesting buildings are the *Rocca*, or castle, overhanging the town, and a Romanesque church, surmounted by a leaning campanile. Este has some manufactures of porcelain and faience wares. Pop. 12,000.

Es'te, one of the oldest and most illustrious families of Italy, possibly of Langobard origin, whose heads from an early date ranked as keepers of the marches of upper Italy, and afterwards received from the emperors several districts and counties, to be held as fiefs of the empire. In 1097 the family divided into two branches, the German and Italian. The former was founded by Welf IV., who had received the investiture of the duchy of Bavaria from the Emperor Henry IV. in 1070. From him are descended the Houses of Brunswick and Hanover, and consequently the sovereigns of Great Britain, also called Este-Guelphs (see GUELPHS). The Italian branch was founded by Welf's brother, Fulco I.; and for several centuries the history of the Este family as heads of the Guelph party is interwoven with the destinies of the other ruling families and small republics of Northern Italy. During this period they first gained possession of Ferrara and the march of Ancona, and afterwards of Modena and Reggio, and were widely celebrated as the patrons of art and literature. Among the most illustrious members of the family was Alfonso I. (died 1535), equally distinguished as a soldier and a statesman, and celebrated by all the poets of his time, particularly by Ariosto. His second wife was the notorious Lucrezia Borgia. A quarrel with the Popes Julius II. and Leo X. brought about the forfeiture of his papal fiefs, which were restored by Charles V. after the siege of Rome in 1527. His successor, Ercole II., who married Renate, daughter of Louis XII. of France and Anne of Brittany, attached himself to Charles V. His brother, a dignitary of the Catholic Church, erected the magnificent Villa d'Este at Tivoli. The next prince, Alfonso II. (died 1597), would have been noways inferior to the preceding but for his immoderate love of splendour, his inordinate ambition, and the cruelty he displayed towards the poet Tasso. Rinaldo (died 1737), by his marriage with Charlotte of Brunswick, united the German and Italian houses, separated since 1070. The male line of the House of Este became extinct on the death of Ercole III. in 1803, whose only daughter married the Archduke Ferdinand, third son of Francis I. of Austria. Their eldest son, Francis IV., by the treaty of 1814–15, was restored to the duchy of Modena, and on his mother's death obtained the duchies of Massa and Carrara. He was succeeded in 1846 by his son, Francis V., who in 1859 was obliged to resign his territories to Victor Emmanuel. With the death of Francis V. in 1875 the Austrian branch also became extinct.

Estella, an ancient city of Spain, in the province of Navarre, on the Ega, 27 miles SW. of Pamplona. Pop. 5600. Here Don Carlos was proclaimed king in 1833; and Estella was again the Carlist headquarters from 1871 to 1876.

Estepa, a town of Spain, 60 miles ESE. of Seville; pop. 8000.

Estepona, a maritime town of Spain, 26 miles NNE. of Gibraltar. It supplies Gibraltar with fruits and vegetables. Pop. 10,000.

Esterházy de Galantha, one of the most powerful families of Hungary, raised in the 17th century to the rank of princes of the empire. The family divided into three main branches—the Csesznek, Altsohl or Zolyom, and Fraknó or Forchtenstein lines. Count Paul Esterházy of Fraknó (1635–1713) served in the Austrian army with such distinction as to gain a field-marshal's baton at the age of thirty, and for his successes against the Turks, and still more for his support of the House of Hapsburg, was made a prince of the empire in 1687. A descendant, Prince Nicholas Joseph (1714–90), is best remembered for his thirty years' patronage of Haydn (q.v.). His grandson, Prince Nicholas IV. (1765–1833), founded the splendid collection of pictures at Vienna, and by this and other expenses brought his vast estates into sequestration. Napoleon, in 1809, offered him the crown of Hungary. His son Prince Paul Anton (1786–1866), who represented the Austrian government at London in 1815–42, added greatly, by his profusion, to the burdens imposed on the family property.

Esters, or ETHEREAL SALTS (also 'compound ethers'), are carbon compounds formed by the union of acids and alcohols, as in inorganic chemistry the metallic salts are formed by the union of acids and metallic hydroxides. Thus when ordinary alcohol (methyl alcohol) and strong hydrochloric acid are mixed and heated they combine and produce ethyl chloride (an ester) and water. Instead of the acid itself its chloride may be employed. Esters may be saponified or hydrolysed when heated with water or caustic soda solution, an alcohol and salt of the acid being formed.

Esther, THE BOOK OF, contains the story of a great deliverance of the Jewish people in Persia through the influence of Queen Esther, who had succeeded Vashti as the favourite wife of Ahasuerus (Xerxes). Haman, the grand-vizier of Persia at the time, irritated at the refusal of the Jew Mordecai to pay him proper homage, devised a plan for exterminating the Jewish people in Persia and confiscating their property. However, through the influence of Esther, who was a Jewess and a kinswoman of Mordecai, Ahasuerus was persuaded to repeal the edict and issue another protecting the Jews. Haman's policy was reversed, and he himself was hanged upon the gallows which he had prepared for Mordecai. The Book of Esther is thus a manifesto of Jewish patriotism, and it became so popular that its annual reading in the synagogue was one of the chief events connected with the celebration of the feast of Purim. It was one of the last books to be admitted into the Jewish Bible, and its right to a place in the canon was questioned for some time. The book had less attraction for the Christian Church than for the Jewish people. It is never quoted in the New Testament, and its authority was often called in question—e.g. by Melito of Sardis, Athanasius, Gregory of Nanzianzus. Luther spoke very disparagingly about it: 'Though they have this book in the canon, in my judgment it deserves more than all to be excluded from the canon.' 'I am so hostile to the book that I would it were not in existence, for it Judaises too much and hath a great deal of heathenish naughtiness.' These criticisms are largely due to the absence from the book of any definite religious teaching. The name of God is never once mentioned, though the king of Persia is referred to no less than 187 times. Modern criticism is disposed

to question the historicity of the narrative, and regard it as a romance or religious novel, like the book of Judith in the Apocrypha, which in some respects it very closely resembles. There is absolutely no corroboration of the story to be found in any other accounts of Xerxes or of the Jewish people in Persia. If the drama of Esther were historical fact, there would have been some reference to the heroine in Chronicles, or Ezra, or Daniel, or Ecclesiasticus, or Philo. The complete silence of our other authorities is inexplicable on the assumption that the narrative rests upon any basis of fact. The narrative too contains many intrinsic improbabilities, and is often at fault in its description of Persian customs and political organisation. Attempts have been made by some modern scholars to prove that the story of Esther had a mythological origin, and Haman and Vashti were originally Elamite deities, Mordecai represents Marduk, and Esther, Istar, the principal deities of the Babylonians. Thus Vashti and Haman on the one side, Mordecai and Esther on the other, represent the antagonism between the gods of Elam and the gods of Babylon. There is no agreement among scholars as to the exact date at which the book of Esther was written, but the prevailing opinion is that it belongs to the Greek period. The Septuagint version of the book contains lengthy additions—some 107 verses in all—which amplify the narrative, and add the religious and theological touches which are absent from the original work. These additions are included in the Apocrypha, and an annotated edition of them appears in the *Oxford Apocrypha and Pseudepigrapha* (1913), vol. i. pp. 665–684.

See *Hastings's Bible Dictionary* and *Encyclopædia Biblica;* Sayce, *Ezra, Nehemiah, and Esther;* commentaries in *Century Bible* and *Cambridge Bible.*

Esthonia, a republic formed in 1919 out of the Russian province of Esthonia and the northern half of Livonia, is bounded on the north by the Gulf of Finland, on the east by Russia and lakes Peipus and Pskoff, on the south by Lettland (Latvia), and on the west by the Baltic. It includes Oesel, Dagö, and other islands. About a fifth of the surface is covered with forests, moors, and small lakes, the rest being arable. The Narva, holding much power in its rapids, is the principal river, other rivers, though numerous, being mostly small and sluggish. Along the northern coast are rich deposits of oil-shale. The climate is variable, with extremes of heat and cold. The Esthonians are well educated, and there is a university at Dorpat (q.v.). The country holds an important place in the transit trade with Russia. Imports are coal, raw wool and cotton, metals, machinery, leather, oils, chemicals; exports, dairy produce, live-stock, flax, linseed, cement, timber, paper, potatoes. Agriculture is the chief occupation, the principal crops being rye, oats, barley, flax, and potatoes. The coastal waters are rich in fish, especially anchovies. Much brandy is made, and some cotton spun and wool woven. The capital is Tallinn or Reval (q.v.), the principal port. Area, 18,000 sq. m.; pop. 1,250,000. The population consists of Esths, who constitute the peasantry, and are a race akin to the Finns, and of Esthlanders, a mixed people in which the German element strongly predominates; there are insignificant German, Swedish, and Russian minorities. German was the official language and the language of the educated classes prior to 1887, when Russian, displaced by Esthonian in 1918, became the official language. In spite of six centuries of subjection to German and Russian rule, the Esths have preserved their national characteristics almost unaltered—language, customs, clothing, dwelling, physical attributes. There are two principal dialects, Dorpat and Reval Esthonian. The people have a well-supported newspaper press, and their literature includes excellent national songs, closely resembling those of the *Kalevala.* See Neuss, *Esthnische Volkslieder* (Reval, 1850–52, and St Petersburg, 1854); *Kalewi Poëg,* edited by Kreutzwald (Dorpat, 1857); and Jannsen's *Estnische Märchen* (1881–88). In religion they are mostly Lutherans; superstitious beliefs are widely prevalent. Esthonia was conquered by Waldemar II. of Denmark in 1219; but in 1346 it was sold to the Teutonic Knights, and incorporated with Livonia. From 1561 it belonged to Sweden, until, seized by Peter the Great in 1710, it was definitively united to his dominions in 1721. In 1917, on the first outbreak of revolution in Russia, it virtually became a federal state in a Russian confederation. Overrun thereafter by Germans and by Russian Reds, and profoundly distrustful of the Whites, Esthonia nevertheless declared (1918) and vindicated her independence. A temporary coalition government under Konstantin Päts was established in 1917. The invaders were driven out. A Constituent Assembly met in 1919; a republic was formally proclaimed; the great estates were broken up; and in 1920 peace was made with Russia.

Esthwaite Water, a lake in the extreme north of Lancashire, 9½ miles W. by N. of Kendal, between Windermere, into which it drains, and Coniston Water; 217 feet above the level of the sea, it is about 1½ mile long by ½ mile wide, and has a maximum depth of 80 feet. It is associated with Wordsworth's schooldays at Hawkshead.

Estienne. See STEPHENS.

Estoile, or STAR, in Heraldry, is distinguished from the Mullet by having six waved points, while the latter consists of five plain points.

Estoppel, a conclusive admission, which cannot be denied or controverted by the party whom it affects. Coke says that it is so called 'because a man's own act or acceptance stoppeth or closeth up his mouth to allege or plead the truth.' Estoppels are usually divided into three kinds—(1) By matter of record, where any judgment has been given in a court of record, the parties to the suit are estopped from afterwards alleging such matters as would be contradictory to the record. Where the judgment is wrongfully signed, the remedy is to apply to the court to set it aside. (2) By matter in writing. Thus, a party who has executed a deed will be precluded from afterwards denying, in any action brought upon that instrument, the fact of which it is evidence. (3) By matter in *pays,* as by acceptance of an estate, where, e.g., a tenant cannot dispute his landlord's title, or, a licensee of a patent is estopped from denying the patentee's right to the patent. Besides these, some other modern rules are referred to the doctrine of estoppel. Where a man's misrepresentation or negligence induces in another a belief in the existence of a certain state of facts, and action is taken upon that belief, the person guilty of misrepresentation or negligence is estopped or barred from denying the existence of that state of facts. Thus, the acceptor of a bill of exchange is barred from denying the handwriting of the drawer; and, where a person draws a cheque in so careless a way that the amount may be easily changed, he is estopped by his own negligence from suing his banker for paying any so increased amount. There is, further, equitable estoppel, or estoppel by acquiescence, where a person, by tacitly representing his own position to be more favourable to another than it is, has induced that other to act on the belief that the representation is true. The doctrine of estoppel prevails in America as well as in England. In Scotland, also, the same principle is recognised, under the name of Personal Excep-

tion (q.v.). See Bigelow's treatise; Everest and Strode; and the article in vol. xiii. of Lord Halsbury's *Laws of England*.

Esto'ver, the right which a tenant has to take a reasonable portion of the wood on an estate for certain definite purposes. Estovers, or *botes* (Saxon), are of three kinds—housebote, which is twofold—viz. *estoverium ædificandi et ardendi*, a right to wood for fuel and repairs of the house; ploughbote, *estoverium arandi*, wood for repairing instruments of husbandry; and haybote, *estoverium claudendi*, wood for repairing hedges and fences.

Estrays. See POUND.

Estreat (Lat. *extractum*), in English law, a true extract copy or note of some original writing or record, and specially of fines or amercements, as entered in the rolls of a court, to be levied by bailiffs or other officers. When, however, it is applied to a Recognisance (q.v.), it signifies that the recognisance itself is estreated for execution. If the condition of a recognisance be broken, the recognisance is forfeited; and on its being estreated the parties become debtors to the crown for the sums in which they are bound.

Estrées, GABRIELLE D', mistress of Henry IV. of France, was born about 1571. She had already parted with her virtue before she became acquainted with Henry, in 1590. For the sake of appearances, she was married to a gentleman of Picardy, named Liancourt, from whom, however, she soon separated. The king was so fond of her that, in spite of the opposition of Sully, he was about to divorce his consort, Marguerite de Valois, in order to marry Mme. de Liancourt, when the latter died suddenly at Paris on 10th April 1599.

Estremadu'ra, a district of Spain, lying between Portugal and New Castile, and watered by the Tagus and the Guadiana. It is bounded on the N. by Leon, on the S. by Andalusia, and since 1833 has been divided into the two provinces of Badajoz (q.v.) and Cáceres (q.v.). Area, 16,700 sq. m.; population, 1,000,000. Like the New Castilians, the inhabitants present a mixture of Moz-arabic and Spanish blood, but are still graver and more taciturn than the former. The lower classes are rough and uncivilised, but honest and hospitable, modest, good-tempered, and brave.

Estremadura, a coast-province of Portugal, south of Beira, with an area of 6900 sq. m., divided into nearly equal portions by the river Tagus. The northern section is mountainous, with bare but picturesque continuations of the Castilian ranges; south of the river and along parts of the coast the country is hilly and better wooded. Many districts are extremely fertile, others utterly barren; scarcely half the province is under cultivation, but in the most favoured localities all the vegetation of middle and southern Europe flourishes. The silk-culture has greatly increased of late years; manufactures are confined to Lisbon, and this city, with Setubal, monopolises also nearly all the trade. Sea-salt, soda, and fruits are the chief exports. The other principal products of the country are wine, oil, corn, and cork; but even the sandy plains are covered with cistus, rosemary, myrtles, and other flowering and fragrant plants. It has now been divided into the administrative districts of Lisbon, Leiria, and Santarem. Pop. 1,550,000.

Estremoz, a town of Portugal in the province of Alemtejo, 23 miles NE. of Evora. It is built round the base of a hill which is crowned by a once formidable castle, erected in 1360. Estremoz is famous for its jars of red porous earthenware for keeping water cool. Pop. 8000.

Eszek. See ESSEK.

Etah, an Eskimo settlement on the north-west coast of Greenland, Prudhoe Land, on Smith Sound.

Etah, a town and district of British India, in the Agra division of the United Provinces. Pop. of town, 9000. The district (area, 1737 sq. m.; pop. 900,000) consists principally of an alluvial plateau, dipping down on the east to the valley of the Ganges. There is a considerable export trade, and indigo and cotton-pressing factories. The district, which came to Britain in 1801, was early the seat of a primitive Aryan civilisation; during the mutiny of 1857 it was the scene of serious disturbances.

Étampes, a town in the French department of Seine-et-Oise, 35 miles SSW. of Paris by rail. An ancient place, with a street 4 miles long, it has a fragment of a royal castle, the 'Tour de Guinette' (*circa* 1160), three interesting churches, a statue of the naturalist Geoffroy Saint-Hilaire, a mediæval hôtel-de-ville, large flour-mills, market-gardens, &c. Pop. 10,000.

Étang (Lat. *stagnum*) is the name given (*Étangs salés*) to large lagoons along the French coast, frequently salt, and generally communicating with the sea by channels. See BERRE.

Étaples, a small French port and watering-place in Pas-de-Calais, 15 miles S. of Boulogne. Peace with England was made there in 1492.

Eta'wah, a town of the Doab, picturesquely situated among the ravines near the left bank of the Jumna, about 70 miles SE. of Agra, is on the East Indian Railway, and at the junction of the Agra-Mainpuri and Gwalior-Farukhabad roads. Half-hidden among trees, the town contains some handsome streets, and carries on a considerable trade. A native cloth, horn combs, and sweetmeats are manufactured. Close by are some famous Hindu places of worship, and the *ghats*, or flights of stairs leading to the river for the purpose of ritual ablution, are lined with handsome shrines. The population is about 45,000.—The district of Etawah, lying entirely in the Gangetic plain, and almost exclusively within the Doab, has an area of 1700 sq. m., and a population of some 760,000, nearly all Hindus.

Etching. See ENGRAVING.

Etchmiadzin. See ECHMIADZIN.

Eternal Punishment. See HELL, CONDITIONAL IMMORTALITY, UNIVERSALISM.

Ethane, $CH_3 \cdot CH_3$, a gaseous compound of carbon and hydrogen, colourless, odourless, and burning with a pale flame. Nearly insoluble in water, it is considerably more soluble in alcohol. A mixture of ethane and air is highly explosive.

Ethelbert, king of Kent, and third in direct descent from Hengist, was born in 552, and succeeded to the throne about the ninth year of his age In a contest with Ceawlin, king of Wessex, in 568, he was defeated at Wibbandune, now Wimbledon, in Surrey. About the year 590, however, the hegemony of Kent over England south of the Humber was established. The most important events of his reign were his own conversion to Christianity, and the formal introduction of that religion into his kingdom, by St Augustine in 597. Ethelbert was also the author of the first written English laws, the collection called *Dooms* by Bede, 'which he established with the consent of his Witan in the days of St Augustine.' Ethelbert died in 616.

Etheldreda, ST (properly ÆTHELTHRYTH), daughter of a king of East Anglia, was born about 630. Her second husband was Oswy, king of Northumbria. To escape, however, from the married state she withdrew first to the monastery founded by her aunt, Ebba, on St Abb's Head, and then to the Isle

of Ely (q.v.), where, in 673, she herself founded a monastic house. She died on 23d June 679, and was canonised, her festival falling on 17th October, the day of the translation of her body to its shrine in 695. Her name was popularly abbreviated or corrupted into St Audrey; and at a fair in the Isle of Ely, a common kind of lace was sold, which came to be known as St Audrey's lace. Hence *tawdry*, applied to any kind of frippery.

Ethelred I., elder brother and predecessor of Alfred the Great, was king of Wessex and Kent from 866 till his death on 23d April 871, shortly after his great victory over the Danes at Æscesdune or Ashdown, a victory supposed to be commemorated by the White Horse (q.v.).—ETHELRED II., the 'Unready,' was only seven at the death of his father, King Edgar, and ten when in 978 the murder of his half-brother, Edward the Martyr, placed him on the English throne, and brought about Dunstan's fall. From boyhood he was swayed by unworthy and traitorous favourites, and his reign, 'the worst,' says Freeman, 'and most shameful in our annals,' was a series of raids and invasions by the Northmen, and endeavours to buy them off with ever-increasing bribes. Still, 'Unready,' his nickname, stands for 'redeless,' deficient in counsel; of misplaced energy he had more than enough. This showed itself in his treacherous massacre of the Danish settlers on St Brice's Day (13th November), 1002, a crime that was punished by fierce invasions, until in 1014 he was forced to take refuge in Normandy. In 1002 he had married Duke Richard's daughter, Emma; the marriage was fraught with important consequences, as the earliest link between England and Normandy. Sweyn's death soon allowed his recall, but on 23d April 1016 he himself died in London. He was succeeded by Edmund Ironside, third of seven sons by a first marriage; by Emma he was the father of Edward the Confessor.

Ether, or ÆTHER. Many physical phenomena are supposed to be due to the propagation of a state of stress or motion through a medium filling all space. Such a medium is called an ether. The theory of propagation through an ether is the exact opposite of the theory of direct action at a distance. Newton said that it was inconceivable to him that any one who was capable of thinking correctly in such matters could admit that direct action at a distance was possible. He suggested that Gravitation (q.v.) might be due to diminution of pressure in a fluid filling space in the neighbourhood of material bodies. Lord Kelvin demonstrated that this diminution of pressure would be accounted for if we suppose that each particle of matter is a source at which an incompressible fluid is being constantly created at a rate proportional to the mass of the particle, the fluid being also constantly annihilated at an infinite distance. Or, conversely, we might suppose that the fluid is created at infinity, and absorbed and annihilated at each particle, at a rate proportional to its mass. In either case the motion of the fluid would be greatest in the neighbourhood of material bodies; but it is a known fact in hydrodynamics that, in a fluid, the pressure is least where the speed of motion is greatest. Thus the state of stress assumed by Newton would be accounted for.

Light and the so-called radiant heat are supposed to consist in waves of transverse vibrations which are propagated through the ether. Indeed, the phenomena of interference (see LIGHT) cannot be explained in any other way. Similarly, electric and magnetic effects are supposed to be due to the propagation of some state of stress through an ether. But it would be utterly unscientific to fill space over and over again with a new medium for every special phenomenon which has to be explained in this way, and it seems probable that one medium can explain all. Maxwell assumed the existence of, and investigated the state of stress in, a medium through which electromagnetic action is propagated. The equations which he obtained are identical in form with those of wave motion in an elastic solid, and the rate of propagation of an undulation is, in his theory, numerically equal to the ratio of the electromagnetic and electrostatic units. This ratio is found by experiment to be numerically equal to the speed of propagation of light. Thus the medium which Maxwell assumed in order to explain electrodynamic phenomena is identical, in his electromagnetic theory of light, with the luminiferous medium; and the theory gives an explanation of reflection, refraction (single and double), and various other phenomena. Confirmation of the theory has been given by the experiments of Hertz and others, which prove the existence of these electro-magnetic undulations, and show that they have properties identical with those of light. See ELECTRICITY, and LIGHT.

In some respects the ether resembles an elastic solid; but in order to account for the immense rapidity of its vibrations when radiation passes through it, its rigidity must be excessively large compared with its density. It may be asked how, if this be so, the earth can move through the ether at the rate of nearly a million miles per day. But, as Stokes pointed out, if we consider that shoemaker's wax is so brittle that it splinters by a hammer, and that it yet flows slowly like a liquid into the crevices of a vessel in which it is placed, and that bullets sink slowly down through it, and corks float slowly up through it, the motion of the earth through the ether does not seem so incomprehensible. So it may be that the motion of planets through the ether is relatively much the same as that of a bullet moving with excessive slowness through the wax. From magneto-optic phenomena it seems certain that something of the nature of elementary rotation is going on in the ether. The elasticity above referred to must be of a rotational type.

There is no evidence of the existence of a condensational-rarefactional wave (as in the case of sound in air) in the ether. In the electro-magnetic theory it is got rid of from its velocity being infinite. In a theory of the ether advanced by Kelvin, in which it is supposed to have negative compressibility, and to be made stable by being infinite or having rigid boundaries, the speed of propagation of the condensational-rarefactional wave is zero. The question of a contractile ether had been previously considered by Green, but was dismissed by him with the statement (erroneous, as Kelvin proved) that it is essentially unstable. The theories of an ether of zero or positive compressibility lead to results which are inconsistent with experiment. On the other hand, Kelvin's theory leads to the known experimental results, as also does the electro-magnetic theory. Larmor has developed a theory (in which the elasticity is of a rotational type) which brings the electro-magnetic theory into line with recent knowledge regarding electricity and matter. In the theory of relativity the action of the ether is avoided. See RELATIVITY.

Ether is prepared from alcohol by the action of sulphuric acid. Alcohol is placed in a retort or still, and about an equal volume of sulphuric acid is added. Heat is at once developed by the mixing of the liquids, and on raising the temperature ether vapour passes over along with a proportion of alcohol. At the same time a stream of alcohol is allowed to pass into the still, and the heat is so regulated that a constant

temperature of about 266° (130° C.) is maintained. When five volumes of alcohol in all have been added, the temperature is allowed to rise to 286° (141° C.), at which point impurities commence to pass over. The ether so obtained contains alcohol, sulphurous acid, and water, and these may be removed by treatment with solution of chloride of calcium, &c., and subsequent redistillation.

The chemical reactions which take place in this process are of great interest, and may be divided into two stages. (1) The sulphuric acid acts on alcohol, forming ethyl-sulphuric acid and water.

Sulphuric Acid. Alcohol. Ethyl-sulphuric Acid. Water.

$$H_2SO_4 + C_2H_5OH = C_2H_5HSO_4 + H_2O.$$

(2) This acid again is acted on by alcohol, with the re-formation of sulphuric acid and the production of ether.

Ethyl-sulphuric Acid. Alcohol. Ether. Sulphuric Acid.

$$C_2H_5HSO_4 + C_2H_5OH = (C_2H_5)_2O + H_2SO_4.$$

From this it will be plain that the sulphuric acid is restored again, and is ready to attack alcohol anew, so as to form more ether. This process would go on indefinitely, were it not that the water liberated in the first reaction dilutes the sulphuric acid, and ultimately renders it too weak for further action.

Ether is a colourless, transparent, volatile liquid of great mobility and high refractive power, and possessing a fragrant odour and a fiery, passing to a cooling, taste. It has a specific gravity of ·720 at 60° (15·5° C.), and boils at 96° (35·6° C.), forming a vapour more than two and a half times as dense as air. When reduced to a temperature of −200° F. (−129° C.) ether freezes. It volatilises spontaneously when placed in an unconfined position, as in the palm of the hand, and vaporises so quickly as to produce intense cold. Indeed, when water is covered with ether, and the latter assisted in its evaporation by being blown upon, it escapes so readily as to reduce the temperature of the water to the freezing-point. It is very inflammable, burning with a yellow-white flame; and mixed with air or oxygen, it gives rise to a dangerous explosive mixture, and hence great care requires to be taken in its distillation to keep all lights and fires out of the room where the vapours are condensing. When ether is added to its own bulk of water, briskly agitated, and allowed to settle, the two liquids appear to separate again; but it is found that the ether has taken up one-eighth of its volume of the water, whilst the latter has dissolved the same quantity of ether. It is readily miscible with alcohol in all proportions. Ether is one of the best solvents for the oils and fats, and hence is employed in analysis for the solution and separation of the oils from other organic matters, as in the analysis of oil-cakes, &c. It is also a good solvent of iodine, sulphur, phosphorus, and of strychnine and other alkaloids, as well as of corrosive sublimate and other salts.

Ether enters into combination with many acids, forming compound ethers possessing great fragrancy, such as

Acetic Ether	$C_2H_5C_2H_3O_2$.	
Butyric Ether	$C_2H_5C_4H_7O_2$,	Pine-apple Oil.
Pelargonic Ether	$C_2H_5C_9H_{17}O_2$,	Essence of Quinces.

Œnanthic ether, on which the flavour and smell of wines, brandy, &c. so much depend, has been proved to be a mixture of various ethyl ethers, chiefly ethyl caprate.

Ether is useful in the preparation of freezing mixtures, the mixture of ether and solid carbonic acid giving rise to a very low temperature indeed. When inhaled by man and the lower animals, ether first produces stimulating and intoxicating effects (it is sometimes used as an intoxicating beverage), but afterwards it gives rise to drowsiness, accompanied by complete insensibility; and, indeed, for some time it was the only agent used for producing Anæsthesia (q.v.) in operations, but it has been in great measure superseded by chloroform.

Etherege, or ETHEREDGE, SIR GEORGE, one of the Restoration dramatists, was born most probably in London about 1636. Little is known of his life. He must have spent much of his youth at Paris, studied law, was 'gentle George' and 'easy Etheredge' in the circle of Sir Charles Sedley and the Earl of Rochester, the most brilliant young reprobates of their time, was on the ambassador's staff at Constantinople from 1668 to 1670 or 1671, had an intrigue with the famous actress, Mrs Barry, afterwards settling £6000 on her daughter, was knighted and married, not with his entire good-will, to a wealthy widow, and in 1686 was sent to be Resident at the Imperial court at Ratisbon. This banishment he found intolerably tedious, but he contrived to vary its monotony with coursing, moderate drinking, sometimes immoderate play, and flirtation with passing actresses, as well as with correspondence with Middleton, Dryden, Betterton, and others. Fortunately, drafts of some hundred of his letters (many of these official), along with poems and other papers, have been preserved in a letter-book acquired by the British Museum in 1837, and help to reveal to us a man of whom our knowledge otherwise would have been singularly scanty. It is not true that Etheredge broke his neck at Ratisbon in 1689, by falling down-stairs after a banquet; he seems to have died in Paris, most likely about the close of 1690. In English literature Etheredge holds a place securely as the founder of the comedy of intrigue, which reached its perfection in the masterpieces of Congreve and Wycherley. He himself had found his inspiration in Molière, and out of him grew that great master of comedy's English counterpart, the legitimate comedy of manners, and the dramatic triumphs of Sheridan and Goldsmith. Etheredge was more important in the impulse he gave the drama than in the magnitude of his own performance. His habitual indolence hindered him from producing more than three plays, *The Comical Revenge; or Love in a Tub*, the earliest play of which any large part was written in rhymed heroics (1664); *She Would if She Could* (1668); and *The Man of Mode; or Sir Fopling Flutter* (1676). These were all highly popular in their day, and we have no better helps to an understanding of the time. The figures we meet are real creations, instinct with life, and some, as Dorimant and Sir Fopling Flutter, have gone into literature as concrete types of the qualities they were meant to represent. See the complete works, ed. A. Wilson Verity (1888); Meindl's study (Vienna, 1901); Gosse's *Seventeenth-century Studies* (1883); Allardyce Nicoll's *Restoration Drama* (1923); Bonamy Dobrée's *Essays in Biography* (1925).

Ethics may be briefly defined as the theory of goodness. The term is derived from the Greek word *ēthos*, which means disposition or character as well as manners or usage. The same signification belongs to the Latin word *mores*, from which Cicero formed the adjective *moralis* to translate the Greek adjective *ēthikos*. Thus in English *ethical* and *moral* are almost synonymous, although the latter term is commonly used with a less technical reference than the former. Nearly always they refer to the character or conduct of men or groups of men. But the term 'ethical' is not properly applied to every kind of inquiry into character and conduct. These are facts in the life of the individual mind and in the social order; and so long as the facts are merely described, or as their causes and effects merely are investigated,

the inquiry belongs to the science of mind—i.e. to psychology, or to the science of society, i.e. to sociology. Ethics regards the facts from a different point of view, which may be called that of appreciation, and which is expressed in judgments of worth or of goodness. Psychological and sociological judgments are descriptive, historical, or causal; but the moral judgment is always one of approval or disapproval. Thus various questions which are usually discussed in ethical treatises (such as the relation of pleasure to desire, the nature of volitional freedom, the formation of virtuous habits, the connection of moral ideas and practice with social customs and institutions) really belong to psychology or to sociology, although they may be of importance as prolegomena or as supplement to ethical study. Every ethical proposition, strictly so-called, has for its predicate the concept 'good' (or its opposite) or some other concept (right, duteous, virtuous, worthy) which involves the same meaning.

Sometimes one of these concepts and sometimes another has been regarded as the fundamental expression of the moral consciousness. Plato and Aristotle, most idealist writers, and also in general the utilitarians, have taken good as the ethical concept. To the Stoics, to Kant, and to most intuitional writers, duty or moral law was fundamental. J. F. Herbart (*Allgemeine praktische Philosophie*, 1808) laid stress on the concept of value or worth; and his suggestions have led to the value-theory of ethics worked out by A. Meinong (*Psychologish-ethische Untersuchungen zur Werttheorie*, 1894), C. v. Ehrenfels (*System der Werttheorie*, 1897–98), and many contemporary writers (cf. H. Münsterberg, *The Eternal Values*, 1909; W. M. Urban, *Valuation: its Nature and Laws*, 1909). These differences of treatment may affect the whole scope of an ethical system, and the mutual relation of such concepts as good, duty, worth, calls for investigation in ethical inquiry. But, whichever concept be taken as fundamental, it is clear that ethics involves a point of view or concept which is *sui generis* and foreign to the positive sciences. And there does not appear to be sufficient reason for discarding the traditional term 'good' for designating this concept.

The central problem of ethics is to determine the grounds or conditions of the valid use of this concept 'good,' and, if possible, to arrive at a reasoned synthesis of the things, or kind of life, to which goodness intrinsically belongs. Were this synthesis arrived at, the traditional problem of the *summum bonum* or chief good would be solved. Differences on this point mark the leading divergence between schools of ethical thought. But it was remarked by Aristotle, at a time when ethical terminology was less complex than it is now, that, in spite of their different views as to the nature of this good, all men are agreed as to its name: calling it *eudaimonia*—a term equivalent to 'well-being,' but unfortunately rendered, according to the universal tradition of translators, by the English word *happiness*. In modern ethical discussions the word happiness (or its equivalent in other languages) signifies a maximum of pleasures, or an experience in which the pleasures greatly exceed the pains. In this sense of the word, however, the assertion that the good is happiness would have been denied by Aristotle, as well as by Plato. While arguing that the good for man must be something obtainable by man, Aristotle did not find the end in pleasure, but rather in the perfect development of a man's self, in an activity according to moral and intellectual excellence. But the doctrine that pleasure is the highest good was held by predecessors and contemporaries of Aristotle, and was afterwards formulated by Epicurus into an ethical theory.

This view that pleasure or happiness is the chief good has been held in two very different forms. According to the one view, good is relative to the individual: for each man it is his own happiness or pleasure; according to the other view, it is the happiness or pleasure, wherever found, of the community, or of mankind, or even of sentient creatures generally. The former was the doctrine of Epicurus, and has been called Egoistic Hedonism. The latter view—called Universalistic Hedonism or Utilitarianism—owes its development to modern and especially to English writers. A principle similar to that of modern utilitarianism was laid down very early in the history of English ethics. Thus, it has been pointed out that Richard Cumberland, in his treatise *De legibus Naturæ* (1672), put forward the 'common good of all' as the supreme end to which all rules of conduct are subordinate, though, according to him, this good includes perfection as well as happiness. In a similar way, Shaftesbury (*Inquiry concerning Virtue and Merit*, accurately published for the first time in his *Characteristics*, 1711), Joseph Butler (in his *Sermons*, 1726), and Francis Hutcheson (*System of Moral Philosophy*, 1755) speak of the 'good of society' as equivalent to virtue. In an earlier work (*Inquiry into the Original of our Ideas of Beauty and Virtue*, 1725) Hutcheson had even anticipated the utilitarian formula, afterwards made famous by Bentham, by setting up 'the greatest happiness for the greatest numbers' as the standard for goodness in conduct. But this attempt at a quantitative utilitarianism was forgotten; and the next important step was taken by David Hume (*Treatise of Human Nature*, 1739; *Inquiry into the Principles of Morals*, 1751). He defined virtue as a quality approved by the spectator, and vice as a quality blamed or censured by the spectator, and endeavoured to show, by a review of the virtues, that the qualities approved are either immediately agreeable or useful (i.e. indirectly agreeable) to ourselves or to others. In this way, utility is made the ground of the distinction between virtue and vice. The *Moral Philosophy* of Paley (1785) contributed largely to define and render applicable to practice the utilitarian criterion of morality; though, in his system, the utilitarian principle is based upon an 'other-worldly' selfishness. Subsequently, utilitarianism was defended and applied to morals, politics, and law by Jeremy Bentham (1748–1832), who was surrounded by an energetic school of writers, including Ricardo, James Mill, J. S. Mill, Austin, and George Grote. J. S. Mill's remarkable essay on *Utilitarianism* (1861) is chiefly occupied with defending the theory against the popular objections to it, which had been increased rather than obviated by Bentham's uncompromising polemics. He especially contended against the representation of utilitarianism as a selfish and a sensual theory. It is not selfish (he argued), for it requires that a man should be impartial in deciding between his own interests and those of others. It is not sensual, for man possesses faculties of a kind which sensual pleasures cannot satisfy. The being of lower faculties may have more contentment, because without the desire for anything further, but has not more pleasure or happiness. In defending this position Mill did not rely merely on the greater permanence, purity, and fruitfulness of the intellectual and social pleasures as compared with the pleasures of sense. He asserted that pleasures differ from one another in kind as well as in degree or intensity, and that the pleasure of higher quality or kind is to be preferred to one of lower quality, even although the intensity of the latter be greater than that of the former. It must be admitted, however, that this distinction is inconsistent with the hedonistic basis of utilitarian ethics, seeing that it makes not the pleasure itself, but that

which distinguishes one pleasure from another, the real ground of moral preference.

Owing to the definiteness of its principle, and the facility (within a certain range) with which it can be applied, the utilitarian maxim led, in the hands of Bentham and his school, to fruitful application to political and legal questions. The proof, or philosophical basis, of the theory presents greater difficulty. Although pleasure is an object of desire, it does not follow that this object is good and the only good; still less does the consequence hold that, because each man seeks his own pleasure, the general happiness ought to be his end. The gulf between egoistic hedonism and utilitarianism requires to be bridged over. The transition from one position to the other has frequently been made by the help of religious or of political considerations. Thus the utilitarianism of Paley was founded on the belief that the happiness of mankind was the ethical end prescribed by God; that of Bentham resulted from looking at action from the point of view of the community and its interests rather than from that of the interests of the individual. In this connection, consideration is given to the sanctions of morality, or pains following the breach of moral law. These sanctions are enumerated as religious, political, social, and internal. The religious sanction is that relied on by Paley. Bentham and Mill laid greater stress on the others. But it is admitted that the political sanction does not exact from an individual beneficence, or active regard to his neighbour's happiness, but only probity, or non-interference with that happiness. The social sanctions, again, are incomplete and variable, and have no exact correspondence with the utilitarian principle; while the internal sanctions depend on the individual conscience, which utilitarian writers commonly hold to be a growth in the individual mind, due to and imitating the social sanctions. The unsatisfactoriness of the proof of utilitarianism is recognised in the chief modern exposition of the theory—that in Sidgwick's *Methods of Ethics* (1874, 6th ed. 1901). The utilitarian theory of the moral end or standard is there associated with an intuitive theory of knowledge not usually held by utilitarians: the justification of the theory is based on the axioms of justice and benevolence, which the exhaustive examination of intuitive ethics carried out in the same work has left standing as formal axioms of the practical reason. Owing to the influence of the doctrine of evolution as applied to mind and society, a still more radical transformation has been effected in the utilitarian theory (Spencer's *Data of Ethics*, 1879—part i. of *Principles of Ethics*, 1892–93). Applied only to the method of utilitarianism in Spencer's hands, the evolution-theory has been used by other writers to show the inadequacy of the utilitarian principle. Attempts have also been made, on the basis of the theory of evolution, to establish some such ethical criterion as that of social vitality, or social equilibrium (L. Stephen, *Science of Ethics*, 1882; S. Alexander, *Moral Order and Progress*), but always without either avoiding or justifying the assumption that evolution is good or leads to the good. The inability of the theory of evolution to serve as the ground of an ethical theory was trenchantly maintained by Huxley (*Evolution and Ethics*, 1893; cf. Sorley, *Ethics of Naturalism*, new ed. 1904).

Utilitarianism is a morality of consequences: finding the criterion of goodness in the kind of feeling which actions tend to produce in sentient beings. As this pleasant or painful feeling can only be ascertained by experience, the theory is nearly always associated with an empirical theory of the origin of our knowledge of goodness. The controversies, especially of English ethics, have been largely occupied with the debate on this question between the Empirical and Intuitive schools of ethics. The latter school lays stress on the immediateness and universality of the moral judgments passed by each man's conscience. A doctrine of the moral sense, as a feeling, or perception, by which actions or motives were morally distinguished apart from their consequences, was developed by Shaftesbury and Hutcheson; and Butler formulated the doctrine that conscience is the supreme authority as to what is right or wrong. It is true that in Butler's *Sermons* Self-love, or a calm regard to one's interests on the whole, is frequently spoken of as co-ordinate with, and indeed, in one place, as superior to conscience. But this is inconsistent with Butler's explicit statements even in that work, and the view does not reappear in the *Dissertation on Virtue* appended to the *Analogy* (1736). In the latter work, also, the virtuous action which conscience prescribes is no longer asserted to be conterminous with action aiming at the good or happiness of society. In this way Butler's severance from utilitarianism is complete, and he may be fitly regarded as the head of the modern intuitive school. Of this school Martineau (*Types of Ethical Theory*, 1885) was a prominent representative; differing, however, from the majority of the school in holding that moral quality belongs primarily to motives, not to action. The weakness of the intuitive position, as stated by Butler and many of his successors, lies in the fact that the source of ethical principles, conscience, is not brought into intelligible relation with the rational or spiritual nature of man. Hence the force of the objection urged against Butler—that he moves in a circle, defining the right as what conscience approves, and conscience as what approves the right. The doctrine of conscience holds an insecure position in his system, because it stands by itself unrelated to reason. On this account, the position has been peculiarly liable to be undermined by empirical analyses, such as Bain's attempt (*The Emotions and the Will*, 1859; *Mental and Moral Science*, 1868) to trace the growth of conscience in the individual from fear and love with a perception of utility added, or the more elaborate efforts of evolutionist writers, by whom it is represented as the result of countless experiences of the effects of action transmitted from individual to individual, until, in the form of a moral sense or conscience, they have become part of the common mental inheritance of the race. A further difficulty connected with the view of conscience held by Intuitionists is the mutual relation of the kinds of actions it approves, or of the laws for action laid down by it. Justice, veracity, beneficence, &c. are said to be its laws; but the attempt is seldom made to show how these are connected with one another.

These obvious difficulties meet at least with an attempted solution in the ethical system of Kant (*Groundwork of the Metaphysic of Morals*, 1785; *Critique of Practical Reason*, 1788). For Kant, conscience is simply practical reason; and its laws are reduced to unity. Reason, although limited in its knowledge of objects to the phenomena of sense, is yet in the practical sphere capable of laying down absolute or unconditional laws. This is shown by the moral law, with its categorical 'thou shalt,' prescribing a principle of conduct irrespective of desire or any ulterior end. Only the action which proceeds from a good will (that is, a will in accordance with moral law) is completely good. External conformity to the law gives legality; morality requires that the law, or respect for it, should be the moving principle of action. This, according to Kant, may prove to us that the will is free; in Schiller's phrase, 'thou shalt' implies 'thou

canst.' Thus, in the order of our knowledge, it is the moral law that convinces us of freedom. But in reality the moral law is simply the law of the will itself, and the will is free when acting under its own law; it is under constraint only when influenced by the sensuous nature with which it is connected in man. The 'categorical imperative' of the moral law is expressed by Kant in the phrase, 'Act according to that maxim (or subjective principle) alone which thou canst at the same time will to be a universal law.' Reason is one in all men, and action to be rational must thus admit of being universalised. In this way reason gives a form for action. It also gives its end; for reason is an end in itself, and humanity, as rational, must therefore always be treated as an end, never as a mere means. Kant's ethical principle remains, however, a formal principle, not admitting of the connection he sought to give it with the content of practical life. This formality or emptiness is due to his purely formal conception of reason itself. To get rid of this formality has been the effort of the later ethical systems which have been most influenced by Kant. They base morality, as he did, on the reason or spiritual principle; but, with a less restricted view of this principle, they seek its content and realisation in practical life and its institutions. This position, largely due to Hegel, has been worked out independently in one of the most important English works of speculative ethics —T. H. Green's *Prolegomena to Ethics* (1883). 'The ultimate standard of worth is,' according to Green, 'an ideal of personal worth,' while, at the same time, 'it is equally true that the human spirit can only realise itself, or fulfil its idea, in persons, and that it can only do this through society, since society is the condition of the development of a personality.' According to this view morality is the gradual realisation of a spiritual principle in human character and in the forms and institutions of domestic, civic, and political life. In this way it is contrasted with the evolutionist or naturalistic systems of ethics which lay stress on natural causation as adequate for the explanation of the whole process, and which give the name morality to those habits of acting which have contributed to the preservation and development of the race. Both views are represented in contemporary ethics; and the latter or naturalistic view shows the influence of the positivism of A. Comte as well as of the theory of evolution (cf. G. Simmel, *System der Moral-Wissenschaft*, 1893). A doctrine fundamentally in harmony with intuitionism, but different from older intuitive theories in many respects, and greatly superior in the precision of thought displayed, has been put forward by G. E. Moore, *Principia Ethica* (1903).

Some of the more important ethical writings, of different schools, have been already mentioned. The best introduction to the history of the subject is Sidgwick's *Outlines of the History of Ethics for English Readers* (1886). Among text-books of ethics the following may be mentioned: J. H. Muirhead, *Elements of Ethics;* J. S. Mackenzie, *Manual of Ethics;* J. Seth, *Study of Ethical Principles;* J. Dewey and J. H. Tufts, *Ethics* (1909). See articles on the great ethical thinkers, ARISTOTLE, EPICURUS, STOICS, BUTLER, KANT, &c.; also EVOLUTION.

Ethiopia, the biblical *Kush*. Originally, all the nations inhabiting the southern part of the globe, as known to the ancients, or rather all men of dark-brown or black colour, were called Ethiopians (assumed by the Greeks to be from the two Greek words *aithō—ōps*, and to mean 'sun-burned;' but it may be possibly a form of an unknown Egyptian word). Later, this name was given more particularly to the inhabitants of the countries south of Libya and Egypt, on the Upper Nile, extending from 10° to 25° N. lat., 28° to 40° E. long—the present Nubia, Sennaar, Kordofan, Abyssinia. The accounts which the ancients have left us of this people are, even where they are not entirely fabulous, extremely scanty and untrustworthy; for though the Romans may, the Greeks almost certainly never got beyond Napata, 19° N. lat. From the Homeric age down to Ptolemy these regions were understood to be peopled by Pygmies, Troglodytes ('dwellers in caverns'), Blemmyes ('hideous men'), Macrobii ('long-lived men'), &c., besides being divided into the lands of cinnamon, myrrh, of elephant-eaters, fish-eaters, tortoise-eaters, serpent-eaters, &c. Homer frequently refers to the 'blameless Ethiopians.' The only portion of ancient records which does contain something akin to historical accounts is that which refers to Meroë, an island formed by the rivers Astaphus and Astaboras, tributaries of the Nile. There stood, from time immemorial, an oracle of Ammon. This and the central position of the island, together with the extraordinary fertility of its soil, the abundance of animals, metals, &c., made it not only the chief place of resort for all the inhabitants of the adjacent parts, especially the numerous nomad tribes, but also the emporium for India, Arabia, Ethiopia, Egypt, Libya, and Carthage. Thus it grew so rapidly that about 1000 B.C. it counted among the most powerful states of the ancient world; it not merely shook off the Egyptian yoke, but conquered Egypt, gave, under Sabako, an Ethiopian dynasty to Egypt (715), and checked the Assyrian power under Sennacherib in Palestine (701). During the reign of Psammetichus, 240,000 Egyptian artisans and traders settled in Meroë, which grew in wealth and prosperity. Many new cities were built, and the state was in the most flourishing condition when it was conquered by Cambyses about 530 B.C. Shortly thereafter Napata, situated on the Nile at the foot of Jebel Barkal, 'the sacred mountain,' was displaced by the town of Meroë from its former position as the capital of Ethiopia. After the destruction of Thebes by Cambyses, most of the inhabitants of that city took refuge in Meroë, and made the country still more Egyptian. Ergamenes transformed its theocracy into a military monarchy in the 3d century. Under Augustus, Meroë was conquered, and a Queen Candace is mentioned as his vassal. Under Nero nothing but ruins marked the place of this once powerful and highly civilised state, and it was left to modern excavators to reveal what had once been the character of this early civilisation (see MEROË).

According to the scanty native chronicles, the son of Solomon and the Queen of Sheba (Makeda as they, Balkis as the Arabian historians call her), named Menilehek, was the first king of the Ethiopians. Few kings' names occur up to the time of Christ, when Bazen occupied the throne. The missionary Frumentius (330) found two brothers (Christians) reigning—Abreha and Azbeha. During the time of the Greek emperor Justin (522), King Elezbaas destroyed the state of the Homerites in Asia, in order to revenge their persecutions of Christians, and was canonised. From 960 to 1300 another dynasty, the Zagœan, held the chief power, all the members of the Solomonic dynasty, save one, having been murdered by Esal, who made her son king. In 1300 Ikon-Amlak, a descendant of this one scion of the house of David, regained possession of the throne. The later history of the country is given under ABYSSINIA. See also EGYPT, ASSYRIA.

Emigrants from the other side of the Arabian isthmus, as were, beyond doubt, the earliest settlers in Ethiopia, it is but natural that the structure

of their language, as well as that of their own bodies, should bear traces of their Semitic origin. Ge'ëz (*Lesāna Ge'ëz*), their oldest language, was suppressed by a royal decree of Ikon-Amlak in the 14th century, and Amharic adopted as the court language. Ever since, Ge'ëz has, except in the province of Tigré, where it is still spoken with slight idiomatic changes, remained the *Lesāna Mazhaf*, the language of books and of the church. It is exclusively used in writing, even of ordinary letters, and the educated alone understand it. Its general structure comes as close to that of Arabic as a sister-dialect can and must. A great many of its words are still classical Arabic; others resemble more Hebrew and Aramaic; others, again, belong to African dialects; and many, as the names of the months,

ኣስመ : ከመዝ : ኣፍቀሮ : ኣግዚኣ
ብሔር : ለዓለም : ኣስከ : ወልደ :
ቀሕደ : ወሀበ : ቢዛ : ከመ : ኵሉ :
ዘየኣምኒ : ቦቱ : ኢይትሐጕል : ኣላ :
ደረክብ : ሕይወተ : ዘለዓለም ::

The text John, iii. 16, in Ethiopic, as printed by the British and Foreign Bible Society.

are Greek. It has twenty-six letters, twenty-two of which bear the ancient Semitic stamp, and exhibit the greatest likeness to the Phœnician—the common original alphabet—though no doubt derived immediately from the Sabean or South Arabic alphabet (see ALPHABET). There are seven vowels, including a very short *e*, which sounds precisely like the Hebrew Shĕva, when open, and like *e* in 'men,' when shut. These vowels are represented by little hooks, and remain inseparably attached to their respective letters; and as Ge'ëz, unlike all its sister-languages, is never written without vowels, the alphabet becomes a syllabary with 182 characters. In addition to this, four consonants (*g*, *k*, and *h* sounds) interject a *u* sound before the principal vowel, *gua*, *guī*, *guē*, &c. Another difference exists in its being written from left to right—a circumstance from which some have concluded that the Greeks introduced writing in Ethiopia; forgetting, in the first place, that Greek itself was frequently written from right to left, and that Zend, certain cuneiforms, hieroglyphs, &c. are likewise written from left to right. As was to be expected among emigrants from South Arabia, the verbal system has most resemblances to the Arabic, although it differs from this, and agrees with Aramaic, in discarding the passive and using for it the reflexive; there is a double infinitive, only a passive participle and participial words formed by *m* prefixed; traces of a dual remain, though it is no more in use; the formation of the so-called broken plural, and of declension generally, a special accusative termination, the distinction of the subjunctive from the imperfect, and other peculiarities distinguish Ge'ëz from Northern Semitic, while the want of the article distinguishes it from Arabic; and in power to subordinate clauses by means of particles and form a concatenated sentence it is superior to all other Semitic dialects. There are no diacritical marks employed in writing; the letters are not combined, and the words are separated by two dots.

Although there may have been some literature in a flourishing country like Ethiopia anterior to Christ, still, owing both to frequent internal convulsions and other causes, no traces of it remain, even the few inscriptions that have been found being of the Christian age. The earliest existing document of post-Christian literature is a complete translation of the Bible, according to tradition by Frumentius, most probably by missionaries from the north, whose native language was Aramean (see FRUMENTIUS). The Old Testament, a translation from the Alexandrine version, or LXX., consists of four parts: (1) the Law or Octateuchos (five books of Moses, Joshua, Judges, Ruth); (2) Kings; (3) Solomon; (4) Prophets, and two books of the Maccabees. The New Testament consists of: (1) Gospels; (2) Acts; (3) Paulus; (4) Apostolus. The Book of Enoch belongs also to the literature of the Old Testament (see ENOCH), besides the Book of Jubilees, the Ascension of Isaiah, and some others. The New Testament comprises the Shepherd of Hermas, and likewise another book, Synodos, containing the pseudo-Clementine or Apostolical Constitutions, in two recensions, with the Apostolic Canons, the canons of various councils, and much other matter. The Ethiopians have a liturgy (*Kanon Kedāsē*—'Holy Canon'), and a symbolico-dogmatical work (*Haimanōta Abau*—'Belief of the Fathers'), containing portions of homilies of the Greek Fathers, Athanasius, Basil the Great, Chrysostom, Cyril, Gregory of Nyssa, and Gregory Nazianzen. Besides these they have martyrologies, called Seneksār (Synaxaria). They employ in this their sacred literature a peculiar kind of rhythm without a distinct metre. Any number of rhyming lines forms a stanza, without reference to the number of words constituting the verse, or of verses constituting the stanza. They also use certain phrases as a refrain. Ethiopic literature consists chiefly of translations, in earlier times from the Greek, and more recently from the Arabic. In the translations from Greek some interesting works have been preserved which had otherwise disappeared—e.g. the Book of Enoch. Among the translations from the Arabic are books of philosophy, medicine, jurisprudence, and history. The native literature consists chiefly of sacred poetry and chronicles, among the last the *Gloria Regum* (*Kebra Nagast*), a work in praise of Axum and the royal family of Ethiopia (*Chronicle of Axum*). They are very fond, however, of riddles, wise saws, and the like, so fascinating to the Eastern mind. They have native vocabularies, Ethiopic and Amharic, though not of great value to the modern lexicographer. No wonder the learned in Europe should have been sorely puzzled by such a language, and that they should, after long consideration, have pronounced it to be either 'Chaldee' or 'Indian,' while Bruce held it to be the language of Adam and Eve. Potken, a Cologne church-dignitary, happening to be at Rome at the beginning of the 16th century, there made the acquaintance of native Ethiopians, and became the first to enlighten the world on the nature of this occult language. After him came the Carmelite Jacob Marianus Victorius from Reate, who wrote *Institutiones Linguæ Chaldææ seu Æthiop.* (Rome, 1548), an entirely worthless book; then Wemmers, who in 1683 published an Ethiopian grammar and dictionary. The principal investigator, however, was Job Ludolf from Gotha, who, aided by the Abba Gregorius, and supported by his own extraordinary linguistic talents and indomitable energy, acquired such a power over this language that, notwithstanding the number of eminent Orientalists, such as Platt, Lawrence, Dorn, Hupfeld, Hoffmann, Roediger, Ewald, Isenberg, Blumenbach, Dillmann, &c., who have since worked in this field, his books still hold their own place. It is hardly necessary to add that Ethiopic is one of the most important and indispensable languages to the Semitic scholar.

Ancient Ge'ëz is now represented by various dialects: (1) by Tigrē, which has best preserved the features of the original language, spoken in the north-east of Abyssinia, and particularly by populations just outside the north border of the kingdom; (2) by Tigriña, or, more properly, Tigraï, spoken about Axum, the ancient seat of the kingdom, which, however, has suffered more from the influence of Amharic; (3) by Amharic, the state language since the end of 13th century, extending far to the south, which has drawn into itself a multitude of elements from the African languages, and developed many forms altogether alien to Semitic. For the Ethiopian region, geographically, see GEOGRAPHICAL DISTRIBUTION; for the Ethiopic group, ethnologically, see ETHNOLOGY.

For excavations see books by Crowfoot and Griffith (1912); also *Annals of Archæology* (1915), *Journal of Egyptian Archæology* (1915, 1916), *Museum of Fine Arts Bulletin* (1917, 1918), and *Sudan Notes and Records* (1920, &c.).

Ethiopianism, a movement for completer self-realisation, originating about the close of the 19th century, among the native races of South Africa. Chief manifestations have been the secularisation of education, and a claim for a larger share in its management; the establishment, largely as the result of the influence of intercourse with the negro churches of the United States, of native churches independent of external control—e.g. the Ethiopian Church of South Africa; the rise of a Native National Congress demanding various reforms, the removal of the colour bar in especial. In 1919 admission to British citizenship, not 'independence,' was sought by the native congress.

Ethmoid Bone, one of the eight bones which collectively form the cranial box, is of cubical form, and enters into the formation of the cranium, the orbits, and the nasal fossæ; see NOSE.

Ethnology embraces a comparative study of the various *races* of mankind, their origin, physical and mental differences, dispersion, geographical distribution and interminglings, leaving human speech to *philology*, human culture (political and social institutions, usages, traditions, folklore, religion) to *sociology*—i.e. the science of man as a *zōon politikon* (Aristotle).

It may be stated broadly that, after the first more or less marked differentiations, whether due to the outward influences of the environment, to natural selection, the struggle for existence, the correlation of parts, or all these combined, all subsequent modifications have been mainly caused by incessant intermingling, and consequently that there are no longer any pure races in existence. (One may perhaps except a few isolated groups, such as the Andamanese Islanders, the Kai Colos of Fiji, the Ainus of Yesso, the Fuegian Kahgans). Long isolation in new centres exposed to new conditions of life would undoubtedly tend to fix changes gradually brought about by natural causes. But, as the earth became more densely peopled, fresh shiftings necessarily arose, colonies were thrown off, contact and collision between the earliest evolved varieties became inevitable. To the influences of the surroundings were thus added the far more potent effects of crossings, and the development of fresh types and sub-varieties of all sorts proceeded at an accelerated rate. This process was necessarily continued down to the present time, resulting in ever-increasing confusion of fundamental elements, and blurring of primordial types.

To this confusion and blurring must be attributed the great difficulty now felt in determining the number and the distinctive characteristics of the original human stocks, and the amazing diversity of views that has always prevailed on this subject. It cannot even be asserted that what we call the main divisions, the primary groups, are themselves original even in their ideal conception, and not the outcome of still more remote and earlier fusions. Who shall say that the dirty yellow tinge, for instance, of the average Chinese is not the result of a blend, as the light brown of the eastern Polynesians certainly appears to be?

This brings us to the consideration of the so-called 'ethnical criteria'—i.e. the various factors on which ethnologists rely in their different schemes of classification. These criteria are partly internal or anatomical—the skeleton in general, and particularly the cranium; partly external—colour of skin, colour and texture of hair, and such other determining elements, whether physical or mental, as may be studied on the living subject. Although opinion varies considerably as to the value of these several characteristics, there is a general consensus in attaching special, if not permanent, importance to the three elements of colour, hair, and form of the skull. Of these colour, probably because the most conspicuous feature, was the first to be considered, and formed the basis of all the early classifications, such as those of F. Bernier (1672), who distinguished four radical types—European White, African Black, Asiatic Yellow, and Northern Lapp; of Linnæus (1738–83), whose *homo sapiens* comprised four species—the light-skinned European, the yellow Asiatic, the black African, and brown or tawny American; and of Blumenbach (1752–1840), whose groupings fluctuated, but whose terminology (Caucasic, Mongolic, &c.) has been largely retained.

Then followed a chaotic interval, during which almost every writer proposed with equal confidence a fresh division of the primary human groups. During this period, ethnology, in common with other studies affording large scope for the exercise of the imaginative faculties, became the battle-ground rather of partisans than of men of science. The wildest theories on the specific unity or disparity of mankind, the permanence or evanescence of types, the innate capacity or incapacity for progress, and so forth, were advocated, often with much erudition, but little common sense, by Nott and Gliddon, Morton, Knox, even Cuvier and Agassiz, apparently more eager to further their peculiar political and religious views than to promote the cause of truth. Some of these theories were even self-destructive, as for instance those of Agassiz on unity of species and difference of origin. Most of them are now interesting only to the historian of mental aberration, and, their standpoint being mainly polemical rather than scientific, they did little to advance ethnological studies.

Order was at last restored by the craniological school, founded by the elder Retzius (1796–1860), which made the shape of the head the basis of all classification, and thus introduced exact methods into this branch of the subject. The result has shown that craniology alone cannot be depended upon to supply sufficient, or even altogether trustworthy, materials for distinguishing the main divisions of mankind. Its chief elements, such as dolichocephaly and brachycephaly (i.e. length or shortness of the skull as measured from front to back), orthognathism and prognathism (less or greater projection of the jaws), are not constant in any given groups, and in many cases the most surprising diversity prevails where some degree of uniformity it might be expected. Thus many of the Eskimos, grouped with the brachycephalic Mongol division, are marked by extreme dolichocephaly; the extinct Tasmanians, belonging to the prognathic Negro division, were highly orthognathic; no norma, either of gnathism or cephalism, can be established for the Oceanic Malay and Papuan races,

while every shade of cephalism prevails amongst the Caucasic peoples. Nevertheless, craniology can be neglected by no ethnologist, and its study has already thrown much light on various departments of anthropological science. See SKULL.

Of late years the colour and texture of the hair, the value of which had been anticipated by Linnæus, have steadily risen in the estimation of naturalists as a racial test. It is now regarded as the most constant of all the physical features, and has been made the foundation of their groupings by some of the most eminent modern anthropologists, such as Huxley, Fr. Müller, Haeckel, and Broca. Its constancy is shown by the Negro division, all branches of which, without any exception, have black and more or less woolly hair, flat or highly elliptical in section; and by the Mongol division, which, including all the American aborigines, is uniformly characterised by straight black hair of the horse-tail type, cylindrical in section. In the Caucasic division this feature varies considerably, but still within certain limits. Thus, it may be straight, wavy, or curly, but never woolly; the colour also may range from jet black through all shades of brown, and even red, to the lightest flaxen; but there still appears to be a certain correlation on the one hand between the black hair and dark complexion, on the other between the light hair and fair complexion of the two well-marked branches of the Caucasic division.

The other ethnical elements, whether physical or mental, are of little value taken apart, but are often useful aids in combination with themselves, and especially with the three above specified criteria. Such are stature; the shape, colour, and position of the eye; the weight or volume of the brain (cranial capacity); the form of the nose—remarkably constant in some groups; the form of mouth and lips; the superciliary and zygomatic arches, and all such other elements as collectively constitute the broad flat features of the lower, the oval and regular of the higher races—Kollmann's chamoprosopic and leptoprosopic types. Of mental or intellectual criteria immeasurably the most important is language, which, however, has had the misfortune of suffering from friends and foes alike, philologists rating it much too high, anthropologists depreciating it to a corresponding extent. Yet that speech cannot be neglected, even by the purely anthropological student, is obvious from the fact that different phonetic systems often involve different anatomical structure of the vocal organs. Owing to these differences, Europeans find it impossible, even after years of residence amongst the natives, to pronounce the various clicks of Bushman, Hottentot, and Zulu-Kafir tongues, or the many rasping sounds of the Thlinkît, Apache, and other American idioms. The 'absolute impossibility' of imitating certain tones in the Papuan languages of New Guinea is by Miklukho Maclay rightly attributed to 'fundamental differences in the anatomical structure of the larynx, and the whole muscular system of the organs of speech in the two races' (European and Melanesian). And he adds that 'not only the organ of speech, but also that of hearing, plays an important part, for the same word may be heard in a totally different manner by different persons' (*Ethnologische Bemerkungen*). Neither the Jews nor the African negroes in America have yet learned to correctly pronounce the European languages spoken by them as their mother-tongues for many generations. At the same time, 'philology and ethnology are not convertible terms' (Sayce), and extreme caution must always be used in the treatment of language as an ethnical test. It has too often proved a pitfall to uncritical writers.

Of other mental or moral criteria it will suffice here to mention *religion*, which, owing to the fundamental unity of the psychic element in man, can never be regarded as a true test of race, and *social pursuits*, such as the chase, pasture, and agriculture. On the latter point much misconception prevails, and it is especially a mistake to suppose that the order of progress is necessarily from the hunting through the pastoral to the agricultural state. Some of the lowest African tribes are, and always have been, tillers of the soil, while other peoples, such as the Kirghiz and Kalmucks, ranking much higher in the social scale, are still nomad pastors. These pursuits, in fact, are questions not of race, but of the outward conditions of soil and climate, as we see in the Arabian peninsula, where the stock-breeders of the Nejd plateau become skilful husbandmen in the Yemen uplands of the extreme south-west.

Basing their conclusions on the comparative study of all these ethnical criteria, the most eminent naturalists, from Linnæus and Blumenbach to Huxley, Virchow, Flower, Broca, and Topinard, mainly agree in classifying the whole human family in three or at most four fundamental divisions. From the foregoing exposition of the subject, it follows of itself that all classifications must be regarded not as *genetical*—i.e. divisions according to common descent—but rather as groupings according to physical and mental resemblances. It also follows that the term *fundamental* is to be understood not absolutely, but only in a relative sense; for all races (the term race being taken as practically equivalent to 'breeds' or 'varieties') are necessarily regarded as belonging to a common primeval stock, constituting a single species. At the same time it does not follow that all must necessarily be supposed to have sprung from a single human pair. On the contrary, the more natural assumption would seem to be a gradual upheaval, so to say—i.e. the slow evolution of a whole anthropoid group spread over a more or less extensive geographical area, in a warm or genial climate, where the disappearance of an original hairy coat would be rather an advantage than otherwise. This view of gradual ascent in a more or less homogeneous mass has the advantage of obviating the many difficulties connected with *unity of species* and *unity of descent*, which are now seen no longer to be identical expressions. It also allows for differences in the physical habitus *from the first*, these differences, however slight, helping in combination with altered environments to account for the divergences that have in the course of ages resulted in the present fundamental human types. Thus, we no longer require to ask ourselves, for instance, whether the black hue shaded into the yellow, the brown into the white; whether prognathism grew into orthognathism, brachycephalic or round into dolichocephalic or long heads, and so on. None of these extremes, but only the germs of all, need be assumed as starting-points; and it is not a little remarkable that the Andamanese Islanders, declared by the highest authority to be 'the most infantile' of human races, are also amongst the least marked in these respects. Their colour is dark, but far from black; their prognathism is not pronounced; their stature is low, but not dwarfish—4 feet 10 inches as compared with the Akka, 4 feet 6 inches, and Batwa, 4 feet 3 inches (Wissmann, Flower, Man). The existing marked types may therefore be taken as collateral developments rather than independent primordial conditions, or gradual modifications of any one extreme type.

The difficulty of determining the exact number of these types is due to the fact, already pointed out by Blumenbach, that none of them are found in what may be called ideal perfection, but that all

tend to merge by imperceptible degrees in each other. But the issue now appears to be narrowed down to a choice between three, four, or at most five primary groups, with one or more marked subdivisions in each. These are the black, woolly-haired *Ethiopic* (*Negro*); the yellow, lank-haired *Mongolic;* the white, smooth-haired *Caucasic;* the coppery, lank and long-haired *American;* and the brown, straight-haired *Malayo-Polynesian.* But the last is commonly rejected as evidently the outcome of comparatively recent mixture, in which the Mongolic elements predominate. In fact, the Oceanic Malays proper cannot be separated anthropologically from the Asiatic Mongol group. Most authorities also regard the American as a remote branch of the same group, and this view seems justified by the striking Mongolic features occurring in every part of the New World, as amongst the Utahs of the western States and the Botocudos of eastern Brazil. We are thus reduced to the three first-mentioned divisions, a grouping again adopted by Flower (1885), who concluded that primitive man had in the course of ages become differentiated into 'the three extreme types represented by the Caucasian of Europe, the Mongolian of Asia, and the Ethiopian of Africa, and that all existing members of the species can be ranged around these types, or somewhere or other between them.' But it is not to be supposed that all the distinctive characters of these three types are found co-existing in any considerable masses of the several groups. The ideal *Homo Æthiopicus, Mongolicus,* and *Caucasicus* must therefore be constructed, so to say, by a sort of eclectic process, by selecting and grouping together the more salient features assumed to be characteristic of each. In this way has been prepared the subjoined comparative scheme of the three main divisions, the points of contrast or resemblance between which will be best shown by their juxtaposition. Here it should be noticed that the Caucasic was divided by Huxley into two distinct branches—the Xanthochroi, or fair, and the Melanochroi, or dark—which in this table are respectively indicated as 1 and 2.

TABLE OF THE CHIEF CHARACTERISTICS OF THE THREE FUNDAMENTAL HUMAN TYPES.

	Ethiopic.	Mongolic.	Caucasic.
Colour and Character of Skin	Blackish, sometimes almost sooty black; velvety and cool to the touch, emitting a distinct odour.	Yellowish, passing into olive, and almost every shade of brown; rough in texture; often with a *fade*, washed-out look.	Whitish; (1) very florid or ruddy; transparent, clearly showing the veins; (2) pale, but often dusky or swarthy; both merging in some places in a light olive, in others in various shades of brown.
Hair and Beard	Jet black, frizzly or 'woolly,' rather short; flat in transverse section; sometimes said to grow in separate tufts; scant or no beard.	Dull black, coarse, lank, lustreless, sometimes (in America) very long; round in section; moustache developed; beard scant or absent.	(1) Flaxen, light brown, and even red, long, wavy, and silky; (2) black or dark brown, rather straight, but sometimes kinky or curly; both oval in section; both with full beard.
Skull and Face	Skull mainly dolichocephalic (long and narrow), sometimes also very high (hypsistenocephalic); prognathous lower jaw; high cheek-bone; large, black, round, and prominent eye, with yellowish cornea; broad flat nose; thick, everted lips, showing the red inner skin.	Skull mainly brachycephalic (round, but never quite circular); mesognathous jaw; large cheek-bone; narrow, almond-shaped, black eye, slightly oblique; very small, concave nose; features generally broad and flat, in America hatchet-shaped.	(1) Skull mainly dolichocephalic; (2) mainly brachycephalic; both orthognathous; (1) eye blue, hazel, or brown; (2) eye large, black, and bright. Both long, straight nose, often arched or aquiline; small mouth, thinnish lips; features mainly oval and regular.
Stature and Figure	Generally tall, rather above the average, ranging from 5 feet 6 inches to 5 feet 10 inches and even 6 feet; large, bony frame, stout and robust, but weak in lower extremities.	Generally short, rather below the average, 5 feet to 5 feet 6 or 7 inches; but American branch often very tall; heavy, squat, angular frame, especially on the uplands (Tibet, Bolivia).	(1) Tall, above the average, 5 feet 6 inches to 5 feet 10 inches and 6 feet; (2) below the average, 5 feet 2 inches to 5 feet 6 or 7 inches; but much diversity within each group. (1) Powerful brawny frames, often very strong; (2) lithe, active frames, often with much staying power (Basques).
Temperament	Sensuous, unintellectual, cheerful, and even boisterous, but fitful, passing suddenly from comedy to tragedy; hence at once affectionate and cruel; science, art, and letters undeveloped.	Sluggish, somewhat morose and taciturn; hence passive, with little initiative, but with great power of endurance, and subject at times to vehement outbursts; science slightly, art and letters moderately developed.	Highly imaginative, active and enterprising; hence at once speculative and practical; (1) somewhat solid, serious and persevering; (2) fiery, impulsive, but inconstant. Science, art, and letters highly developed in both.
Language	All agglutinating, mostly with prefixes and alliterative harmony (Bantu); relatively few abstract terms.	Some isolating and uninflected, with tendency to monosyllabism and tone; some agglutinating, mostly with postfixes and vowel harmony; some polysynthetic; abstract terms numerous.	Nearly all inflecting, mainly by postfixes completely merged in modified root; hence more or less synthetic, with a general tendency towards analysis; abstract terms practically unlimited.
Religion	Non-theistic; nature-worship, with fetichism and witchcraft as conspicuous elements.	Polytheistic; spirit-worship (Animism); belief in dreams and visions (Shamanism); also higher religions.	Monotheistic (Unitarian, Trinitarian), with creeds based on revelations; priesthood (mediation) a prominent feature; also Brahmanism.

Subjoined is a brief summary of the main divisions and subdivisions of these three fundamental groups.

I. The Ethiopic Group falls naturally into a western or African, and an eastern or Oceanic division. The western, occupying all Africa from the Sahara southwards, comprises a northern or *Sudanese* branch (African Negroes proper), and a southern or *Bantu* branch (more or less mixed Negro and Negroid population), reaching northwards to about 5° N. lat. The former are marked by considerable physical unity and great linguistic diversity; the latter by almost absolute linguistic unity (Bantu languages) and great physical diversity. The chief members of the Sudanese branch are Mandingan, Wolof, Felup, Sonrhai, Haussa, Egbe, Ibo, Yoruba, Fanti, Nupe, Michi Batta (West Sudan, Upper Guinea, Adamawa); Kanuri, Kanembu, Tibu, Mosgu, Yedina, Bagirmi,

Maba (Central Sudan, East Sahara, Wadai); Shilluk, Nuba, Dinka, Janghey, Bongo, Bari, Monbuttu, Zandeh (East Sudan, White Nile, and Welle-Mobanji basins); Masai, Kavirondo, Elgeyo, Samburu, Turkana (Masai Land). The chief members of the Bantu branch are Wa-Pokomo, Wa-Sambara, Wa-Chaga, Wa-Swahili, Wa-Zaramo, Wa-Sagara, Wa-Nyamezi, Wa-Gogo, Ma-Nyanja, Ma-Kua, Ma-Vita, Ajawa (eastern seaboard); Zulu-Kafir, Ba-Suto, Be-Chuana, Tonga, Ba-Rotse, Mashona, Ba-Yeye, Makalaka, Makololo, Maganya (South Africa); Ova-Herero, Ova-Mbo, Ganguella, A-Bunda, Ba-Fyot, A-Bongo, Ma-Yombe, Fan, Ba-Kale, Mpongwe, Ba-Koko, Dwalla, Bubi (western seaboard); Wa-Regga, Ba-Lolo, Tu-Shilonge, Ba-Ngala, Bu-Banghi, Ba-Teke (in the Congo and Ogowe basins).

The Oceanic division of the Ethiopic group comprises two branches: (1) The *Papuans* of the Eastern Archipelago and New Guinea; (2) the closely allied *Melanesians* of the Solomon, New Hebrides, New Caledonia, Loyalty, and Fiji archipelagoes.

Within both Ethiopic domains are scattered several dwarfish groups, the so-called *Negritos* and *Negrillos*—i.e. 'Little Negroes,' perhaps representing the true aboriginal element in these regions. In Africa the best known are the *Akkas* of the Upper Welle basin, the *Obongos* of the Gabun, the *Batwas* of the Middle Congo (smallest of men). The *Bushmen* of South Africa lead through the taller *Hottentots* to the Negroes proper. In Oceania still survive the *Aetas* of the Philippine Islands, the *Simangs* of the Malay Peninsula, the so-called *Mincopies* of the Andaman Islands, and the *Arfaks* of New Guinea. The *Kalangs* of Java have recently died out. Besides their smaller stature, all the Negritos differ from the Negroes by their brachycephaly.

II. The MONGOLIC GROUP occupies the greater part of the eastern hemisphere (in Europe much assimilated to the Caucasians), and till the discovery of America was in exclusive possession of the New World. Its chief branches are: (1) The *Mongolo-Tatars* of Central and North Asia, Asia Minor, parts of Russia and the Balkan Peninsula; (2) the *Tibeto-Indo-Chinese* of Tibet, China proper, Formosa, and Indo-China; (3) the *Finno-Ugrians* of Finland, Lapland, Esthonia, Middle Volga, Ural Mountains, North Siberia, Hungary (Magyars); (4) the *Malays* and *Malayans* of the Malay Peninsula, the greater and lesser Sunda Islands, Madagascar, the Philippines, Formosa; (5) the *American Indians*, comprising all the New World aborigines.

III. The CAUCASIC GROUP has in recent times spread over the whole of the New World, South Africa, and Australasia: (1) *Nordic*, tall, fair dolichocephals: North-west Europeans, Kurds, Afghans, West Persians; (2) *Alpine*, brachycephals: Central Europeans, Armenians, Tajiks; (3) *Mediterranean*, short, dark dolichocephals: South Europeans, North Africans, Arabs, Dravidians, Polynesians, Todas, Ainu. Chief linguistic branches: (1) *Aryans* of India, Iran, Armenia, Asia Minor, and great part of Europe, with sub-branches Hindus, Afghans, Persians, Beluchis, Armenians, Ossetians, Hellenes, Thraco-Illyrians, Italo-Siculi, Celts, Teutons, and Letto-Slavs; (2) *Semites* of Mesopotamia, Syria, Arabia, and North Africa, with sub-branches Assyrians (extinct), Syrians, Arabs, Phœnicians (extinct), Abyssinians, all except the last named now assimilated in speech to the Arabs; (3) *Hamites* of North and East Africa, with chief sub-branches Berbers of Mauritania, Tuaregs of West Sahara, Copts and Fellahîn of Egypt, Fulahs (?) of West Sudan, Bejas (Bishari) and Afars (Danâkil) along west side of the Red Sea, the mixed populations of Galla, Somali, and Kaffa Lands; (4) *Basques* of the Western Pyrenees; (5) *Malayo-Polynesian* or *Austronesian*; besides many groups in the Caucasus.

The jungle tribes of the Deccan, the Veddas, the Sakai, and the Australians have been grouped as Pre-Dravidians.

Although treatises on various branches of the anthropological sciences are past counting, comprehensive works of a strictly ethnological character are not numerous, and of these few can be recommended as safe guides to the student. The subjoined are valuable either intrinsically or as able expositions of particular theories: Blumenbach, *De Generis humani varietate nativa* (3d ed. 1795); Prichard, *Natural History of Man* (1843) and *Researches* (1813); Desmoulins, *Hist. Nat. des Races Humaines* (1826); Baer, *Vorlesungen über Anthropologie* (1824); Edwards, *Des Races Humaines* (1829); Bory de Saint-Vincent, *L'Homme* (2d ed. 1827); Courtet de l'Isle, *Tableau ethnographique* (1849); Thomas Smyth, *The Unity of the Human Race* (1851); Carl Vogt, *Lectures on Man, &c.* (English ed. undated); Hollard, *De l'Homme* (1853); Cuvier, *L'Homme* (1857); Nott & Gliddon, *Types of Mankind* (1854) and *Indigenous Races of the Earth* (1854); Knox, *The Races of Men* (1862); D. Wilson, *Prehistoric Man* (1862); Latham, *Man and his Migrations* (1851); *Nat. Hist. of the Varieties of Man* (1850), and other ethnological essays; Waitz, *Anthropologie der Naturvölker* (1864); Müller, 'Ethnographie,' in *Reise der Novara* (1861 *et seq.*); Brace, *The Races of the Old World* (1863); Broca, *Le Linguistique et l'Anthropologie* (1862), &c.; Pouchet, *Plurality of the Human Races* (English ed. 1864); De Quatrefages, *Histoire Générale des Races Humaines* (1889); works by Retzius, Bastian, Haeckel, &c.; Huxley in *Journal of Ethnol. Soc.* (1870); Hovelacque, *Langues, Races, Nationalités* (1872); Peschel, *The Races of Man* (1876); Topinard, *Anthropology* (trans. 1878); Tylor, *Anthropology* (1881); Brinton, *Races and Peoples* (1890); Deniker, *The Races of Man* (1900); Ratzel, *History of Mankind* (trans. 1897); Ripley, *The Races of Europe* (1910); Sergi, *The Mediterranean Race* (trans. 1902); Keane, *Ethnology* (2d ed. 1896), *Man, Past and Present* (1900; rev. 1919), and *The World's Peoples* (1908); Dixon, *Racial History of Man* (1923); Haddon, *The Races of Man* (new ed. 1924).

Ethyl is a colourless, inflammable gas, obtained by the action of iodide of ethyl, C_2H_5I, on granulated zinc. It possesses an agreeable odour, is insoluble in water, but soluble in alcohol. It is not, however, on its own account that ethyl is of importance, but because it is the starting-point of an important series of organic compounds known as the *ethyl series*. In all of these the group CH_2-CH_3 or C_2H_5 is present, and acts as if it were an atom of some elementary substance—e.g. potassium. Thus we have

Potassium,	K;	Ethyl,	C_2H_5
A molecule of Potassium,	K_2;	A molecule of Ethyl,	$(C_2H_5)_2$
Potassium Iodide,	KI;	Ethyl Iodide,	C_2H_5I
Potassium Oxide,	K_2O;	Ethyl Oxide or Ether	$(C_2H_5)_2O$
Caustic Potash,	KOH;	Ethyl Hydrate or Alcohol,	C_2H_5OH.

In these we see that the group of atoms, C_2H_5, always enters into combination as if it were indivisible, and it is usual to call this group ethyl, and to reserve the term diethyl for the compound $(C_2H_5)_2$ described above. Ethyl, C_2H_5, is only hypothetical, and does not exist in the free state, while diethyl, $(C_2H_5)_2$, is an actual gas, called butane. See ALCOHOL, BASE, and ETHER.

Ethylamine, $NH_2C_2H_5$, is a substance resembling ordinary ammonia in its odour and many of its properties. It is found in coal-tar, in the oil obtained during the destructive distillation of bones, in the gases evolved during putrefaction, and may be produced by complicated chemical processes. It has been called an artificial alkaloid (see ALKALOID), as being ammonia in which one atom of hydrogen is replaced by the group Ethyl.

Ethylene. See OLEFIANT GAS.

Étienne. See STEPHENS.

Etiolation. See BLANCHING.

Etive, a salmon-river and a sea-loch of Argyllshire. The river, issuing from a loch on Rannoch Muir, near lonely Kingshouse Inn, runs 15 miles south-westward to the head of the loch, which itself extends 10½ miles south-westward, then 8¾ westward, until at Dunstaffnage Castle, 3½ miles NNE. of Oban, it merges in the Firth of Lorn. Narrowing from 1½ mile to less than 2 furlongs at Connel Ferry, its reef-barred entrance, where the depth too decreases from 420 feet to 6 at low-water, this loch offers a good example of an ancient submerged glen. Like that of Loch Awe (q.v.), its scenery is magnificent, the upper reach closely engirt by mountains, of which the loftiest are Ben Cruachan (3689 feet) and Ben Starav (3541). Ardchattan Priory, founded on its north shore in 1281 for monks of the order of Vallis Caulium, is a beautiful ruin; so, too, is Dunstaffnage, the fabled seat of the Dalriadan kings, the stronghold really of Macdougals and Campbells, and the prison for a while of Flora Macdonald. See also BEREGONIUM.

Etna, or ÆTNA (called by the modern Sicilians MONTE GIBELLO—the last part of the name being the Arabic *Jebel* Italianised), an isolated volcanic mountain close to the east coast of Sicily, with a base 90 miles in circumference, and a height of 10,758 feet. The mountain mass rises with gentle and regular slopes up to a single cone, containing the crater, a chasm about 1000 feet in depth and from 2 to 3 miles in circumference. The regularity of the slope is, however, broken by the Val del Bove, an immense gully excavating the eastern flank of the mountain, 4 or 5 miles in diameter, and surrounded by nearly vertical precipices from 2000 to 4000 feet high; it has a singularly dreary and blasted appearance. A striking feature is the very great number of secondary cones dotted all over the flanks of the mountain. Of these the principal are the Monti Rossi, 450 feet high, twin peaks which were cast up during the eruption of 1669. The slopes of the mountain are divided into three sharply defined zones, the cultivated, the woody, and the desert region. This last, extending from about 6300 feet upwards, is a dreary waste of black lava, scoriæ, ashes, and sand, covered during the greater part of the year with a sheet of snow. The wooded region, which stretches down to the line of 2000 feet, though with considerable variation of breadth, is planted with forests of chestnuts, beeches, birches, pines, maples, and oaks. Below this lies the cultivated zone, a thickly peopled region of great fertility, where the vine, date-palm, bananas, sugar-cane, oranges, lemons, olives, figs, almonds, &c. are grown. The ascent is usually made from Catania, a town on the coast to the south. The origin of the mountain goes back to the Pliocene age, when its foundation was probably begun in a submarine bay penetrating into the west coast of Sicily. The geological structure of the Val del Bove lends support to the view that there once existed a second great crater, the centre of permanent eruption.

The most remarkable of the recorded eruptions of Etna are the following: 1169, when Catania and 15,000 of its inhabitants were destroyed; 1329, when a new crater opened near the Val del Bove; 1444, when the cone fell into the crater; 1537, on which occasion two villages and many human beings perished; from 1603 to 1620 Etna was almost continually in activity; in 1666 three new craters were formed. The most violent outburst of all was, however, that of 1669, when a chasm 12 miles long opened in the flank of the mountain, and from it issued a line of flames, whilst a new crater was made. During an outburst in 1755 a large flood of water was poured down from the Val del Bove. In 1852–53 there was a violent eruption which lasted nine months; a torrent of lava, 6 miles long by 2 broad, and some 12 feet in depth, was ejected. There were great eruptions in 1879, 1886, 1892, and 1923. In the last mentioned the new crater of 1911 (on the north-east side of the main cone) was active, and a lower crater sent forth a lava-flow that reached the outskirts of Linguaglossa. About 100 eruptions have been pretty accurately described, 16 having occurred in the 19th century. In 1880 an observatory was built on the south side of the mountain, at a height of 9075 feet above the sea (nearly 1000 feet higher than the hospice of the Great St Bernard). See Ferrara, *Descrizione dell' Etna* (1818); Rodwell, *Etna and its Eruptions* (1878); Sartorius von Waltershausen, *Der Aetna*, edited by Von Lasaulx (2 vols. Leip. 1880); G. de Lorenzo, *L'Etna* (1907); *Geographical Review* (1916).

Eton, a town in the south of Buckinghamshire, on the left bank of the Thames, 21 miles WSW. of London. It lies opposite to Windsor, in Berkshire. Eton chiefly consists of one long street, and is mainly dependent on the college. Pop. 3000.

ETON COLLEGE, one among the most famous educational establishments in England, was founded in 1440 by Henry VI., under the title of 'The College of the Blessed Mary of Eton beside Windsor.' The original foundation consisted of a provost, 10 priests, 4 clerks, 6 choristers, 25 poor grammar-scholars, a master, and 25 poor infirm men. The king provided for the establishment out of his own demesne lands and the estates of certain alien priories. A supplementary charter was granted in 1441, in which year also the college buildings were commenced. Henry was very solicitous that the work should be of a durable kind. Some of the buildings were finished in 1443, and were handed over by the royal commissioners to the provost, clerk, and scholars. Political troubles of various kinds retarded the completion of the buildings till 1523. Bishop Waynfleete was the first head-master, and afterwards a munificent supporter of the college. The institution passed through much peril in the reign of Edward IV., and again in the time of the Commonwealth; but it weathered the dangers, and the increasing value of its estates brought in a large income. Since 1868 the college consists of a provost and 10 fellows, who constitute the 'governing body,' 2 chaplains or conducts, and 70 king's scholars or collegers. The members of the governing body are nominated by the universities of Oxford and Cambridge and other learned and responsible electors. The scholars are lodged within the college walls. The main portion of the establishment, however, consists of the *oppidans*, students who live in houses held by the masters, and whose friends pay liberally for their education. The tuition is the same for them as for the collegers. There are valuable scholarships at King's College, Cambridge, also other scholarships and prizes open to all. Till 1851 the course of education was purely classical, but mathematics was admitted into the curriculum in that year, physical science in 1869, and the college now possesses an admirable museum, laboratory, and observatory. Among famous Etonians have been Bolingbroke, Boyle, Canning, Chatham, Lord Randolph Churchill, Derby, Fielding, Fox, Gladstone, Gray, Hallam, Kinglake, Lyttelton, Milman, Porson, Praed, Pusey, Lord Rosebery, Lord Salisbury, Shelley, Fitzjames Stephen, Leslie Stephen, Swinburne, the Walpoles, Wellesley, and Wellington. Famous heads have been Lupton, Udall, Savile, Wotton, Barnard, Keate, Hawtrey.

The college buildings are of various date and varying beauty—from the original work of the 'royal saint' onwards—include the chapel (with remarkably fine mural paintings by William Baker,

1479–1488), hall, library, and schools, the provost's and master's apartments, and the lodgings of the fellows, surrounding two quadrangles. The chapel is of stone, the other buildings of brick; and the effect of the whole is strikingly picturesque, as seen from the terrace of Windsor Castle. The Gothic chapel is especially beautiful, rich in carving and painted glass. The 'Montem,' or triennial procession to Salt Hill (*ad montem*), was celebrated last in 1846. The acting of miracle plays on Founder's Day was revived in 1919.

See Creasy's *Eminent Etonians* (1850; new ed. 1876); Jesse's *Celebrated Etonians* (1875); Thackeray's *Life of Hawtrey* (1896); Coleridge, *Eton in the Forties* (1896); A. C. Benson's *Fasti Etonienses;* histories by Maxwell Lyte (1875; 4th ed. 1911), Sterry (1898), and Cust (1899); and books by Lubbock (1899), Brock (1900), Stone (1910), and Austen-Leigh (1921).

Étretat, a Norman watering-place, 18 miles NE. of Havre; pop. 2000.

Etruria, the country of the Etruscans, lay west of the Tiber and the Apennines, and included the valley of the Arno. In the 6th and 5th centuries B.C. the Etruscans held also the valley of the Po, called Etruria Circumpadana, and a region south of the Tiber, called Etruria Campaniana. Etruria Propria was a confederation of twelve cities or states, the *duodecim populi Etruriæ.* No list of these cities has come down to us, but Veii, Tarquinii, Cære, Clusium, Cortona, Perusia, Vulci, Volsinii, Vetulonia, Volaterræ, and Arretium may probably be included, while the twelfth may have been either Rusellæ, Falerii, or Populonia. To the northern confederation twelve cities are also assigned; among them we may reckon Mantua, Chiavenna, Felsina (Bologna), Ravenna, and Hatria, important enough to give a name to the Adriatic. In the southern province were Capua and Nola, and possibly Salerno. Some of these cities are now deserted sites, marked only by vast cemeteries and the remains of cyclopean walls, while others still retain more or less of their old importance.

Veii, for four centuries the formidable foe and rival of Rome, from which it is only 11 miles distant, is now utterly desolate. It was taken and destroyed by Camillus in 396 B.C. The necropolis, extending over 16 sq. m., attests the splendour of the ancient city and the vast population which must have dwelt within its walls, 7 miles in circuit. Six miles from the sea, midway between Rome and Civita Vecchia, is the village of Cervetri, which preserves the name and marks the site of Cære, which, under its older name of Agylla, is said to have been a 'Pelasgian' city before the arrival of the Etruscans. On this site inscriptions have been found, written in a language and an alphabet called 'Pelasgic,' and believed to be pre-Etruscan. The paintings in some of the tombs are in a style no less archaic. Of later date is the tomb of the Tarquins, who are said to have fled to Cære when expelled from Rome. Cortona, perched upon a rock, and surrounded by fragments of massive walls, possibly of pre-Etruscan date, occupies the most venerable site in Italy. In the time of Herodotus, Cortona, like Cære, retained its 'Pelasgic' character. Dionysius says it was a great and flourishing city of the Umbrians before it was taken by the Etruscans, who made it their northern capital. The bronze-workers of Cortona were renowned, and the local museum contains noteworthy examples of their skill. The southern capital was Tarquinii, a city purely Etruscan. Corneto, a town 60 miles from Rome, and not far from the sea, occupies a portion of the site. The necropolis of Tarquinii, which extends over many miles, contains several sepulchral chambers, painted in the archaic style of the genuine art of the Etruscans, and giving a curious insight into their religious beliefs. We have scenes from the under-world, representing souls riding on horseback or seated in cars, led away in the charge of good or evil spirits. Elsewhere the daily life of the people is depicted; we see horsemen returning from the chase, chariots, boar-hunts, wrestlers, pugilists, banqueting scenes, dancing girls, and musicians. Fig. 1 represents a dancing girl and musicians from the walls of a tomb called the Grotta del Triclinio, and fig. 2 a death-scene from a tomb called the Camera del Morte. The tombs of Clusium (now Chiusi) exhibit the same archaic character as those of Tarquinii. A vast chambered tumulus called the Poggio Gajella may be that described by Varro as the tomb of Lars Porsena. Vulci, though barely mentioned by historians, must have been a very wealthy and populous city. The necropolis has yielded in plenty some of the richest artistic treasures of any Etruscan site. The Cucumella, a huge chambered tumulus like that at Clusium, bears a curious resemblance to the great tomb of Alyattes, king of Lydia, the father of Crœsus, near Sardis. Volsinii (Orvieto) was one of the most powerful Etruscan cities, and one of the last to yield to Rome. Here have been found many painted vases, and at the foot of the hill to the north lies a great Etruscan cemetery. Perusia (Perugia) is peculiarly rich in inscriptions, among them the famous cippus (46 lines). It has not been deciphered, but appears to be the record of the assignment of a sepulchre to the Velthina family. Velathri (now Volterra), called Volaterræ by the Romans, stands, like Cortona, upon an almost impregnable rock, surrounded by Etruscan walls, five miles in circuit. It held out against the Romans after all the rest of Etruria had been subdued. The people burned their dead instead of burying them, and the local museum contains many ash-chests, like miniature sarcophagi, the sides carved with mythological subjects, or with representations of bull-fights, boar-hunts, horse-races, and gladiatorial combats. Cyclopean walls mark the sites of Rusellæ, Cosa, Saturnia, and of Pupluna (Populonia), a seaport, interesting chiefly for its coins. The walls of Fæsulæ (Fiesole), near Florence, are well known to travellers. Vetulonia was formerly identified with Magliano, but now with Colonna (Vetulonia since 1887) in the Maremma; here an extensive necropolis has yielded many objects of archæological value. Neither Luna nor Pisæ has yielded any remains of interest. Other Etruscan sites, among them Viterbo (Surrina), Bologna (Felsina), Toscanella (Tuscania), Siena (Senæ), Arezzo (Arretium), Sovana (Suana), Falerii (Faleria), and Ferento (Ferentium), are described by Dennis, *Cities and Cemeteries of Etruria* (2d ed. 1878), to which the reader may be referred for fuller information.

History.—The history of Etruria, like that of Carthage, has to be reconstructed from accounts transmitted by hereditary foes. The Roman legends represent Etruria as a powerful and wealthy state before Rome was founded. According to a tradition preserved by Varro, the Etruscan era commenced in 1044 B.C., nearly three centuries before that of Rome. When legend ceases and history begins, we find the Etruscans a great naval power, allied with Carthage against the Greeks, and dominant throughout northern and central Italy, Rome itself being included in the Etruscan dominion, and ruled by Etruscan kings. The legend of the migration of the Tarquin dynasty from Tarquinii may signify the extension of the domination of that powerful city over the regions southward of the Tiber. A cemetery, believed to be Etruscan, has been discovered on the Esquiline, and the Cælian Hill in Rome bears the name of the Etruscan chieftain Cæles Vibenna. The

paintings and inscriptions in a tomb at Vulci give an Etruscan version of the Tarquinian story. We see the hero 'Macstrna' (Mastarna), an Etruscan appellation applied to Servius Tullius, cutting the bonds of his friend and companion Caile Vibinas (Cæles Vibenna), while Cneve Tarchunies Rumach (Cn. Tarquinius Romanus) is being killed by an Etruscan. The names of Tarquin, Mastarna, and Cæles Vibenna, thus curiously preserved, prove that Livy's account of the Etruscan kings of Rome is not wholly legendary. But that it was not derived from contemporary sources is indicated by an archæological discovery of much interest. We learn that in 509 B.C. Lars Porsena of Clusium, as Livy calls him, marched with a great army to the gates of Rome to re-establish Tarquin on the throne. Now, in a tomb at Vulci, a sarcophagus was found, on which is depicted in relief a high official with insignia resembling those of a Roman consul. He is riding in procession on a biga, preceded by two lictors with their fasces, and followed by two servants. The inscription informs us that this deceased magistrate, Tute Larth, was *purtsvana thuns*, 'five times Porsena.' It is manifest that Porsena was not, as Livy supposed, a proper name, but, like 'Pharaoh' in Egypt, the designation of an office; and that the Etruscan chief who took up Tarquin's cause was the elected 'Porsena' or chief-magistrate of Clusium. In like manner, since the word *machs* meant 'first' in Etruscan, it seems probable that Macstrna, the Etruscan appellation of Servius Tullius, was not a proper name, but a designation of the kingly office, equivalent, it would seem, to Princeps. We are also told that Tarquin, with his two sons, Titus and Aruns, took refuge in Cære. Not only are Tite and Arnth usual names in Etruscan epitaphs, but at Cervetri, the site of Cære, there is an immense chambered tomb containing mortuary records of forty-six members of the Tarcna family, which must have been resident at Cære for many generations.

As an Etruscan city, Rome plainly attained a greater height of prosperity than she regained for

Fig. 2.

two centuries. This is indicated not only by the legends of the splendour of the Tarquinian kings, but by the evidence of such vast constructions as the Cloaca Maxima, the Capitoline temple, and the Servian wall. The state ceremonial of Rome appears also to have descended from the period of Etruscan rule. The insignia of consular authority, the toga prætexta with its purple border, the ivory curule chair, the twelve lictors with their fasces and axes, all of Etruscan origin, are not likely to have been copied from the usages of hereditary foes, but are more probably survivals from the period when Rome was one of the Etruscan cities. An Etruscan origin may also be assigned to the circus, the gladiatorial combats, the horse-races, the triumphal processions, the pipe-players, the lituus, the colleges of augurs, as well as the arrangement of the house, the art of constructing aqueducts and sewers, the division of the *as* into twelve parts, the beginnings of military science, and some of the Roman weapons. More than all, the high position of the wife, so different from that which she occupied in Greece, was the same as that which she occupied in Etruria.

How feeble was the Roman republic in its

Fig. 1.

infancy appears from the fact that for a century after the expulsion of her Etruscan lords Rome maintained with varying fortunes the struggle with the Etruscan town of Veii, distant 11 miles only from her gates. That Veii fully held her own is shown by the admission that in the year 476 B.C. she captured the Janiculum. At that time the Etruscans were still the greatest military power in Italy. At the height of their prosperity, in the 6th century B.C., they shared with the Phœnicians and the Greeks the maritime supremacy of the Mediterranean. In 538 B.C., in conjunction with the Carthaginians, they sent a powerful fleet to expel the Greek colonists from Corsica. They attacked the Greek colony of Cumæ in 525 B.C., and again in 474 B.C., when their naval power was shattered by Hiero I. of Syracuse, in a great battle fought off Cumæ, the first event in Etruscan history as to which we possess contemporary records. The victory was celebrated by an ode of Pindar, then resident at the court of Hiero; while from the inscription on a bronze helmet, found at Olympia in 1817, and now in the British Museum, we learn that it was an Etruscan trophy from Cumæ, dedicated by Hiero and the Syracusans to the Olympian Zeus. In 453 B.C. we find the Etruscans still in possession of Corsica, and in 414 they were able to send a contingent of three ships to aid the Athenians at the siege of Syracuse.

But from this time dates the rapid declension of their power. Towards the close of this century the Etruscan dominion in Campania was overthrown by the Samnites and the Greeks of Cumæ, Capua being taken by the Samnites in 423. Then the Gauls swarmed over the Alps, and, after overwhelming the Etruscan cities in the valley of the Po, crossed the Apennines, having destroyed the wealthy city of Melpum in 396 B.C., the year in which the long struggle between Rome and Veii was brought to an end by the capture of the latter by Camillus, after a ten years' siege. The Gauls continued their devastating progress through Etruria, and in 390 plundered Rome, after having vainly laid siege to Clusium. Etruria was fatally weakened by the loss of her two outlying provinces and the devastation of the central province by the Gauls. After a prolonged resistance, southern Etruria submitted to Rome in 351 B.C. In 311 war was renewed; the Romans crossed the natural boundary formed by

the Ciminian Forest, and, after repeated defeats of the Etruscans, a decisive contest took place in 283 at the Vadimonian Lake, when Tarquinii lost its independence; and three years later the Romans reached Volaterræ, the northern stronghold of the Etruscans, when the struggle, which had endured for five centuries, came finally to an end.

In the Second Punic War, the chief Etruscan cities furnished supplies for the Roman fleet. It is plain that these cities retained wealth and power as semi-independent allies under the Roman suzerainty. They seem to have been gradually Romanised, and were finally admitted to the Roman franchise in 89 B.C. The great Etruscan families secured leading positions in the Roman commonwealth. Pompey the Great seems to have been of Etruscan lineage, tombs of the Pumpu family having been discovered at Corneto (Tarquinii), Clusium, Cortona, and Perugia. There was a Tarquinian gens at Rome in the time of Cicero, while Mæcenas, who bears an Etruscan name, was from the Etruscan city of Arretium (Arezzo). Families of undoubted Etruscan lineage still linger on in Etruria. The necropolis at Volterra contains the tomb, with Etruscan epitaphs, of the Ceicna (Cæcina) family, members of which distinguished themselves under the early emperors, and whose lineal representative, Nicolas Cæcina, bishop and patrician, was buried in the cathedral of Volterra in 1765.

Origin.—The people of Etruria were called Etrusci or Tusci by the Romans, Tyrrheni or Tyrseni by the Greeks, Tursci by the Umbrians, and Rasena by themselves. Their origin and ethnic affinities though much discussed are still in doubt. An early tradition, reported by Herodotus, and often repeated, brings them from Lydia; but Dionysius of Halicarnassus doubts any such migration, because it is not mentioned in the Lydian history of Xanthus, and because the Etruscans differed from the Lydians in language, laws, customs, and religion. Dionysius says the Etruscans were unlike all others in speech and manners, and claims for them an indigenous origin.

Modern writers who accept the Lydian tradition point out that Tarquinii, probably the mother-city of the Etruscans, is near the coast, that striking structural resemblances exist between tombs at Vulci, Clusium, and Tarquinii and certain tombs near Sardis, that certain Lydian inscriptions seem to contain some of the Etruscan symbols. They argue, too, that if Phocæans settled in Corsica, Lydians may have found their way to Italy. It must be acknowledged, however, that the migration of so numerous a people by sea is a formidable difficulty.

The difficulty is of course overcome by those who hold that the Etruscans entered Italy by land-route from the north; but here it should be remarked that the general tendency of archæological research is to discredit the view that the Etruscans were invaders from the Rhætian Alps. That the origin of the Etruscans should have been referred at various times to such diverse peoples as the Egyptians, Phœnicians, Hittites, Babylonians, Ligurians, Celts, Basques, Finns, serves well to prove the complexity of the problem. Perhaps the theory which now gains most general acceptance is that probably there were two elements in the population of Etruria, one autochthonous, numerous, and servile; the other an intrusive conquering aristocracy, Pelasgian in stock, and coming to Italy by sea-route from the east. Thus Cære and Cortona are said to have been 'Pelasgic' cities before they became Etruscan. Certain inscriptions from Etrurian tombs, formerly classed as Etruscan, are now attributed to the more ancient 'Pelasgic' race. Conestabile distinguishes between the tombs of an aboriginal people who practised cremation and those of the later invaders who buried their dead. Livy says that the speech of the country-folk in Etruria differed from the language spoken in the towns, and we may well believe that a conquered race would be left to till the soil for the benefit of invaders dwelling in walled towns. The splendid tombs from which our knowledge of Etruscan speech, luxury, and art is derived cluster round the walls of a few great cities, and are mostly the sepulchres of wealthy nobles. We occasionally meet with the urn of a freedman (*lautni*) or of a slave, but we know nothing of the tombs of the inhabitants of the villages, who may well have belonged to another race, and have spoken a different language. Again, the abrupt collapse of the Etruscan dominion in Campania and in the valley of the Po indicates that it was a dominion of conquest rather than of colonisation; and the complete effacement of the language in Etruria proper argues that the Rasena were a ruling aristocracy, comparatively few in number, though high in culture.

The physical type of the Etruscans is hardly to be determined from the evidence of the crania of their tombs; for while heads are to be found there which represent the intruding Aryan, so also are skulls which, if they represent the intruding Etruscan, are certainly indistinguishable from the crania of the native Ligurians (Italians). The descriptions by ancient authors, '*pinguis Etruscus*,' '*obesus Tyrrhenus*,' are confirmed by the recumbent portrait effigies on the sarcophagi, which show the Etruscans as a sturdy race, short and stout, with large heads, thick arms, high colour, scanty beard, and hair black or occasionally chestnut. It has been remarked that they were not unlike the Kheta (Hittites) who invaded Syria from the north, and whose monuments are found in Asia Minor as far west as the neighbourhood of Sardis. In any case we may agree with Dionysius that the language, customs, and religion of the Etruscans differed from those of any nation with which he could have been acquainted, while their physical type, as represented on their monuments, is so unlike that of other Europeans as to incline us to agree with the dictum of Seneca: *Tuscos Asia sibi vindicat*—'Asia claims the Etruscans as her own.'

Language.—The Etruscans had an extensive literature. The subjects represented on the monuments prove their familiarity with the tale of Troy and the cycle of Greek heroic legend, and we learn that they possessed histories, poems, dramas, and works on augury and divination. A fragment of writing (now in the museum of Agram), identified as part of a Book of Ritual, was found in 1891 on a piece of linen wrapped round an Egyptian mummy, but with this exception all their books have perished, so that in addition to a few doubtful Etruscan words preserved by Hesychius, Varro, and other writers, our knowledge of the language is derived almost solely from inscriptions. Of these inscriptions some thousands have been discovered, but we have unfortunately no clue to their meaning, as the few bilinguals consist mainly of proper names. It is in these circumstances that it has so far been found impossible definitely to connect the Etruscan tongue with any of the known great families of language. Thus in modern times it has been maintained that the Etruscan language was Semitic, Celtic, Armenian, Gothic, Basque, or Albanian. Professor Sayce thinks it is *sui generis*, belonging to a family of speech which has everywhere become extinct. Many hold that the affinities are Ugro-Altaic, while the reference to Asia Minor has also gained ground. The failure of Corssen's attempt to explain the language as an Aryan dialect, akin to Umbrian, Oscan, and Latin,

was a gain in the negative direction, and few scholars would now be found to maintain that it belongs either to the Aryan or Semitic family of speech. It seems rather to have been an agglutinative dialect, approximating, like Finnic, to the inflectional stage. It was written from right to left, in an archaic form of the Italic alphabet, which was obtained from Eubœa about the 7th century B.C. In retaining the letters *theta, phi, chi,* and *san,* and in rejecting *d, b, g,* and *o,* the Etruscan alphabet differs from the Latin.

Most Etruscan inscriptions are very short, few containing more than twenty words. A sepulchral tablet of Capua and the Perugian cippus mentioned above bear the only two of length. Inscriptions have been found as far north as the Alps, near Nice, Turin, and the lakes of Como and Lugano. But they come mostly from Central Etruria. Some vast cemeteries, such as those of Veii and Bologna, have yielded few or none, possibly because they date from a time when the art of writing had not become general.

The greater part of the inscriptions are short mortuary records, stating usually the name and parentage of the deceased; his age, his condition in life, and the public offices he held being occasionally added. They occur on the walls or over the entrances of vaults, on steles or pillars erected in front of tombs, or on the labels and seals of sepulchral niches, but they are more usually painted on the urns, or cut in the stone of the sarcophagi, a recumbent figure of the deceased frequently reposing on the lid, while the sides are sculptured with mythological subjects or scenes from the life of the deceased. The inscriptions found in 1886 in Lemnos in a language resembling Etruscan have been important, not so much linguistically as from the point of view of racial origins.

Working with such materials, considerable progress has been made in the decipherment of the language. True, the leaf of the Book of Ritual, the sepulchral tablet of Capua, and the cippus of Perugia have been only very partially interpreted, but in the decipherment of the language most of the short mortuary inscriptions can now be read with tolerable certainty. To the small vocabulary new words continue to be added. Of proper names a few, such as Caie (Gaius), Cneve (Gnævus), Marce (Marcus), and Tite (Titus), are borrowed from neighbouring or subject races. Of genuine Etruscan names the most usual for men are Arnth (Aruns), Aule (Aulus), Larth (Lars), Sethre, Vele, Velthur, and Vete; and for women, Arnthia, Aulia, Larthia, Sethria, Fastia, Ramtha, Thania, and Thancvil. Many Roman gentile names, such as Spurinna and Perpenna, were of Etruscan origin, while Pompeius, Petronius, Cafatius, Cassius, Cæcina, Volumnius, and Afinius appear in Etruscan tombs as Pumpu, Petruni, Cahate, Cazni, Ceicna, Velimna, and Afuna. A few Etruscan names have been explained. Thus, Thancvil (Tanaquil) was the wife of Tarquinius Priscus. Thana must have been the Etruscan goddess of maternity (= Juno Lucina), as on a mirror she assists at the birth of Minerva, and *cvil* (or *cver*) denotes 'gift' or 'dedication,' the word Tinscvil being inscribed on objects dedicated to Tinia (Jupiter). Hence Thancvil would mean 'Thana's gift,' and may be compared with such Christian names as Theodore or Diodorus. Again, Spurie, an Etruscan name, seems to be equivalent to the Latin Publius. The words *spural* and *spurana,* inscribed on vessels, armour, and tombs, signify that they were 'civic' or 'public' property; and the phrase *amce marunuch spurana,* in an epitaph, probably means '*fuit curator publicus.*'

Relationship is sometimes expressed by words, such as *puia,* 'wife;' *clan,* 'son;' *sec,* 'daughter;' but more commonly by suffixes. Thus, Aulesa is the 'wife of Aule,' Theprisa the 'wife of the Thepri' (Tiberius), Larthial the 'son of Larthia,' Larthialisa the 'wife of Larthia's son.' Velthur is a 'descendant of Vele,' and Velthurithura a 'descendant of Velthur.' Gentile names are formed by the suffix *-na,* corresponding to the Latin *-ius.* Thus, Vipna is the equivalent of Vibius, Varna of Varius, Caizna of Cæsius. This suffix is a common formative. Thus *suthi,* '*sepulcrum,*' gives *suthina,* '*sepulcralis.*' The suffix *-l* or *-al* has a similar force—e.g. *fuflun l,* 'a Bacchic cup,' from *Fufluns,* 'Bacchus;' and *Truial,* 'a Trojan,' from *Truia,* 'Troy.' Other ethnic formatives are *-ach* and *-ate,* as *Rumach,* 'a Roman,' and *Manthvate,* 'a Mantuan.'

Six words inscribed on the faces of a pair of dice give the first six digits, and other numerals appear in records of age which occur in epitaphs. The words *mach, ci, zal, sa, thu, huth, semph, cezp, muv* are believed to be the digits, while *ce-alchl, cezp-alchl, semph-alchl, muv-alchl, zathrum,* and *ciem-zathrum* must be decades. Ordinals and multiplicatives are formed from the cardinals. Thus *ci,* 'two,' gives *ci-s,* 'second,' and *ci-zi,* 'twice.'

The detection of the numerals has made it possible to show that the plural ends in *r* or *l.* Thus, *clan,* 'son,' gives *clen-ar,* 'sons;' as *ci clenar,* 'two sons,' and *clenar zal,* 'three sons.' The phrases *huth naper, naper ci, naper xii.,* show that *naper* is a plural, meaning '*loculi*' or 'tombs.' The plural in *-l* also appears in *arce ril lxvii.,* '*habuit annos lxvii.,*' and in *mursl xx.* So *tular* signifies 'cippi,' and *suthinesl* 'sepulchral niches.'

The names of men and women already cited, and such forms as *lautni,* 'a freedman,' and *lautnitha,* 'a freed-woman,' show that Etruscan was a gender language. There seems to have been no distinction between nominative and accusative. The genitive ended in *-s,* the dative in *-si* or *-thi;* and, as in the Altaic languages, the plural suffix preceded that denoting the case. Thus, from *clan,* 'son,' we have gen. *clen-s,* dat. *clen-si,* nom. and acc. pl. *clen-ar,* dat. pl. *clen-ar-asi;* while *precuth-ur-asi* is the dat. pl. of *precus.* From *tiv,* 'moon' or 'month,' we have *tiv-r,* '*menses,*' and *tiv-r-s,* '*mensium;*' from *usil,* '*sol,*' *usils,* '*solis;*' and from *suthi,* '*sepulcrum,*' *suthi-thi,* '*sepulcro.*' The suffixes *-c* and *-m* are enclitic conjunctions—thus, *vel. sethre puiac* is the epitaph of 'Vele Sethre and wife,' and *arnth vipis serturis puiac mutainei* that of 'Arnth (son of) Vipi Serturi and (his) wife Mutainei.' According to Dr Pauli, *mi* means 'this,' or 'this is;' while *cehen, cen,* or *ecn* means 'here.' The meaning of several substantives, in addition to those already cited, has also been determined with tolerable certainty.

Coming to the verbs, *am-ce* certainly means '*fuit,*' while *ma* appears to be '*est.*' The 3d pers. sing. of the perfect tense ended in *-ce,* and of the present in *-e.* We have *tur-e,* '*dat;*' *tur-ce,* '*dedit;*' *ar-ce,* '*habuit;*' *tham-ce,* '*extruxit*' *sval-ce,* '*obiit;*' *lupu-ce,* '*decessit.*' Thus, *clenar zal arce* is '*filios tres habuit,*' and *ramtha matulnei sech marces matulnas puiam amce sethres ceisinies* may be translated 'Ramtha Matulnei was the daughter of Marce Metulna, and wife of Sethre Ceisinie.' These examples may serve to show that the once apparently hopeless task of translating the Etruscan inscriptions is at last in a fair way of being accomplished.

Religion.—The Etruscans were proverbially a religious people—'*gens ante omnes dedita religionibus*'—'*genitrix et mater superstitionis Etruria.*' Their tombs bear witness to a belief in a future life, and a dread of the malignant power of their deities. Affairs of state were regulated by the decisions of colleges of haruspices and augurs, who interpreted, according to established rules, omens and portents obtained from the inspection of the

entrails of victims, the flight of birds, and from lightning, of which twelve kinds were distinguished. Varro, Cicero, and Martianus Capella have described the methods of divination, as laid down in the *libri disciplinæ Etruscæ*. The heavens were regarded as the *templum* of the gods, and were divided into sixteen regions, in each of which one or more of the gods presided or resided. By ascertaining the precise 'region' in which an omen, such as a flash of lightning, occurred, the fulgurators determined the name of the god who sent the message, and interpreted it in accordance with his functions. Those gods who possessed the power of sending lightning were called the Novensiles, or 'Thunderers.' In the museum at Volterra is an effigy of an augur, holding in his hand the instrument by which these observations were made, and a real specimen of the instrument has actually been discovered near Piacenza. It is a bronze model of the liver of a calf, which must have been used like a sextant. Beginning with the north, the rim is divided into sixteen compartments, in each of which the name of one of the gods is engraved. The heavens were observed through apertures which correspond to the blood-vessels which supply the liver. One side of the instrument is dedicated to the sun, the other to the moon, probably for observations by day or by night. The protuberance called the *lobus Spigelii* was the 'mount of the gods,' and the gall-bladder was dedicated to Neptune. The names of the deities inscribed on this curious instrument, coupled with the account of Martianus Capella, have supplied unexpected information as to the Etruscan Pantheon, and this is supplemented by the names appended to the deities in the mythological subjects painted on the walls of tombs, or engraved on the backs of those polished bronze mirrors of Etruscan ladies, so many of which have come to light. In many cases the subjects are taken from the Greek mythology, and the names are merely those of Hellenic or Italic deities, conformed to the phonetic laws of Etruscan spelling. Such are Ani (Janus), Uni (Juno), Maris (Mars), Apulu (Apollo), Nethuns (Neptune), Ercle (Hercules), Menrva (Minerva), Velch (Vulcan), Satre (Saturnus), Artumes (Artemis), Letun (Latona), Vetis (Vedius), Silvans (Silvanus), Aita (Hades), Phersipnei (Persephone), and Charu (Charon). But besides these borrowed names there are a host of genuine Etruscan deities, such as Tinia, who answers to Jupiter, Laran to Mars, Fufluns to Bacchus, Sethlans to Vulcan, Turan to Venus, Turms to Mercury, Thalna to Juno, Thana to Lucina, Thesan to Aurora, while the sun and the moon were called Usil and Lala. Of other deities no analogues have been found in the Greek or Roman Pantheon. Lasa and Mean seem to be recording Fates; Epiur, Snenath, Munthuch, and Malavisch to be guardian spirits; Tuchulcha, Asira, Nathum, and Tarsu avenging Furies; Vanth, Leinth, and Culsu conductors of souls or deities of the tomb. More obscure are the functions of beings called Racuneta, Talitha, Tethum, Thufla, Mlacuch, Achuvitr, Tipanu, Sitmica, and Ethausva. If anything were wanted to prove that the Etruscan mythology differed from that of all Aryan, Semitic, and Hamitic nations, this strange list of names would be sufficient. Classical writers have assigned to the Etruscans other deities whose names are not found in inscriptions, and which may be Sabine, Umbrian, or Faliscan. Among them may be enumerated Mantus and Mania, king and queen of the under-world; Summanus, a god who ruled the night; Vertumnus, the god of autumn; Voltumna, whose temple was the meeting-place of the federated states; Nortia, the goddess of Fortune, in the doors of whose temple at Volsinii nails were driven to mark the successive years; and the Novensiles, a collective name for those gods who hurled thunderbolts.

Fig. 3.—Etruscan Mirror from Vulci, with Fufluns (Bacchus), Semla (Semele), and Apulu (Apollo).
Half size. After a Drawing by Mr George Scharf.

Civilisation.—The government was a loose federal union of the twelve cities or states, each ruled by magistrates annually elected from a class of hereditary sacerdotal nobles. The titles of these magistrates, Lauchme (Lucumo), Purtsvana (Porsena), and Marunuch, probably correspond to Consul, Imperator, and Curator. The position of the wife was high; she is the social equal of the husband, she takes her place at the feast, her tomb is sumptuously furnished, and descent through the mother is recorded even more uniformly than through the father. The reliefs on the Afuna sarcophagus at Palermo, in which a matron bids farewell to her sorrowing family, afford a touching proof of the affection with which the wife and mother was

regarded. Of the high civilisation attained by the Etruscans we have abundant proofs. Till the battle of Cumæ they were one of the three great naval powers of the Mediterranean. They excelled in medicine, astronomy, mining, metallurgy, and such engineering works as the construction of roads, tunnels, and chambered tombs. The walls of their cities, built of huge blocks, admirably fitted together without cement, remain to attest the skill of the artificers. The jewelry, of the Phœnician type, with patterns formed by soldering on minute grains of gold, is unrivalled. The skill of the bronze-workers is shown by the Chimæra and the statue of the Orator at Florence, by the Wolf in the Capitol at Rome, and by a magnificent lamp at Cortona. The earlier coins, which date from the 6th century B.C., show the influence of Asia Minor, while after the repulse of the Athenians in Sicily they are modelled on the coinage of Syracuse.

Many of the painted vases which have been found in such vast numbers in Etruscan tombs were either imported from Greece or made by Corinthian artists who had settled in Etruria, the subjects represented being drawn mainly from Greek mythology or the cycle of Homeric legend. Some of these vases may have been prizes won in the national games, and deposited in the tombs as cherished possessions of the deceased, together with his armour and his weapons. In like manner, the polished mirrors and jewelry of Etruscan ladies were commonly placed in their tombs. But the tombs are themselves the most characteristic works which the Etruscans have left behind them. They are of two kinds: the stone pyramid or cone with interior chambers, which is manifestly a survival of the tumulus, and the rock-cut chamber, which is a survival of the cave. But Etruscan tombs are not merely sepulchres; they are abodes for the spirits of the dead, constructed on the model of the abodes inhabited during life; they are provided with chairs and other furniture; useful and ornamental objects were deposited by the body of the deceased, while the walls were decorated with subjects from daily life, or scenes from the under-world. There is usually an antechamber in which the family could assemble at the annual funeral feast to do homage to the spirits of departed ancestors.

The best general work still is *Die Etrusker*, by K. O. Müller, edited by Dr Deecke (1877), supplemented by Deecke's *Etruskische Forschungen* and Pauli's *Etruskische Studien*. For inscriptions, see Fabretti, *Corpus Inscriptionum Italicarum;* Pauli, *Corpus Inscriptionum Etruscarum* (1893–1902); for tombs, Dennis, *Cities and Cemeteries of Etruria;* for mirrors, Gerhard's *Etruskische Spiegel*. See also Jules Martha, *L'Art Étrusque* (1888), and *La Langue Étrusque* (1913); Thomsen, *De la Langue Étrusque* (1899); Ridgeway, *The Early Age of Greece* (1901); Cameron, *Old Etruria and Modern Tuscany* (1909); Poulsen, *Etruscan Tomb Paintings* (1922).

Etruria, a village of Staffordshire, now in the county borough of Stoke-on-Trent. Here, in 1769, Josiah Wedgwood (q.v.) and Thomas Bentley (1731–80) opened their celebrated Etruria potteries, so named after the Etruscan ware.

Etruscans. See ETRURIA.

Etsch. See ADIGE.

Ettmüller, ERNST MORITZ LUDWIG, a learned German philologist, was born 5th October 1802, at Gersdorf, near Löbau in Saxony, and studied first medicine, next German philology and history, at Leipzig and Jena, in 1833 was called to the Zurich Academy, and in 1863 to the university there, as professor of German Literature. Here he died, 15th April 1877. Ettmüller contributed enormously to the knowledge of Middle High German and Middle Low German by his scholarly editions of the literary monuments in these dialects. In 1840 he edited *Beowulf*, in 1850 an Anglo-Saxon chrestomathy; in the following year appeared his much-valued *Lexicon Anglo-Saxonicum*. Ettmüller also studied old Norse literature, edited the *Vaaluspâ*, translations, and a Norse reading-book. He also published original verse, and *Herbstabende und Winternächte, Gespräche über Deutsche Dichtungen und Dichter* (3 vols. 1865–67).

Ettrick Water, a stream of Selkirkshire, rising on Capel Fell, and winding 32 miles northeastward, past Thirlestane Castle, Tushielaw, and Philiphaugh, till, after a total descent of 1500 feet, it joins the Tweed, 3 miles below Selkirk, and 5 from the influx of its chief affluent, the Yarrow. In Ettrick churchyard, towards the stream's source, lie Boston and Hogg the 'Ettrick Shepherd.' Ettrick Forest, erst so 'fair,' now treeless and pastoral, included all Selkirkshire, with parts of Peebles and Edinburgh shires. It was a favourite royal hunting-ground till James V.'s expedition against the Border thieves (1529), after which deer gave place to sheep. See Craig-Brown's *History of Selkirkshire* (1886).

Etty, WILLIAM, R.A., painter, was born at York, 10th March 1787, the son of a miller and spice-maker. For seven years he was apprenticed to a printer in Hull, working at art during every moment that could be spared from his uncongenial employment. In the beginning of 1806 he removed to London, where in 1807 he became a student in the Royal Academy schools; and for a year he was a pupil of Sir Thomas Lawrence. His progress was at first slow; he competed unsuccessfully for prizes and medals; but in 1811 his 'Sappho' was hung in the Royal Institution, and his 'Telemachus rescuing Antiope' found a place on the walls of the Royal Academy. In 1820 he produced 'Pandora,' followed by 'The Coral-finders' (1820) and 'Cleopatra's Arrival in Cilicia' (1821). In 1822 he spent eighteen months in Italy—to which he had made a very brief visit in 1816—studying the works of the great masters, especially the Venetians, upon whom his own practice as a colourist is very distinctly founded. Two years later he was elected A.R.A., and soon after he began a series of large subjects—'Woman pleading for the Vanquished' (1825), three scenes from the history of Judith (1827–31), and 'Benaiah' (1829), all of which were acquired by the Royal Scottish Academy, and now hang in the National Gallery of Scotland. In 1828 he attained full academic honours. Among his other chief works are 'Youth at the Prow and Pleasure at the Helm' (1832), in the National Gallery, London; 'The Sirens' (1837), in the Manchester Institution; and three subjects from the career of Joan of Arc, executed shortly before his death, which occurred at York, 13th November 1849. As a colourist Etty ranks at the very head of the English school. His painting of flesh is distinguished by the utmost richness, delicacy, and refinement, and the glowing, blending hues of his draperies and of his landscape backgrounds are in admirable harmony with his figures. His drawing is too frequently mannered and inaccurate, though it occasionally possesses style and distinction. He was an indefatigable student of the living figure, and some of his most exquisite works are studies executed in the Life School of the Royal Academy, which he attended during most of his life. See Autobiography in *Art Journal* (1849); and Life by A. Gilchrist (1855).

Étude, a term used in music to designate compositions intended either to train or to test the player's technical skill. It is applied equally to pieces written for the beginner as to those written for the skilled expert, no matter what his instrument be.

Etymology (Gr.), the investigation of the origin or derivation and of the original significa-

tion of words. It forms a subsidiary part of the science of comparative philology, and, though it has occupied the attention of the learned and the curious in every age, it is only within the 19th and 20th centuries that its study has been pursued on scientific principles. Ignorance, or what is still more dangerous, half-knowledge, has often suggested false etymologies, and many more have sprung from that excess of confident and self-sufficient ingenuity which will not take plain words like *beef-eater* and *welsh-rabbit* for what they are. Folk-etymology, properly so called, has played an important rôle in the development of languages. The words that the people have known from their infancy are for them things, but it is quite different with the new terms they meet. These arrest their curiosity, and, as they believe that every word has its signification, they seek for this, guided by resemblances of sound with words already known, and consequently reach conclusions often hopelessly distorted by false analogies. We see the same illogical process in the Old Testament interpretation of personal names, applied conveniently after the fact; in the Homeric explanations of the names of gods and men; in the quaint etymologies so common in medieval writers, and in such moderns as Thomas Fuller; in the vagaries of our Celtic topographers; and even in the pages of some modern dictionaries it is possible to find such a statement as that the English word *news* is derived from a certain conjunction of the points of the compass, N. E. W. and S. These whimsical etymologies were laughed at by Dean Swift, whose *ostler* = *oat-stealer*, was a stroke of genius, but have not yet disappeared; and, indeed, the modern Englishman's ideas of method in etymology are hardly at all beyond the point attained by the grammarians of Alexandria and by Varro among the Romans. It was the birth of philology and the study of the languages of the East that made a scientific etymology possible. It no longer sought the relations of the words of a single language exclusively within itself, but extended its view to the whole group of cognate tongues, or, wider still, to a whole family, and became a new science under the name of Comparative Grammar. Grimm's Law was the first finger-post that pointed out the path; among his greatest successors are Curtius and Fick. The Teutonic revival within England in the 19th century commenced the history of English upon an historical method, from which has grown a really scientific English etymology, as seen in the dictionaries of Skeat, Murray, and Weekley. No more useful chart of warning could be given than Professor Skeat's canons for etymology: 'Before attempting an etymology, ascertain the earliest form and use of the word, and observe chronology. If the word be of native origin, we should next trace its history in cognate languages. If the word be borrowed, we must observe geography and the history of events, remembering that borrowings are due to actual contact.' See Curtius, *Grundzügen der Griechischen Etymologie* (5th ed. 1879); Fick, *Vergleichendes Wörterbuch der Indo-germanischen Sprachen* (4th ed. Gött. 1890 *et seq.*); Karl Andresen, *Ueber Deutsche Volksetymologie* (6th ed. 1899); and A. S. Palmer's *Folk-Etymology* (1882).

Etymologicum Magnum is the name of a Greek lexicon, the oldest of the kind, professing to give the roots of the words. It appears to belong to the 10th century; the author's name is unknown. The etymologies are mere guesses, sometimes right, often wildly absurd; but the book is valuable, as containing many traditions and notices of the meanings of old and unusual words. There is an edition by Schäfer (Leip. 1816); one by Sturz, called *Etymologicum Gudianum* (Leip. 1818); and another by Gaisford (Oxford, 1849).

Etzel. See ATTILA.

Eu, a town in the French department of Seine-Inférieure, on the Bresle, 2 miles from its mouth, and 21 NE. of Dieppe by rail. It is remarkable for its fine 13th-century Gothic church, and for the Château d'Eu (1578), a low building of red brick, with high, tent-shaped roofs of slate. The seat from 996 of the Counts of Eu, a collateral branch of the Norman ducal line, after various vicissitudes Eu was purchased by Mademoiselle de Montpensier in 1675, whose fanciful taste has perpetuated itself in the decoration of the château; eventually, in 1821, it came to Louis-Philippe, who expended large sums on the embellishment of the château and its park, and who here received Queen Victoria in 1843. In 1874 Viollet-le-Duc restored it for the Comte de Paris. Pop. 6000.

Eubœa (ancient *Euboia*, Turk. *Egripo*, Ital. *Negroponte*), an island of Greece in the Ægean Sea, runs parallel to the mainland for 98 miles, its breadth varying from 30 miles at its widest part to barely 4 at its narrowest. Area, 1420 sq. m., or a little smaller than Suffolk. About midway along its west shore, near Chalcis, the strait (Euripus) separating Eubœa from the mainland contracts to 120 feet, and is spanned by two bridges, resting on a rocky islet in the middle. The island, which has its long axis disposed north-west and south-east, is traversed longitudinally by a chain of mountains, rising in the centre, in Mount Delphi, to an elevation of 5725 feet. Iron and copper occur in the mountains; and at Carystos, in the south of the island, the marble called *cipolino*, so largely used in the buildings of Rome, is quarried. Hot springs (sulphur) exist in the north. Although the east coast is steep and rocky, the west side of the island slopes gradually, and its pastures support numerous herds of swine, sheep, and goats, whilst the arable land produces wheat, oil, figs, and wine. Honey also is an important article of trade. The declivities of the mountains are covered with forests. The climate is salubrious. The chief towns are Chalcis (q.v.) on the west coast and Carystos (pop. 3000). Population of nome (including some smaller islands) 133,000, mostly Greeks and Albanians. Eubœa was peopled in early historic times chiefly by Thessalian tribes and by Ionic Greeks, and afterwards by colonists from Athens, who formed a number of independent cities or states. Of these the most powerful were the rival commercial cities of Chalcis and Eretria; and it is around them and their exploits that the history of the island for some centuries mainly concentrates itself. After the Persian wars, however, Eubœa was subjugated by the Athenians, under whose rule it continued till they, in their turn, were subdued by Philip of Macedon. By the Romans it was finally united with the province of Achaia under Vespasian. In 1351 it came into the possession of the Venetians, and received the name of Negroponte. In the year 1470 the island was taken by the Turks, in whose hands it remained till 1821, when the inhabitants rose to vindicate their independence at the call of the beautiful Modena Maurogenia. Subsequently (1830) it was incorporated in the kingdom of Greece.

Eucalyptus, a genus of Myrtaceæ, including about 200 species, which form the preponderant and most characteristic vegetation of the Australian forest. Their frequently enormous height (150–350 feet), their entire leathery glaucous leaves, which turn vertically with their edges to the sun, and so cast no shadow, and their frequently ragged bark and peculiar aromatic odour combine to give a unique and unmistakable character. Many species are known as gum-trees, from their resinous exudations. The Blue Gum Tree of Tasmania (*E. Globulus*) is best known in Europe as a hygienic agent in malari-

ous situations, and has been planted extensively in Italy, &c. Its value is ascribed to its rapid growth (sometimes over 10 feet per annum), and the consequent drainage of the soil. Eucalyptus leaves yield essential oils on distillation. Oils rich in eucalyptol are used therapeutically, those with less are best for extracting minute particles of minerals from 'tailings' of mines. The culture of Eucalyptus has also been introduced with good results into Algeria, Mexico, the Cape, &c. The Red Gum Tree (*E. rostrata*) yields a red astringent resin, once known as Botany Bay Kino; and *E. robusta*, the Swamp Mahogany Tree, has also a beautiful red gum. *E. viminalis* yields a copious

Eucalyptus Amygdalina.

sweet exudation from its bark and leaves, which is sold as Eucalyptus manna, and resembles genuine Manna (q.v.) in properties. That of the South Australian Mallee, *E. dumosa*, is also gathered for food from the ground, on which it lies like hoar-frost. *E. amygdalina* (a 'Peppermint') is remarkable both for height and girth. The timber of the Iron-bark (*E. paniculata*) is much used in shipbuilding and engineering, and is peculiarly suitable for girders, being of great strength and durability. Probably the most widely used species are the Western Australian Jarrah (*E. marginata*) and Karri (*E. diversicolor*), the former especially valuable for piles and sleepers, the latter for bridge-decking, and both for street-paving. The bark of some species is useful as a source of tannin; whilst a liqueur made of Eucalyptus is drunk in Italy. The seeds were first sent from Melbourne to Paris by M. Ramel in 1854. See TIMBER, WESTERN AUSTRALIA, Warren's *Australian Timbers* (1900), and J. H. Maiden's *Critical Revision of the Genus Eucalyptus* (1903, &c.).

Eucharist. See LITURGY, LORD'S SUPPER.

Euchlorine is a very explosive green-coloured gas, possessing bleaching properties, and is prepared by the action of strong hydrochloric acid on chlorate of potash. It is dangerously explosive by heat, and its composition is still a matter of discussion. It is generally supposed to contain chlorine peroxide and free chlorine.

Euchre, a game at cards, very popular in America, but not played until the first quarter of the 19th century. Euchre is played with a pack of thirty-two cards (all cards below a seven being rejected). The cards rank as at whist, with the exception of the *bowers*. Knave of the trump suit (*right bower*) is the best trump; knave of the same colour (*left bower*) is the next best, that card belonging to the trump suit. Each player receives five cards from the dealer, by two or three at a time, the top card being then turned up for trumps. When two play, the non-dealer either *orders up* the trump, and plays his hand, or *passes*. If he orders up, the dealer discards a card, and substitutes the trump card for it. If he passes, the dealer either *takes up* the trump (discarding as before), and the hand is played, or *passes*. This he signifies by turning down the trump. If both pass, the non-dealer may name any other suit for trumps (called *making it*), or may pass again. If he passes, the dealer may make it. If either makes it, the hand is then played; if both pass again, the hand is thrown up, and the opponent deals. If the hand is played, the non-dealer leads; the dealer plays, and must follow suit, if able. The highest card wins the trick; trumps win other suits, and the play continues as at whist. A player ordering up, or taking up, or making the trump, and winning five tricks (called a *march*), scores two; if he wins three tricks (called the *point*), he scores one. If he fails to make three tricks, he is *euchred*, and his adversary scores two. The game is five up. When four play, they cut for partners, as at whist. If the first hand passes, the second may *assist*, when his partner (the dealer) takes up the trump, and the hand is played. If a player has a very strong hand, he may *play alone*—single-handed against both adversaries; and if a lone player wins five tricks, he scores four. Euchre is sometimes played by three persons (*cut-throat euchre*); but the game most in vogue among good players is the four-handed.

Eucken, RUDOLF CHRISTOPH, born 5th January 1846 at Aurich in East Friesland, studied at Göttingen and Berlin, and became professor first at Basel and then, in 1874, at Jena. Like Bergson's, his philosophy is an 'activism' nearer the ethical idealism of Kant and Fichte than the intellectualism of Hegel, and is the struggle for the spiritual control of life, a vindication of the significance and worth of life; man being a co-worker with the divine. He would end the conflict between religion and modern culture in a new idealism. Most of his principal works have been translated, e.g. *The Problem of Life* (1909), *The Life of the Spirit* (1909), *Life's Basis and Life's Ideal* (1910), *Main Currents of Modern Thought* (1912), *Present-day Ethics* (1913), *Collected Essays* (1914), *Socialism* (1921), and *Rudolf Eucken: his Life, Work, and Travels* (1921). See *Eucken*, by A. J. Jones (1912).

Euclid is known to us almost exclusively from those of his works which have survived. Proclus in his commentaries on the first book of the *Elements* mentions that Euclid lived in the time of Ptolemy I. of Egypt, that he was younger than Plato, but older than Archimedes and Eratosthenes. Hence 300 B.C. may be taken as an approximate date for the middle of his career. He taught in Alexandria, and probably was the founder of its illustrious mathematical school. His chief extant work is the *Elements* in thirteen books. Books i.–iv. and vi. treat of plane geometry; v. of proportion in general; vii.–ix. of the properties of numbers; x. of incommensurable magnitudes; xi.–xiii. of solid geometry. Besides the *Elements*, there are the *Data*, a collection of geometrical theorems, and the *Phænomena*, or appearances of the heavens. Regarding the genuineness of the *Section of the Scale*, *Introduction to Harmony*, *Optics*, *Catoptrics*, and *Divisions of Superficies*, commentators are divided in opinion, though they lean rather to the view that most if not all of these writings are spurious. Some other works not now extant are attributed to Euclid. The only one of any importance was the treatise on *Porisms*. Euclid's *Elements*

has been translated into many languages, and is probably better known (or was till lately) than any other mathematical book. With many of its blemishes removed and its deficiencies supplied, was widely used in Britain as a text-book of geometry after it had long been almost universally given up in Europe and America.

The first printed edition of Euclid was a translation from Arabic into Latin, which appeared at Venice in 1482. The first printed Greek text was published at Basel in 1533. Gregory's edition (Oxford, 1703) contains all the works attributed to Euclid. Standard modern editions are those of Heiberg (5 vols. Copenhagen, 1883–88), and T. L. Heath (3 vols. 1908–9). For an account of what the Greeks had done in geometry before Euclid's time, and for Euclid's own achievement, see Cantor's *Geschichte der Mathematik* (1880-92); W. B. Frankland's *Story of Euclid* (1902); Dodgson's *Euclid and his Modern Rivals* (1879); and Perry on *The Teaching of Mathematics* (1901).

Euclid of Megara, a Greek philosopher, who has often been confounded with the mathematician of the same name. He was one of the chief disciples of Socrates, but had previously studied the dialectics of the Eleatics; on one occasion Socrates declared that his pupil's subtle logic might win sophists, but never men. After the death of his master (399 B.C.), Euclid established a school of his own, which received the name of the Megaric School. The basis of his system was the Eleatic dogma of a one, only, universal existence; and, blending with this the Socratic idea of the predominance of the moral element, Euclid held this one real existence to be the *Good*, though it receives various names under its special manifestations.

Eudæmonism, the doctrine that happiness (Gr. *eudaimonia*) is the chief good. See ETHICS.

Eudiometer. See GASES.

Eudocia, the name of several Byzantine princesses. Of these the most celebrated was the wife of Theodosius II. Pulcheria, the emperor's sister, who from her sixteenth year (414) had directed the government under the weak-minded emperor, chose Athenais (born 401), the beautiful and accomplished daughter of an Athenian sophist Leontius, to be her brother's wife. She renounced paganism, took the name of Eudocia, and was married to Theodosius in 421. Soon afterwards a violent rivalry arose between the two sisters-in-law. On the outbreak of the Nestorian controversy, Eudocia took the side of Nestorius, and Pulcheria, conspiring with Cyril of Alexandria, brought about his fall. During the last four years of Theodosius, Pulcheria was banished from the court, and the doctrines of Eutyches (q.v.) and Dioscuros—the opposite of Nestorianism—were victorious at the 'Robber Synod' of Ephesus (449) through the influence of Eudocia. But shortly before the emperor's death (450) Pulcheria regained her former influence, while Eudocia fell into disgrace and retired to Jerusalem, where she spent the remainder of her life in works of piety and charity, and died in 460. Eudocia wrote a panegyric on the victories of Theodosius over the Persians, paraphrases of Scripture, and a poem on the legend of St Cyprian. The *Homero-cento* on the Life of Christ (consisting of 2343 hexameters made up of verses and half-verses culled from Homer), doubtfully attributed to her, was edited by Teucher (1793). See BYZANTINE EMPIRE; and Miss Teetgen, *The Empress Pulcheria* (1907).

Eudoxus of Cnidus, called by Cicero the prince of astronomers, flourished about 370 B.C. He studied under Plato for some time, and afterwards went to Egypt, where he derived much knowledge from the priests. He is said to have introduced an astronomical system of homocentric spheres into Greece, and the year of 365½ days, likewise to have distinguished true astronomy from astrology.

Euganean Hills, a range of well-wooded hills, with a north and south axis, lying SW. of Padua in northern Italy. They owe their origin to eruptions of trachyte during the Jurassic period. The highest point, Monte Venda, reaches 1749 feet. On their slopes stand several villas, amongst them Petrarch's house at Arquà.

Eugene, PRINCE. François Eugène, commonly called Prince Eugene of Savoy, one of the greatest generals of his time, was born at Paris, 18th October 1663. He was the youngest of the five sons of Eugene Maurice of Savoy-Carignan, Count of Soissons (grandson of the Duke of Savoy, Charles Emmanuel I.), and of Olympia Mancini, a niece of Cardinal Mazarin. He was intended for the church, but had a strong predilection for the camp, and, after his father's death (1673), his mother's banishment from court by command of the young king Louis XIV., and the latter's refusal to give him a commission, he indignantly renounced his country, and at twenty entered the service of the Emperor Leopold as a volunteer against the Turks. He early displayed extraordinary courage and tactical talent in the Turkish war, especially at the famous siege of Vienna in 1683, and rose rapidly in rank. In the Coalition War against Louis XIV. in Italy, he covered himself with the glory peculiar both to the soldier and the general; he became field-marshal in 1693, and overwhelmed the Turks, who left 30,000 dead on the field, in the famous battle of Zenta, September 11, 1697, which put an end to their power in Hungary. The outbreak in 1701 of the Spanish War of Succession recalled him to the command of the army of Italy, but though he displayed a strategy worthy of Hannibal, inflicted several severe defeats upon the French, and even captured the Duke of Villeroi in Cremona by a daring night-attack, he was prevented from effecting anything of importance by the smallness of his own forces and the skilful tactics of the Duke of Vendôme, who inflicted upon him a severe defeat at Luzzara (15th August 1702). Becoming in 1703 president of the council of war, he took the command of the imperial army in Germany, and helped Marlborough to gain the brilliant victory of Blenheim (13th August 1704). Eugene was checked at Cassano (August 16, 1705) by Vendôme, and twice wounded in the field, but after a daring march appeared before Turin and crushed the French in a complete defeat which closed their career in Italy. He shared with Marlborough the glory of the fields of Oudenarde (in 1708) and Malplaquet (in 1709); but, being crippled in his resources by the retirement of Holland and England from the contest, he was unable to withstand the enemy on the Rhine, and his defeat by Villars at Denain (24th July 1712) was followed by other disasters, until the peace of Rastadt (6th March 1714) put an end to the war. On the recommencement of the war (in 1716) against the Turks, Eugene with but 64,000 men defeated an army of 150,000 men at Peterwardein, took Temesvar, and in the year 1717, after a desperate battle, carried Belgrade by assault. He had already lain for a month before the city contending against dysentery and a force six times his own, when he determined to stake everything upon a general attack. In the bloody struggle Eugene received his thirteenth wound.

After the peace of Passarowitz (21st July 1718), he returned covered with glory to Vienna, where, during the succeeding years of peace, he laboured with unwearied energy in the cabinet. When the question of the succession to the throne of Poland brought on a new war with France, Eugene appeared again on the Rhine, but owing to insufficient resources and failing vigour he was unable to do more than keep the enemy out of Bavaria. After the peace, he returned to Vienna, where he died,

21st April 1736. Prince Eugene was of middling stature, his face thin and long; his eager dark eyes alone revealed the vigour of his nature. His dress was plain and simple like his manners; he had no passion but that of glory; no appetite save an inveterate relish for snuff. Although a strict disciplinarian and a general who risked his soldiers' lives as freely as his own, he was worshipped by his men, and he has gone down to posterity as a hero in popular song. As 'Prinz Eugen, der edle Ritter,' his memory is green with thousands who never heard of his campaigns. He introduced no new tactics in the art of war, and was deficient in the guidance and command of masses; but by his rapidity of perception and decision, and faculty for turning to instant advantage existing circumstances, he raised the prestige of the Austrian arms to an eminence unequalled before or since his time. He successively served under three emperors, of whom he was wont to say that in Leopold I. he had a father, in Joseph I. a brother, and in Charles VI. a master. Compare Dumont, *Histoire Militaire du Prince Eugène* (with continuation, 1823–29), and the monographs of Kausler (1838–39), Arneth (1858–59), Von Sybel (1861), and Col. Malleson (1888).

Eugenia, a genus of Myrtaceous trees and shrubs, allied to the myrtle, pimento, and clove. See MYRTACEÆ, PIMENTO, CLOVE.

Eugenics.—The word eugenics is derived from the Greek word *εὐγενής*, which is defined in Liddell and Scott as meaning well-born. The word was first used by Francis Galton, the founder of the science, in *Inquiries into Human Faculty*, which was published in 1883 by Macmillan, and reprinted later in the 'Everyman's Library.' On p. 17 of the reprint the word occurs in the following sentence, 'Its (i.e. the book's) intention is to touch on various topics more or less connected with that of cultivation of race, or, as we might call it, with "eugenic" questions,' and in a footnote to the word 'eugenic' we find the following definition, 'That is, with questions bearing on what is termed in Greeke *ugenes*, namely, good in stock, hereditarily endowed with noble qualities. This, and the allied words, *eugeneia*, &c., are equally applicable to men, brutes, and plants. We greatly want a brief word to express the science of improving stock, which is by no means confined to questions of judicious mating, but which, especially in the case of man, takes cognisance of all influences that tend, in however remote a degree, to give to the more suitable races or strains of blood a better chance of prevailing speedily over the less suitable than they otherwise would have had. The word *eugenics* would sufficiently express the idea.' The word occurs at least four more times in the course of this book: (1) on p. 19, 'In any scheme of eugenics, energy is the most important quality to favour;' (2) on p. 30, 'The investigation of human eugenics—that is, of the conditions under which men of a high type are produced—is at present extremely hampered by the want of full family histories, both medical and general, extending over three or four generations. There is no such difficulty in investigating animal eugenics . . . Believing, as I do, that human eugenics will become recognised before long as a study of the highest practical importance, it seems to me that no time ought to be lost in encouraging and directing a habit of compiling personal and family histories;' (3) on p. 199, 'The most merciful form of what I ventured to call "eugenics" would consist in watching for the indications of superior strains or races, and in so favouring them that their progeny shall outnumber and gradually replace that of the old one;' (4) on p. 211 there is a section dealing with 'Marks for Family Merit,' in which the subject of the possible improvement of race being undertaken by man is considered. It is regarded at the moment as Utopian, but Galton proceeds to sketch out faintly 'some sort of basis for eugenics.'

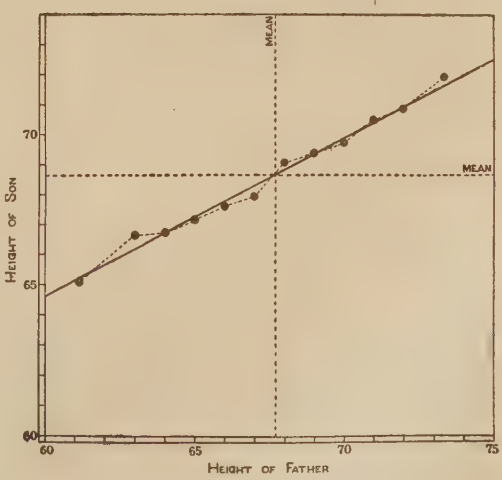
The ideas here expressed were far in advance of the age, and, though evidently much in Galton's mind, it was nearly twenty years before he again brought the subject of eugenics as a possible science before the public. In 1901 Galton gave the second Huxley Lecture, which was entitled, 'The Possible Improvement of the Human Breed under the Existing Conditions of Law and Sentiment' (*Nature*, vol. lxiv. p. 659 *et seq.*). This lecture was described by Galton as an attempt to 'induce anthropologists to regard human improvement as a subject that should be kept openly and squarely in view, not only on account of its transcendent importance, but also because it affords excellent but neglected fields for investigation.' He goes on to show that the natural character and faculties of human beings vary, and that though talents are distributed in different degrees, the frequency of those degrees follows certain statistical laws, of which the best known is the Normal Law of Frequency. He deals with the question of marriage of like to like in each class of society, and points out how qualities descend in a population, and how the intelligence of a community could be raised by concentrating attention on the more intelligent members of it and securing them as parents. He says that among the Utopias in which he had indulged was one of a great society 'publishing intelligence and memoirs, holding yearly elections, administering large funds, establishing personal relations like a missionary society with its missionaries, keeping elaborate registers and discussing them statistically with honest precision;' but Galton felt at the same time that a crusade in favour of race improvement must be justified, and an unbiased scientific inquiry along many roads must be started with that end in view. Throughout this lecture the word eugenics never occurs, but in 1904, at a meeting of the Sociological Society, Galton gave a paper on 'Eugenics: Its Definition, Scope, and Aims' (*Sociological Papers*, vol. i. p. 45 *et seq.*; *Essays in Eugenics*, by Francis Galton, the Eugenics Education Society, 1909, p. 35), in which he defined eugenics as 'the science which deals with all influences that improve the inborn qualities of a race, also with those that develop them to the utmost advantage.' Galton considered that there were three stages to be passed through before eugenics could be regarded as of national importance: (1) It must be made familiar as an academic question; (2) it must be recognised as a subject whose practical development deserves serious consideration; and (3) it must be introduced into the national conscience like a new religion. It was obvious from the discussion that followed the paper that the first stage was very far from being passed, and towards the end of 1904 Galton offered to found a fellowship for the study of 'National Eugenics' in connection with London University. In 1905 the first Galton Fellow, Mr Edgar Schuster, was appointed, and a 'Eugenics Record Office' was started. In this same year Galton gave three further papers before the Sociological Society, 'Restrictions in Marriage,' 'Studies in National Eugenics,' and 'Eugenics as a Factor in Religion' (*Sociological Papers*, 1906, vol. ii. p. 3 *et seq.*), in which he dealt with points that had been raised by his former paper on eugenics, and discussed possible lines of inquiry.

In 1907, when the term of Mr Schuster's office as Fellow was ended, Galton, with the consent of the University of London, decided to form the Francis Galton Laboratory for the Study of National Eugenics, which was to be under the supervision of Professor Karl Pearson, the director of the

biometric laboratory, in consultation with Francis Galton. Mr David Heron was appointed the second Galton Research Fellow, and a Francis Galton Scholar and a computer were added to the staff. By attaching his new laboratory to the biometric laboratory, Galton emphasised what he regarded as a very important point, that the science of eugenics should use what were then the new methods of statistical analysis associated with the word biometry and the journal of *Biometrika*, and in that same year he took as the title of his Herbert Spencer Lecture, *Probability, the Foundation of Eugenics* (1907). He there gives what he describes as 'Object-lessons in the Methods of Biometry,' since popular ignorance of biometry obstructs the path of eugenics. Galton felt that probability could yield results sufficiently exact to afford a foundation for eugenic action, but that such action would only be possible if public opinion were behind it, and that much research must be carried out before the necessity of legislative or other action could be made clear and conclusive to public opinion. In 1911 Francis Galton died, and left the residue of his estate to the University of London for the establishment of a professorship and laboratory of National Eugenics, and expressed the wish that the post of first Galton professor should be offered to Professor Karl Pearson on such conditions as 'will give him liberty to continue his biometric laboratory.' The study of national eugenics in the will was defined as the study 'of the agencies under social control that may improve or impair the racial faculties of future generations physically and mentally.' In the meantime interest in eugenics had been spreading. Galton's papers given to the London Sociological Society were reprinted in *The American Journal of Sociology* (Chicago, 1904–5, vol. x. pp. 1–25, and vol. xi. pp. 11–25), and translations in German were published in the *Archiv für Rassen und Gesellschafts-Biologie* (Berlin, 1905, vol. ii. p. 812 *et seq.*). Dr Alfred Ploetz, one of the editors of that journal, gave much encouragement to the new science, and in 1905 founded a society, 'Internationale Gesellschaft für Rassen-Hygiene,' to carry out research in inheritance and variation, and to make the results public. In England the Eugenics Education Society was founded in London in 1907–8, the rules of the society were approved at a meeting held in December 1907, the first general meeting of the society was held in February 1908, and the first number of the journal of this society, *The Eugenics Review*, was published in April 1909. Branches of the Eugenics Education Society were soon started in various towns in the United Kingdom and in the colonies. A 'Eugenics Record Office' was established in New York in October 1910, and issued its first report in 1913. In Germany eugenics does not seem to have become a popular word, and 'race hygiene' was generally substituted. Branches of the international society for race hygiene grew up in other places in Germany and in Sweden, and a joint general meeting of the Deutsche and of the Internationale Gesellschaft für Rassen-Hygiene was held in Dresden in 1911. The first International Eugenics Congress was held in London in July 1912, under the auspices of the Eugenics Education Society. The subject found its way into many journals in all countries. In Italy Professor Gini, Professor Sergi, and others published their papers mainly in the *Rivista Italiana di Sociologia* (Rome) and in the *Rivista di Antropologia* (Rome). In France 'La Société Française d'Eugénique' was founded, and published the first number of its journal *Eugénique* in 1913, but many papers had appeared previously in various journals, and French interest in eugenics is of an earlier date. A new journal, *Archiv für Frauenkunde und Eugenik* (Würzburg), edited by Dr Max Hirsch, was first published in March 1914. In the Scandinavian countries interest in biometric and eugenic inquiries was aroused, practical suggestions for race improvement were made, and papers on race hygiene were published at an early date, and books were issued by Professor J. A. Mjöen (Kristiania, 1915), and by Dr Lundborg (Stockholm, 1914).

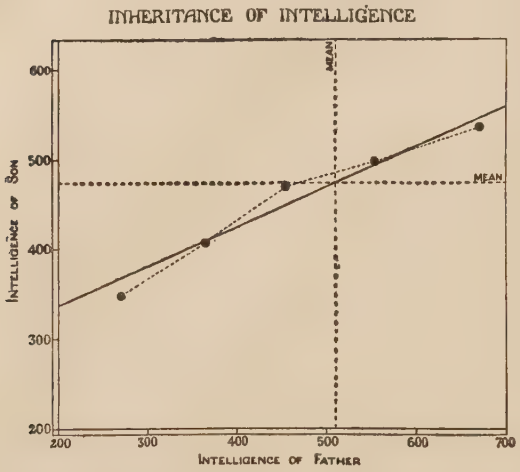
The need of a science of eugenics does not exist in any state in an early stage of development. When the very existence of man depends on his own strength and power to look after himself, which means, broadly speaking, on his physical condition and mental soundness, only the stronger will survive, and natural selection, by weeding out all who fall much below the average, keeps a race healthy physically and mentally. On the other hand, when man with increasing civilisation develops a social conscience which expresses itself in sympathy with weakness, in caring for the diseased in mind and body and with those unable to battle for themselves, and further, when increasing medical knowledge enables some who left to nature would die early, to live, to marry, and to have children, then natural selection is partially suspended, and race improvement, if it is to come at all, must be undertaken by man. Those who believe in the necessity for eugenics are influenced chiefly by three factors—by a belief in the power of heredity, by the knowledge that fertility is greatest among the less desirable members of the community, and, thirdly, by the belief that natural selection is largely suspended. It is in the conjunction of the three that the danger for the race exists. The strength of heredity in physical and mental characteristics is now well established owing mainly to the work of Francis Galton and Karl Pearson. The characteristics of a child are determined by the presence or absence of those same characteristics in the parents and family of the child. Using the mathematical theory of statistics, we can determine not what will happen to the next child of any one particular marriage, but what will happen on the average to the children of a certain type of parent. Given sufficient information about the two families that are intermarrying, it is possible to foretell the sum of good or evil that such a marriage will mean for the children. The fuller the family history, the more nearly we can predict what the result

INHERITANCE OF STATURE



of any marriage will be. The two diagrams show the inheritance of stature and intelligence between father and son, and from the data we can determine not only what the average height and intelligence

of the sons of a certain type of father may be, but also the limits within which the sons of a given father are likely to be found. If the average height of a father be 65 inches, and nothing is known about the mother, we can state that the average



height of the sons of all such fathers will be 67·2 inches, and that 75 per cent. of the sons will be found to be not less than 64·1 inches and not more than 70·3 inches in height; but if the father is 6 feet, we can say that the average height of sons of this type of father will be 70·9 inches, and that 75 per cent. of the sons will be found to be not less than 67·8 inches or more than 74 inches in height. If we take the inheritance of intelligence in middle-class families in which no parents of very low grade of intelligence are included, and measure that intelligence in units, which can be called mentaces, we find that the average number of mentaces possessed by these fathers is 510, and that the groups vary from 'slow' fathers who have an average of 269 mentaces, to the very able who have an average of 672 mentaces. Fathers whose intelligence is measured by only 269 mentaces will have sons who on the average have 348 mentaces, and we can say in round numbers that 87 per cent. of their sons will have less than 457 mentaces, that is to say, will be well below the average intelligence of this community; while, if the father's intelligence is measured by 672 mentaces, the average for the sons will be 535, and 87 per cent. of these sons will have more than 426 mentaces. The pedigree of an able family, reproduced by permission from a lecture by Professor Pearson on *The Scope and Importance to the State of the Science of National Eugenics* (Eugenics Laboratory Lecture, series i.), illustrates the inheritance of intelligence in another way; and pedigrees showing the inheritance of commercial and legal ability will be found in the first volume of the *Treasury of Human Inheritance*, another publication of the Eugenics Laboratory. General health and many diseases are inherited in practically the same degree as stature and intelligence. The following pedigrees of mental defect and deaf-mutism are reproduced, by permission, from the *Treasury of Human Inheritance* (Eugenics Laboratory Memoirs,

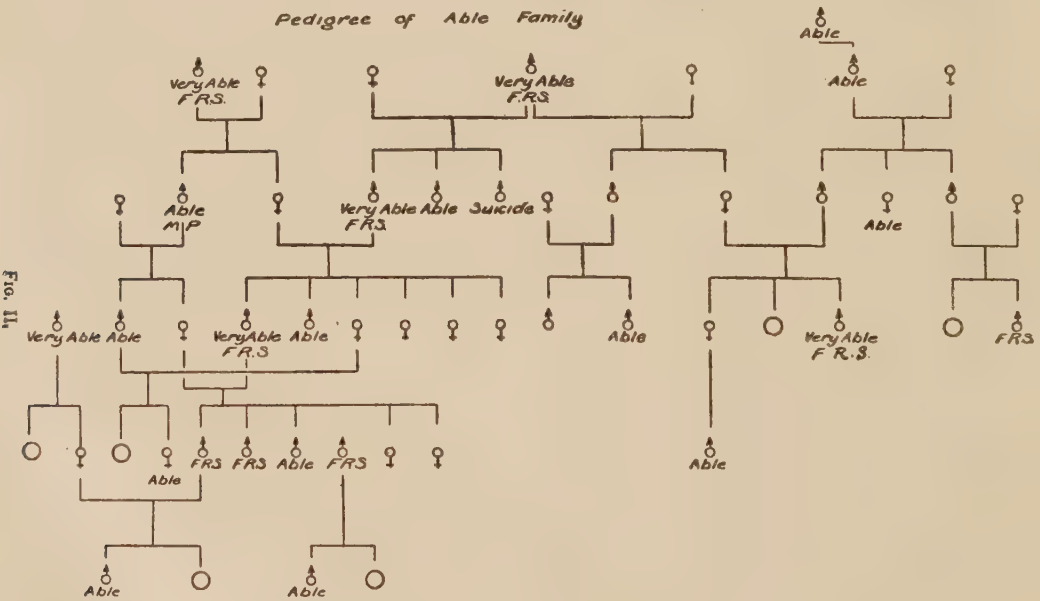
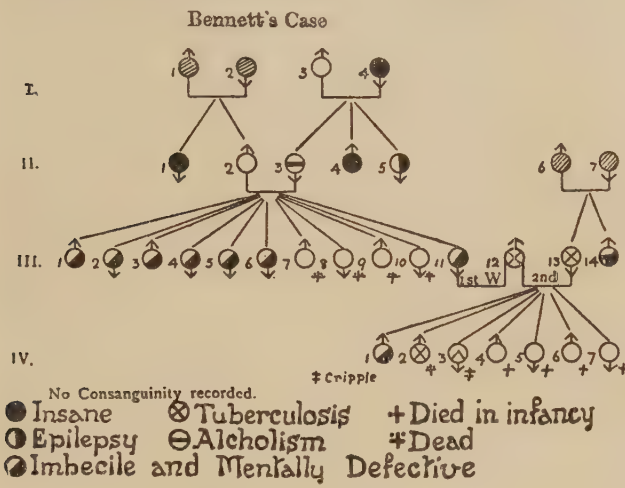


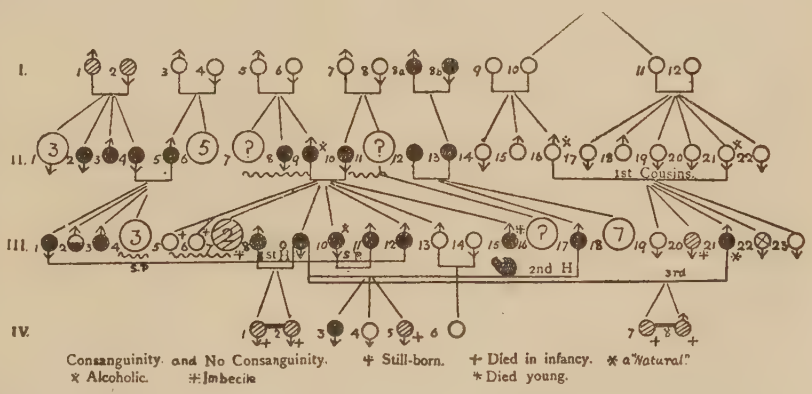
FIG. 11.

series ix. and xi. part iii. plate xix. fig. 177, and part iv. plate xxvii. fig. 273). Fig. 177 illustrates the inheritance of mental defect. In the second generation a normal man, of whose parents nothing is known, but who had an insane sister, married an alcoholic 'dull' woman, daughter of an insane woman, and sister of an insane man and of an epileptic woman. Of the children of this marriage, seven were imbecile or mentally weak and four died young. The youngest daughter married a tuberculous man, and fortunately there were no children. The other pedigree shows the inheritance of deaf-mutism. In the first generation two deaf-mutes (I. 8*a* and 8*b*) married, and had a deaf-mute child, who married a deaf-mute, and had seven normal children and one deaf-mute son, who married a deaf-mute woman as her second husband, and had three children, the eldest deaf-mute, the second normal, and the third died aged five months, condition unknown. In the second generation in this pedigree there were three marriages of deaf-mutes, resulting in the birth of seven deaf-mutes and one person partially deaf. These pedigrees are only two out of thousands collected and published in

the *Treasury of Human Inheritance*, and in other publications, such as *Menschliche Erblichkeitslehre*, by Erwin Baur, Eugen Fischer, and Fritz Leny (München, 1923), showing the force of heredity; Galton's followers feel that in this direction the first stage is passed, and that heredity in mental and physical characters is sufficiently familiar as an academic question, and must now be made a living force in the national conscience. If we accept the inheritance of human characteristics, then it is obvious that if any one group in the community has a greater fertility than any other group rapid changes may and must take place in the constitution of the race unless some other force steps in. That force has been in the past the selective death-rate, and probably in the very early stages of development the selective marriage-rate, but the latter is difficult to measure. Each generation depends on a relatively small percentage of those born in the previous generation. Owing to emigration and to the lack of full information about married people, it is impossible to follow the children born in England in any one year, and say how many live to adult life, and how many marry and what children they have; but various estimates have been made, and in round numbers it seems likely that half the people born in one year either die before they become adult or do not marry (see *The Chances of Death*, by Karl Pearson, 1897, vol. i. chapter iii.; and *The Groundwork of Eugenics*, Eugenics Laboratory Lecture, series ii., p. 28, footnote). Of the half who do marry, roughly a quarter of the marriages produce half the children in the next generation. The following figure, taken from the statistics of Danish marriages, illustrates the point.



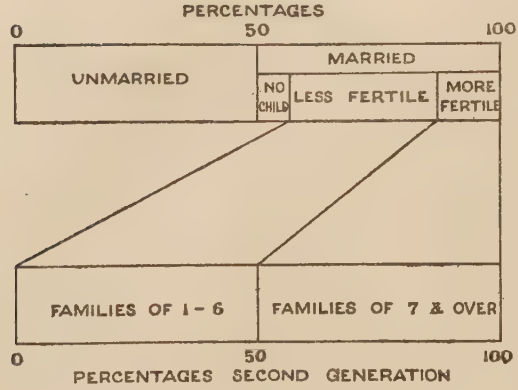
Roughly, 50 per cent. of the first generation die unmarried, 8 per cent., though married, have no children, and the remaining 42 per cent. are responsible for the whole of the next generation, but not in equal proportions, for half the next generation are the children of 29 per cent., and the other half of 13 per cent., of the original generation. It is more difficult to obtain information for England with regard to the number of women who marry, but the estimates made in Denmark will probably not be very different from the conditions existing in England in 1911. In the census for England and Wales for 1911 the fertility of marriages is obtainable; and if we take only those in which the wife had reached the age of forty-five years or over, and consider that we are dealing with completed families, we obtain a diagram very similar to that found for Denmark, and find that roughly a quarter of the married people in one generation produce half the next generation. It is obvious from this that if the quarter of the married people who are more fertile belong to the less desirable members of the community, a very rapid deterioration may set in. If we consider the extreme case, and suppose that the 25 per cent. who are having seven or eight or more children belong entirely to those who are of slow or very dull intelligence, and that they marry people of the same type, then in the third generation, instead of having 25 out of every 100 slow or very dull people, we should have 50, and in four generations we should have 96 out of 100 with this type of intelligence (see *Groundwork of Eugenics*). This has not happened; but that something of the kind has been happening has been shown by David Heron in his paper *On the Relation of Fertility in Man to Social Status* (Drapers' Company Research Memoirs, Studies in National Deterioration, No. 1), by W. C. D. and C. D. Whetham in *The Family and the Nation* (1909), by Sidney Webb in *The Decline of the Birth-rate* (Fabian Tract No. 131, London, 1907), and by many other writers. The data in the following table, in which all childless marriages are excluded, have been taken from various sources:

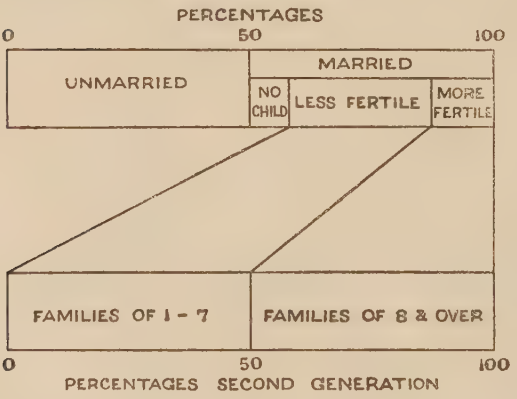


Group.		Fertility of Various Stocks.
English intellectuals	Completed.	4·7
Family records, middle class		5·3
Working class, New South Wales		5·3
Deaf-mutes, England	Probably Completed.	6·2
Deaf-mutes, America		6·1
Tuberculous stock		5·7
Insane stock		6·0
Edinburgh degenerates	Incomplete.	6·1
London mental defectives		7·0
Manchester mental defectives		6·3
Criminals		6·6

There is no doubt that the largest number of children is born to the least desirable members

of the community, and the question is how far natural selection is righting what is obviously a serious matter for the community. It seems likely that the danger is greater on the mental and moral than on the physical side, but it is difficult to measure it; parents who have bad habits, and these probably include the most stupid ones, lose more children at the very young ages than parents with good habits, but not to such a large extent as unhealthy parents, and this loss is probably being diminished as the infant death-rate falls. As long as the selective death-rate operates at all, many of the physically weakest in the community will die before they become adult. Professor Pearson and Dr Ploetz have both shown that when parents die young, not only will the number of their children be smaller, but that the proportion of those who die in childhood will be greater than when the parents live to a ripe old age. In well-to-do Quaker families, if the mother died between the age of nineteen and twenty-nine, 73 per cent. of her daughters died before they were twenty-one; but if the mother lived to be over seventy, the percentage of those who died under twenty-one was halved (*The Groundwork of Eugenics*, p. 26). Dr Ploetz took the percentage of children who died under five years in 'fürstlichen' and 'bürgerlichen' families, and showed that the percentage who died before reaching the age of five years diminished as the age at death of the mother increased. The death-rate in the earlier years of life is now diminishing, and in this decrease some see a suspension of natural selection, but though decreasing, it would seem unlikely that natural selection on the physical side will ever be entirely suspended. Physical and mental disabilities seem to be no bar to marriage, judging by the pedigrees that can be studied, and we cannot hope that improvement of the race will come through a selective marriage rate. It seems that it must come through the selective death-rate or through the conscious action of man. We have obtained some evidence as to the power of the selective death-rate, as it still exists, from data collected in working-class districts by medical officers of health. Here we could not deal with families that were completed or nearly completed, and groups of mothers had to be considered whose ages did not widely differ. We see from the table that mothers with bad health and bad habits at each age-group have more children than their more desirable neighbours, and we also see that, on the whole, the women with bad habits have more children than the women with bad health. At ages thirty-two and over, women with bad health have had 7·5 children born, and women with bad habits have had 7·8. The selective death-rate is still operating, and the number of living children is practically the same in this district whether the mother's health is good or bad, and possibly by the time these children are adult the children of the mother with good health will be more in number than the children of the mother with bad health. The selective death-rate, however, has not been able to compensate for the larger number of children born to mothers who have bad habits; that type of mother has more children living than the mother with good habits. In another district we can group all the fathers together, and find what the number of the children would be if all the mothers were of the same age and the fathers were in two groups, one representing the men who were in regular work in 1909, and who were presumably, on the whole, the more steady and intelligent men, and the other representing the men who were irregularly employed, and we find that the regular workman had an average of 3·6 children born and 2·7 living, and that the irregularly employed man had an average of 4·1 children born and 3·0 alive. The average age of the mothers of these children was about thirty, and the difference may be expected to go on increasing, since there is very little sign of the action of a selective death-rate here. These examples show that though physically we may be just stationary as a race, probably mentally and





	Age of Mother.							
	Under 25.		25–29.		29–32.		32 and over.	
	Children.		Children.		Children.		Children.	
	Born.	Living.	Born.	Living.	Born.	Living.	Born.	Living.
Mother's health good . .	1·6	1·3	2·6	2·2	3·8	3·1	6·3	4·7
,, ,, not good .	1·8	1·3	3·1	2·1	4·6	3·2	7·5	4·7
Mother's habits good . .	1·6	1·3	2·6	2·1	3·7	2·9	6·1	4·5
,, ,, not good .	1·8	1·3	3·1	2·3	4·9	3·5	7·8	5·0

morally we are not even stationary, but that if these characteristics are inherited, we are steadily adding to the proportion of our people possessing undesirable traits in these directions. Advance in medical knowledge now allows people suffering from certain types of disease to live to adult life, to marry and have children, as, for example, women suffering from the type of dwarfism known as achondroplasia (*Treasury of Human Inheritance*, parts vii. and viii., Eugenics Laboratory Memoirs, xv. plate li.), from the eye disease glioma retinæ (*Treasury of Human Inheritance*, vol. ii. plate xxvi.), and it further enables many unhealthy babies to live to grow up. Those who believe in the necessity of race improvement being undertaken by man do not suggest that there should be less care for the weaklings, but do suggest that those who are responsible for the well-being of the state should exercise care for the individual in such a way that future generations will not suffer for the ignorance and carelessness of the present. Public opinion is now very largely in favour of attempting to repress the productivity of the worst stocks. The permanent care of the feeble-minded is a step which few consider anything but right and needful for the benefit of the individual and of the race, and the law has given its sanction; but the establishment of the necessary institutions has been hindered, first by the war, and now by the need for economy after the war. Galton considered that it was even more important to increase the productivity of the best stocks, than to repress that of the worst; he foresaw great danger to the race in checks to over-population, fearing that the doctrines would be followed only by the prudent and self-denying, whose descendants were required, and not by the impulsive and self-seeking. He believed that improvement in the race could only come from within the race, by favouring those with good 'natural tendencies,' the one thing that must inevitably assert itself. The work of Galton and others seems to show that acquired knowledge and acquired characteristics are not transmitted to the offspring, and that no betterment of the environment can effect an improvement in the race; it may assist the individual, but it will not enable him to pass on a better constitution to his children. Galton urged that some means should be found for favouring individuals who bore signs of belonging to a superior race, that some weight should be given to ancestral characters, in addition to that already given to personal ones. This he considered was necessary, owing to the fact that an individual gifted with high qualities, who is an average specimen of a good race, will have more highly qualified children than an equally gifted individual who is an exceptionally good specimen of a poor race. If we could raise the average standard of the race only one grade in ability and character, Galton showed in 1869 (*Hereditary Genius*, p. 343), that instead of having 233 really eminent men in a million, we should have 2423; and he adds, 'but far more important to the progress of civilisation would be the increase in the yet higher orders of intellect.' In man survival has followed the development of mind rather than of body, and if natural selection is still helping to preserve man's physical fitness, it seems as if eugenics must concentrate on the improvement of man's mental and moral equipment. It is probably truer now even than in 1869, that 'we are in crying want for a greater fund of ability in all stations of life; for neither the classes of statesmen, philosophers, artisans, nor labourers are up to the modern complexity of their several professions.' Galton's proposal, to improve the race by breeding men for ability and character, seems the only practical and reasoned proposal for producing men able enough to deal with our existing complex problems. It was to the study of this question of race improvement that Galton gave the word eugenics.

Eugénie (1826–1920). See NAPOLEON III., and books by Clara Tschudi (1899), Jane Stoddart (1906), L. G. Daudet (1912), and E. Legge (1916).

Eugenius, the name of four popes, of whom the last is the most important. Gabriele Condolmiere was born in 1383 at Venice, and became pope as Eugenius IV. in 1431. The great event in his career was the schism created in the church by the proceedings of the Council of Basel, which had been convoked by his predecessor, Martin V., and showed a strong desire for ecclesiastical reform and a diminution of the papal power. Eugenius was compelled to flee from Rome in 1434 by an intrigue of the Colonna faction, whereupon he opened a new council, which met first at Ferrara, next at Florence, and issued a bull of excommunication against the bishops assembled at Basel, whom he pronounced to be 'a satanic conclave, which was spreading the abomination of desolation into the bosom of the church.' The Council of Basel formally deposed him from his pontifical office in 1439, and elected in his stead Amadeus, Duke of Savoy, under the title of Felix V. The conduct of France and Germany seemed to warrant this bold step, for Charles VII. had introduced into the former country the decrees of the Council of Basel, with some modifications, through the Pragmatic Sanction (1438), and the same thing happened in Germany by means of the Deed of Acceptance (1439). At the Council of Ferrara, John Paleologus II., emperor of Constantinople, and upwards of twenty Greek bishops, presented themselves, and a union between the two great divisions of Christendom—the Greek and Latin Church—was thus for a moment effected in July 1439. In 1444 Eugenius was able again to enter Rome, and three years later he died, just after signing a treaty of pacification by which Germany declared against the antipope. His pontificate was stormy and unhappy, and in his old age he regretted that he ever left his monastery. See BASEL (COUNCIL OF).

Eugubine Tables (Lat. *Tabulæ Iguvinæ*), the name given to seven bronze tablets, the inscriptions on which present a comprehensive and very remarkable memorial of the Umbrian language. They were discovered in 1444 at Gubbio (the ancient *Iguvium* or *Eugubium*), where they are still preserved. The characters on four of the tablets are Etruscan, on two Roman, and on one partly Roman and partly Etruscan; the inscriptions run from right to left. The *language* employed, however, is in all cases the same, and differs both from Etruscan and Latin, but resembles somewhat the older forms of the latter and also the Oscan dialects, so far as we know them. The subjects of the inscriptions are directions concerning sacrificial usages and forms of prayer, and they seem to have been inscribed in the 1st and 2d centuries A.D. Philip Bonarota first published them in a complete form in Dempster's *Etruria Regalis* (2 vols. Florence, 1723–24). The first really judicious attempt at interpretation was that of Lanzi, in his *Saggio di Lingua Etrusca* (3 vols. Rome, 1789), who points out the important fact that they related to sacrificial usages, &c. Ottfried Müller, Lassen, Grotefend, and Lepsius continued their study; the last gave the most accurate copy of the inscriptions in his *Inscriptiones Umbricæ et Oscæ* (Leip. 1841). The best and most complete work on the language and contents of the tablets is that of Aufrecht and Kirchhoff, entitled *Die Umbrischen Sprachdenkmäler* (1849–51). See F. W. Newman, *The Text of*

the Iguvine Inscriptions, with Latin translation and notes (1864); and Bréal, *Les Tables Eugubines* (Paris, 1875–78).

Euhemerism, the name usually applied to the historical theory of the origin of mythology from Euhemerus, a native of Messene and a contemporary of Cassander of Macedonia in the 4th century B.C. In the course of a voyage to the Indian Sea he professed to have discovered an island called Panchaia, in which he found a number of inscriptions representing the principal gods of Greece as mere earth-born kings and heroes deified after death for their superior strength or capacity. His book, entitled *Hiera Anagraphē*, is lost, as well as its Latin translation by Ennius. It drew upon him the imputation of atheism, and its unblushing inventions made his name with honest inquirers, such as Strabo, a byword for mendacity. Its main theory, however, was adopted by many eminent men, including Polybius, as well as by several of the Christian assailants of paganism—by Minucius Felix, Lactantius, and St Augustine, who found the ground ready prepared for them in their efforts to strip Zeus and the other pagan gods of the attributes of deity. Later Greek writers carried the theory still further, eliminating everything supernatural or extravagant, and leaving only a string of tales perfectly credible and commonplace. Æolus became an ancient mariner with a special knowledge of the winds, the Cyclopes a race of savages inhabiting Sicily, Atlas a great astronomer, and Scylla a fast-sailing pirate, as was also Pegasus, the winged horse of Bellerophon. Euhemerism was the favourite theory with the *soi-disant* philosophical historians of the 18th century in France, and the translation of Abbé Banier's great work, *The Mythology and Fables of Antiquity, explained from History* (Lond. 6 vols. 1739), extended it to England. To this school belong also writers such as Vossius, Bochart, and Huet. Herbert Spencer based religious emotions on primitive ancestor-worship, and explained totemism as due to nicknames, afterwards imbued with a sense of mystery. The historical school seeks the origin of gods in the practical experience and empirical thought of the Proto-Egyptians, the mysterious and supernatural being accretions. 'Osiris was regarded as an actual king who had died and been reanimated' (Elliot Smith).

Eulenspiegel, Till, the prototype of all the knavish fools of later time, is said to have been born in the village of Kneitlingen, near Schöppenstädt, in Brunswick, about the end of the 13th century. His father was called Klaus Eulenspiegel, and his mother Anna Wortbeck. He was thrice baptised, in the font, in mud, having been dropped from his mother's arms, and finally in hot water, to cleanse him from the mud; he afterwards wandered over Europe, and had many comical adventures, and played many rough practical jokes and tricks on the people whom he met with. His tomb is shown at Mölln, about four leagues from Lübeck, where tradition makes him die about 1350; but the inhabitants of Damme, in Belgium, also boast of having his bones in their churchyard, and place his death in 1301. Many regard Eulenspiegel as an altogether imaginary person, whose name was used merely to father a cycle of medieval tricks and adventures; others argue that there were two historical individuals of that name, father and son, of whom the former died at Damme, and the latter at Mölln. The stories that circulate in Germany under Eulenspiegel's name were not collected, as the book containing them itself informs us, till after Eulenspiegel's death, and without doubt were originally written in the Low German tongue; from Low German they were translated into High German. The book underwent considerable alterations at the hands of both Protestants and Catholics, who made it a vehicle for the expression of their own likes and dislikes. The oldest known edition is that printed at Strasburg in 1515, of which but one copy is known to exist —that in the British Museum (new ed. Halle, 1885). Another was issued in 1519, a new edition of which was edited by Lappenberg (Leip. 1854). The next impression, that of 1520–30, originated at Cologne (not in Lower Saxony), and was reproduced by photo-lithography at Berlin in 1865. A metrical version, *Der Eulenspiegel reimenweis*, was made by Fischart, and published at Frankfurt in 1571. For centuries it has been a favourite *Volksbuch*, not only in Germany, but in many other countries. Translations of it exist in Bohemian Polish, Italian, English (as a miracle play: *A merye Jest of a man that was called Howleglas*), Dutch, Danish, French, and Latin. Simrock modernised it (1878); works by Böttger (1850) and J. Wolff (1875) owe to it little beyond the name. De Coster made 'Thyll Ulenspiegel' a personification of Flanders. Hauptmann has written an epic; and on his 'pranks' Richard Strauss composed a notable orchestral piece. A version of the story is given in Roscoe's *German Novelists;* an English translation by K. R. H. Mackenzie appeared in 1890. It should be added that the Low German *Ulenspegel* has nothing to do with owls or glasses. It became in French 'Ulespiègle,' whence the word *espiègle.*

Euler, Leonhard, a distinguished mathematician, born 15th April 1707, at Basel, where he afterwards studied under John Bernoulli, and was the friend of Daniel and Nicholas Bernoulli. At the age of nineteen he was second in the contest for a prize offered by the Academy of Paris for the best treatise on the masting of ships. His friends the Bernoullis had been called to St Petersburg by Catharine I., when she founded the Academy, and in 1727 they induced Euler to settle in that capital, where in 1730 he was appointed to the chair of Physics, in 1733 of Mathematics. From that time he continued to labour in the field of mathematics with an ardour that excited the generous rivalry of the Bernoullis. More than half the mathematical treatises in the 26 quarto volumes published by the St Petersburg Academy from 1727 to 1783 are by Euler, and at his death he left more than 200 treatises in MS., which were afterwards published by the Academy. The French Academy of Sciences awarded him its prize on several occasions, and in 1740 his treatise on Tides shared the prize with those of Maclaurin and Daniel Bernoulli. In 1741 he accepted the invitation of Frederick the Great to Berlin, and there published a great number of valuable papers. In 1766 he returned to St Petersburg, where he died, September 18, 1783. The last years of his life were spent in total blindness, amid which he still pursued his researches, dictated his well-known *Introduction to Algebra* to his servant, and perfected, with some assistance, his theory of the moon's motion, constructing new tables, and carrying in his wonderful memory all the elaborate computations involved in his difficult task. After his return to St Petersburg, he also prepared his *Lettres à une Princesse d'Allemagne* (3 vols. 1768–72), in which, along with much theory unsoundly applied, there is a clear exposition of the most important facts in physics. Euler was of an upright, amiable, and religious character, and a man of wider general culture than might have been looked for in one who pursued his special studies so keenly. His proper domain was the abstruser parts of pure mathematics, and here his principal works include his Theory of Planetary Motion, Introduc-

tion to the Analysis of Infinities, Institutions of the Differential and of the Integral Calculus, and Dioptrics, which are all, as well as his *Opuscula Analytica*, in Latin. See Rudio's *Leonhard Euler* (Basel, 1884) and *Die Baseler Mathematiker* (*ib.* 1884); also the Basel edition of his *Opera Omnia* (1911 *et seq.*).

Eume'nides (Gr., 'the benign'), the euphemistic name for the Erinyes, the Roman *Furiæ* or *Diræ*, three fearful winged maidens who dwell in the depths of Tartarus, daughters of Earth or of Night, represented with serpents twined in their hair, and with blood dripping from their eyes, whose function as early as Homer and Hesiod is to punish men both in this world and after death for such crimes as perjury, murder, and the violation of filial duty and of the rite of hospitality. They were regarded also as goddesses of Fate, somewhat like the Moiræ or Fates, and they had a share in the grim providence which led the doomed ones into the way of calamity. A part of their function was also to hinder man from acquiring too much knowledge of the future. Their number is usually three, and their names Alecto, Megæra, and Tisiphone; but sometimes in the poets they appear as one, and we find a whole chorus of Erinyes in the tragedies of Æschylus. The later poets and sculptors represented them in the more pleasing form of winged virgins, attired in the garb of huntresses, bearing torches in their hands, and with a wreath of serpents round their heads. Gradually, they came to be considered goddesses of the infernal regions, who punished crimes after death, but seldom appeared on earth. In Athens their worship, which, like that of the other infernal deities, was conducted in silence, was held in great honour. The sacrifices offered to them were black sheep and libations of *nephalia*, honey mixed with water. The turtle-dove and the narcissus were sacred to them. They had a sanctuary in the vicinity of the Areopagus, and one at Colonus.

Eumolpus (the 'sweet singer'), in Greek Mythology, the son of Poseidon and Chione, was brought up in Ethiopia, whence he went to Thrace. Afterwards passing into Attica, at the head of a body of Thracians, to assist the Eleusinians in their war against Erechtheus, he and his sons were slain in battle. He was regarded as the founder of the Eleusinian mysteries. An illustrious Athenian family, the *Eumolpidæ*, claimed descent from Eumolpus, and held the office of priests of Demeter in Eleusis.

Eunomius, the leader of an extreme sect of Arians, called after him Eunomians, was born at the village of Dacora, in Cappadocia. He attached himself to Aëtius, then at Alexandria, and became his disciple and associate. Through the influence of Eudoxius he became Bishop of Cyzicum about 360, but was compelled in a short time to resign his see, and after this he came forward as the leader of a party. His confession of faith, sent to Theodosius in 383, was rejected, and Eunomius was seized at Chalcedon, and sent first to Mœsia, then to Cappadocia, where he was still living in his native village in 392. According to Philostorgius, he was unhandsome, with white spots (Gr. *alphoi*) on his face, and had a stammering tongue in spite of his eloquence. The doctrines of Eunomius and Aëtius, which were simply those of Arius carried to an extreme, were condemned at the second Œcumenical Council. After his death the Eunomians (who were also called Exucontians, Heterousiasts, and Anomœans) broke completely with the orthodox church. Their internal disunion quickly put an end to the party. His only extant writings are his two apologies and his confession. See ARIUS, and the article by Loofs in the Hauck-Herzog, *Realencyklopädie* (1896–1909).

Eunuch (Gr. *eunouchos*, 'one who has charge of a bed;' *eunē*, 'a bed') is, etymologically, a man intrusted with the charge of women's apartments in the East; but the word means always a person who has been castrated, in order to serve in the harem. The barbarous custom of castrating men is usually an accompaniment of polygamy, and seems to have been earliest practised in Africa; but it established itself, along with Asiatic vices, in the Roman empire. At the Byzantine court the eunuchs often played an important rôle, and became so prominent in affairs of state that the word eunuch came practically to be the name of a great state-officer, the chamberlain. The Italian word *castrato* is that usually employed for a man who has as a youth suffered castration to prevent his voice from breaking. Such persons preserve the pure, clear, high timbre of the boy's voice, and add the grown man's lung power; and in spite of the canonical law and more than one papal bull, came to be highly prized in Italy for singing in churches, in the opera, and at concerts, and till of late were common. In the 18th century it was estimated that 4000 boys were yearly castrated for musical purposes. The castrati were at one time not unknown in France, Germany, and England, as connected with the Italian opera. Many—such as Farinelli (q.v.) and Caffarelli—were really great singers. See CASTRATION.

Euomphalus, a large genus of fossil gasteropodous shells, characterised by its depressed and discoidal shell, with angled or coronated whorls, five-sided mouth, and very large umbilicus.

Euonymin is an extract from the bark and root-bark of the *Euonymus atropurpureus*, the Spindle Tree (q.v.), or Wahoo, a shrub indigenous to the United States. A mixture of a number of substances, it has long been used in America as a cholagogue, purgative and diuretic, and in Britain for its supposed stimulant action on the liver.

Eupatoria (formerly *Koslov*), a port on a bay in the west of the Crimea, 40 miles NW. of Simferopol. The principal building is the Tatar mosque, built in 1552. Eupatoria exports corn, hides, wool, and salt, and manufactures candles, soap, leather, and marine engines. Its shallow harbour is sheltered only from the north and north-east winds. There are brine and mud baths. Pop. 26,000 (Tatars, Karaite Jews, Armenians, and Greeks). The town was taken from the Tatars by the Russians in 1783, in September 1854 was occupied and fortified by a portion of the Anglo-French invading army, and in February 1855 was the scene of a Turkish defeat of the Russians.

Hemp Agrimony (*Eupatorium cannabinum*).

Eupatorium, a large genus of Compositæ, allied to Coltsfoot (Tussilago) and Butter-bur (Petasites). The species are mostly tropical and temperate American, but *E. cannabinum* is the common Hemp

Agrimony of river-banks and marshy places, formerly reputed in domestic medicine. The roots of several American species are still so employed, notably Thorough-wort (*E. perfoliatum*) and *E. purpureum*. Their astringency gives several South American species a reputation in the treatment of wounds and snake-bites; and the Guaco, reckoned of almost universal efficacy in tropical America, is derived from the allied *Mikania guaco*. The roots of some are used in tanning, and others yield a variety of indigo.

Eupat'rides, the first class of citizens in ancient Athens, corresponding to the Roman *optimates*, 'the aristocrats or nobles.' The second class was the *geōmoroi;* the third, the *dēmiourgoi*. Like the Roman patricians, the eupatrides retained the priestly offices after the establishment of the democracy.

Eupen, a manufacturing town of Rhenish Prussia, ceded to Belgium in 1919, in a beautiful valley on the Vedre, and 12 miles by rail S. of Aix-la-Chapelle. It has flourishing woollen manufactures, besides dye-works, machine-shops, breweries, &c. It owes its prosperity chiefly to French refugees, who settled here after the peace of Lunéville (1801), which assigned it to France; in 1814 it came from Limburg to Prussia. Pop. 13,000, almost all Catholics and German-speaking.

Euphemism (Gr. *eu*, 'well,' and *phēmi*, 'I speak'), a figure of rhetoric by which an unpleasant or offensive matter is designated in indirect and milder terms. The ancient Greeks used a multitude of euphemisms, to avoid words that were thought to be ominous of evil, or offensive to the unseen powers. They spoke of the Eumenides, or 'benign goddesses,' instead of the Furies; just as the elves and fairies of more modern folklore used to be spoken of as 'good neighbours.' This instinct has done much to change the significations of words and impair the noble simplicity of our language, from a mawkish and prurient nastiness which fondly imagines itself the mother of nice ideas.

Euphonium, a bass Saxhorn (q.v.).—The *Euphonon* was a variation of the Harmonica (q.v.), invented by Chladni in 1790.

Euphorbia, Oil of, or Oil of Caper Spurge, an extremely acrid fixed oil, obtained by expression, or by the aid of alcohol or ether, from the

Caper Spurge (*Euphorbia lathyris*).

seeds of the Caper Spurge (*Euphorbia lathyris*), a plant common in many parts of Europe, and naturalised in some places in Britain (see Spurge). Oil of euphorbia has much resemblance to croton-oil in its properties, although less powerful, and is sometimes used as a substitute for it, in doses of from three to ten drops. It is good for use only when recently extracted.

Euphorbiaceæ, a very extensive order of dicotyledons, containing some 4000 known species—trees, shrubs, and herbaceous plants, of the most extraordinarily varied, often cactus-like habit. They abound chiefly in warm countries, most of all in tropical America. The few found in the colder parts of the world are all herbaceous. The British species are different kinds of Spurge (Euphorbia) and Dog's Mercury (Mercurialis). The Euphorbiaceæ usually abound in an acrid and poisonous milky juice; although there are species of which the juice is bland or becomes so through the application of heat. The recognition that the peculiar 'flower' in Euphorbia, &c. is really a reduced inflorescence, is due to Robert Brown (see Cyathium, Spurge). Amongst those most remarkable for the acridity of their juice are the Manchineel (q.v.) and *Excœcaria agallocha*, an East Indian tree—formerly supposed to yield one of the kinds of aloes wood—the smoke from the burning of which is extremely dangerous to the eyes, and of which the juice sometimes blinds the woodcutter. Many of the Euphorbiaceæ are valued for their medicinal properties. Thus, the juice of some of the spurges, the roots of others, the bark of different species of Croton (Cascarilla Bark, Copalche Bark), &c. are used in medicine; and to plants of this order we are indebted for castor-oil, croton-oil, &c. A few of the Euphorbiaceæ yield fragrant balsamic products (see Croton); a few, although their juice is poisonous, yield a wholesome starch in considerable abundance (see Manioc); a few are cultivated and used as pot-herbs, particularly species of Plukenetia in the East Indies; a few yield wholesome and agreeable sub-acid fruits, as *Cicca disticha* and *C. racemosa* in the East Indies; the seeds of some are edible, as those of the Candle-nut (q.v.), &c.; the oil of the seeds is also in some cases used for food, like other bland oils, but more frequently for burning, as castor-oil, candle-nut oil, the oil of *Elæococca verrucosa* in Japan and Mauritius, and the solid oil of *Stillingia sebifera*, which is used in China for making candles, and in medical preparations as a substitute for lard. See Tallow-tree. Others yield dyestuffs. The timber of some is valuable—e.g. African Teak (q.v.). Many species are cultivated in gardens and hot-houses, more frequently for their curious appearance than for their beauty; but the large, deep crimson bracts of *Poinsettia pulcherrima*, a native of Mexico, make it a very attractive plant.

Euphorbium, an extremely acrid gum-resin, obtained from several species of Euphorbia or Spurge (q.v.), as *E. officinarum* and *E. antiquorum* in the north of Africa, Arabia, and the East Indies, and *E. Canariensis* in the Canary Islands. It is obtained by incisions in the branches, whence issues an irritating milky juice, which dries in the sun, and becomes a yellowish-gray, waxy gum-resin. The persons who collect it are obliged to defend their mouths and nostrils by a cloth, as its particles produce incessant sneezing, violent inflammation of the nostrils, and a very painful burning sensation in the mouth. On account of its excessive acridity its use is now almost entirely confined to veterinary medicine, although it is still occasionally mixed with Burgundy pitch or other substances to make rubefacient plasters for chronic affections of the joints; and its powder, mixed with much starch or flour, has been employed as an *errhine* in chronic affections of the eyes, ears, or brain. It was formerly administered as an emetic and drastic

purgative, but is dangerously violent in its action.

Euphrasy. See EYEBRIGHT.

Euphrates (Pers. *Ufratu*, Heb. *Phrat*, Syr. *Ephrat*, Arab. *Furat*) is the largest river in Western Asia, and, with the Tigris, forms the most important river-system of that part of the Continent. It has its source in the heart of Armenia in two branches—the Kara-Su (270 miles) and the Murad (300 miles), of which the former rises a few miles NE. of Erzerum, and the latter over 130 miles to the east, near Lake Van—uniting in about 39° N. lat. and 39° E. long., close to Keban Maadin (2664 feet above the sea). From here the united stream flows in a general southerly direction, and breaks through the Taurus in a succession of rapids and cataracts for about 40 miles, emerging at Sumeysát (the ancient *Samosata*), and passing Bír, at which point it is 100 miles distant from the nearest shore of the Mediterranean. Flowing south, it separates for a considerable distance Mesopotamia from Syria and the deserts of Syrian Arabia; then curving to the south-east, it flows on to Kurna, where it is joined by the waters of the Tigris; and the joint river, taking the name of the Shat-el-Arab, empties itself by several arms (only one of which is navigable by large vessels) into the Persian Gulf, 60 miles below Basra, after a course of fully 1700 miles. The principal of its few tributaries after leaving the mountains are the Sajur on the right, and the Balik-su and Khabúr on the left bank, besides the Persian river Karún, which enters the estuary at Mohammera. The chief towns now on its banks are Sumeysát, Bír, Ana, Hít, and Hilla, Basra lying really on a creek a short distance from the main stream; the river between Ana and Hit is studded with islands, many of them inhabited. The Euphrates is more or less navigable for light craft as far as Hit, and farther while the river is in flood (April to August). In ancient times, when canals and embankments regulated the river's inundations, these exercised the same beneficial effect over a fertile and populous country as those of the Nile on Egypt; but barely a hundredth of the old system is maintained to-day. Numerous remains of ancient cities are still to be traced near the banks, such as the famous site of Babylon, and the Birs Nimrúd (see BABYLONIA). In 1908 Sir William Willcocks submitted to the Turkish government a scheme for irrigating some 3,000,000 acres in Mesopotamia, at a cost of £7,410,000, with every prospect of a highly remunerative return—to make another Egypt of Mesopotamia. In 1911 the government approved a much less extensive scheme, which would, however, restore fertility to a large area in the Euphrates Valley. It included the damming up of the head of the Euphrates canal, into which the main current of the river had for many years been diverted, with disastrous consequences for agriculture on the banks of the river and for such navigation by small craft and rafts as was formerly practicable.

It used to be debated which of the two ancient trade-routes to India—that by Suez, or the other by way of Scanderoon and down the Euphrates Valley—was to be preferred. Captain (afterwards General) F. R. Chesney, having, in 1831, descended the Euphrates, maintained that this was the shortest possible route to Bombay, with less open sea than any other, and that the country it would open out was rich in natural products. In 1835–36, with government support, Chesney conducted an expedition thither, which launched two iron steamers at Birejik, and though the channel was difficult, one steamer reached the mouth of the river, the other being lost in a violent storm. In 1856 he laid down a practicable route for a railway by which the distance from England to Karachi was to be 1000 miles shorter than by the Suez route. Another scheme for a railway in 1862 also collapsed. In 1900–5 Sir W. Willcocks planned a railway from the Mediterranean by way of Damascus or Homs to Tadmor, thence to Hit, and so by the Euphrates Valley to Bagdad. The Bagdad railway, built under German auspices, which in the first decades of the 20th century became the key of the Nearer Eastern Question, is partly a Euphrates Valley line. In passing from Adana to Mosul on the Tigris it crosses the Euphrates at Jerablus, and runs for a long way across the Euphrates basin. From Mosul it passes by the Tigris Valley to Bagdad. The continuation from Bagdad to the Persian Gulf, with its branch to the Persian frontier at Khanakin, was a thorny political problem until the Eastern Question (q.v.) resolved itself into the Great War. Beyond Bagdad it returns to the Euphrates, and proceeds by Hilleh (with a branch to Kerbela) and Samawa to Basra. In 1919 the British authorities took over the administration of the railway.

Euphro'syne (i.e. 'the joyous one'), one of the Graces (q.v.).

Euphuism, a term used in English literature to denote an affected and bombastic style of language, fashionable for a short period at the court of Queen Elizabeth and in the literature of the time. The word was formed from the title of the book which brought the style into vogue, the *Euphues* of John Lyly (q.v.). Euphuism is usually taken to have been an exaggeration of the prevailing Italian taste; but Dr Landmann (*Der Euphuismus*, Giessen, 1881) has sought to prove that the peculiarities of Lyly's style are directly to be traced to Antonio de Guevara (1490–1545), Spanish court preacher, historiographer, bishop, and moralist. His chief work was an historical romance, based on the life and the meditations of Marcus Aurelius, one English translation of which by Lord Berners appeared in 1531, another by North (as *The Dial of Princes*) in 1558–67. Euphuism has even been called *Guevarism*. In Holofernes in *Love's Labour's Lost*, and in Sir Piercy Shafton in the *Monastery*, Euphuism is caricatured. See Underhill's *Spanish Literature in the England of the Tudors* (1900), but especially Feuillerat's *John Lyly* (1910).

Eu'poda, a section of vegetarian beetles in the Tetramerous division. The gorgeous Kangaroo-beetles of tropical Asia and Africa, the Donaceæ on water-plants, Crioceris on lilies, asparagus, &c. are examples. Comparatively few are British.

Eurasians is a convenient term for the offspring of Europeans and Asiatics, and is chiefly used in India of the children by European fathers of Hindu mothers and their descendants. They prefer to be called Anglo-Indians. The term Eurasian is also used in geography for facts true of Europe and Asia (Eurasia) taken as one continent, for the races common to both continents, or specifically for the primitive Aryan peoples.

Eure, a department of Normandy, immediately south of the department of Seine-Inférieure, contains an area of 2290 sq. m. Pop. (1881) 364,291; (1921) 303,159; the decrease has gone on steadily since 1846 (423,247), small families, often limited to one child, prevailing among all classes. The surface is generally level; the highest point reaches only 790 feet. The principal river is the Seine. The Eure, from which this department derives its name, and the Rille, both affluents of the Seine, are the only other important rivers; the Eure, which rises in the department of Orne, has a course of 141 miles, and is navigable for 54 miles. The climate is mild, moist, and foggy. Along the Seine the soil is in some parts sandy, stony, and

barren, but the greater part is very fertile. The chief natural products are corn, hemp, flax, vegetables, and fruit, particularly apples and pears, from which large quantities of cider and perry are made. The breeding of cattle, horses, and sheep is favoured by extensive meadows and pasture-lands. Iron is found in considerable quantities. There are extensive iron and copper works and pin-manufactories. Cotton goods, cloth, linen, paper, and beet-sugar also are manufactured. The department is divided into five arrondissements—Évreux, Louviers, Les Andelys, Bernay, and Pont-Audemer. The capital is Évreux.

Eure-et-Loir, a department of France, to the south of the preceding, with an area of 2260 sq. m. Pop. (1872) 282,622; (1921) 251,255. It is watered mainly by the Eure in the north, and the Loir in the south. It is in general level, the east and south being occupied by high and extensive flats; while in the west the scenery is finely varied by wooded hills and valleys. The soil is fertile, and good crops of wheat and oats are raised, besides considerable quantities of vegetables and fruit; cider is prepared, and some wine. Stock-raising also is of importance, and iron and a few other minerals are worked. The rivers, though not navigable, furnish valuable water-power for the numerous mills on their banks; besides foundries, there are manufactories of beet-root sugar, cotton, wool, silk, paper, boots, and hats. The department is divided into the four arrondissements of Chartres, Châteaudun, Dreux, and Nogent-le-Rotrou, with the town of Chartres for capital.

Eureka, (1) a port and capital of Humboldt county, California, on Humboldt Bay, chiefly noteworthy for its mild, equable climate. It has several lumber-mills, and exports great quantities of redwood lumber from the giant forests around. Pop. 13,000.—(2) A mining-town, capital of Eureka county, Nevada, 90 miles by rail S. of the Palisades station on the Central Pacific Railroad. Here are gold, silver, and lead mines. Pop. 700.

Euripides, the latest of the three great Greek tragedians, was born at the time when the Persian attack upon the freedom of Greece was being repelled in a series of glorious victories; and this fact is expressed in the story that he was born 480 B.C. at Salamis, whither the Athenians had fled, and where the Persian fleet was defeated in that year. The first half of his life coincided with the growth of the Athenian empire, the second with its decline. Æschylus, the first of the three tragedians, a man of forty when Euripides was born, probably had died before Euripides produced his first play—at which time Sophocles had already been thirteen years before the public, and Aristophanes, the comedian, who was to be the constant opponent of Euripides, was not yet born. Euripides was the son of wealthy parents, who probably had made their fortune by trade, for Aristophanes (*Ach.* 478, *Ran.* 840) banters him on the subject with jests which would have been pointless had they not contained some truth. Tradition says that his father intended him to compete in the national athletic festivals of Greece; and this may account for Euripides' pronounced dislike of athletes (*Frag.* 284). He then took to painting, but, like Théophile Gautier, abandoned it for literature; and he has indeed the painter's eye for an effective situation. Tradition represents him as the friend of Socrates, and the pupil of Prodicus, Protagoras, and Anaxagoras; and he does more than once reproduce in his plays Anaxagoras' doctrine of the origin of all things from the wedlock of Earth and Air (cf. *Frag.* 836, 890, 935; Ar. *Ran.* 892). He is said to have been married twice, and to have had three sons. Scandal has been busy with his wives, but there can be no truth in it, otherwise we should have heard of it from Aristophanes; and his reputation as a woman-hater is not confirmed by an impartial study of his plays. How many dramas he wrote we do not know, but the names and some fragments of about eighty are known to us, and of these eighty we possess eighteen complete. He won the tragic prize only five times, and he died 406 B.C. at the court of Archelaus, king of Macedonia. His habits were those of the scholar and the recluse. He was one of the first and the few private persons in Greece to possess a library (cf. *Hipp.* 452, 954; *Iph. A.* 798; *Alc.* 962; *Frag.* 629; Ar. *Ran.* 943, 1403). He took no such part in public life as did Æschylus and even Sophocles. In politics he was a moderate, approving of democracy (*Frag.* 628), but not of demagogues (*Hec.* 132, 254). His views of life on the whole were pessimistic: he did not share Aristophanes' romantic illusions as to the past, and the contemplation of the future could bring no comfort in an age when the doctrine of progress had not as yet been formulated. The immoralities of the accepted mythology shocked him as well as other thinkers; but his philosophy sufficed neither to shake off the old religion nor to reconcile him to it. The names and probable order of the surviving plays are: *Alcestis*, *Medea*, *Hippolytus*, *Hecuba*, *Andromache*, *Supplices*, *Heraclidæ*, *Troades*, *Helena*, *Phœnissæ*, *Orestes;* the *Bacchæ* and *Iphigenia in Aulis* were put on the Athenian stage only after the author's death; and it is uncertain to what period belonged the *Ion*, *Hercules Furens*, *Iphigenia in Tauris*, *Electra*, and *Cyclops*, whilst it is doubtful whether the *Rhesus* is genuine. Whereas the characters in the plays of Æschylus and Sophocles had been heroic in their proportions and greater than life, Euripides set to work to be human. And in this we have the secret both of his success and of his failure: of his failure, because he made the mistake of imagining human life to be the same thing as everyday life; of his success, because in his treatment of everyday motives and emotions he was, 'with his droppings of warm tears,' the 'most tragic of the poets.' His skill as a playwright is of the highest order; he can construct plots which are exciting beyond anything attempted by his predecessors, and he has an unerring instinct for a 'situation.' But he has all the unscrupulousness of the practical playwright: in his consuming desire to get on to the situation as rapidly as possible, and to bring the curtain down sharp on it, he substitutes a bald prologue for a proper exposition, and, instead of working out the dénouement, makes a *Deus ex machinâ* cut the knot of the situation. For the sake of the same all-important consideration he will sacrifice consistency in character-drawing, and transgress all the bounds of artistic self-restraint. His popularity increased, indeed we might almost say began, after his death; his plays were 'revived' on the stage more frequently than those of Æschylus or Sophocles; they fill a much larger place in the mind of Aristotle, as appears from his *Poetics*, than those of the other two tragedians; and the number of his plays that have survived is greater than both theirs put together. And Euripides was a favourite with Theocritus, Virgil, Ovid, Horace, Milton, and Browning.

Notable critics of the text were Porson (1797), Elmsley (1813), G. Hermann (1838), Badham (1851), Weil (1890). There are complete texts by Dindorf (1870), Kirchhoff, Paley, Nauck, and Murray. Murray's poetic translations of many of the plays have been acted. A. S. Way's verse-translation of the whole (3 vols. 1894–98) are also admirable. Verrall, in *Euripides the Rationalist* (1895), asserts that Euripides wrote his plays deliberately (though not explicitly) to make the gods ridiculous and undermine popular faith in miracles. See also Norwood, *Riddle of the Bacchae* (1908), Verrall, *The Bacchants* (1911), Murray, *Euripides and his Age* (1913).

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EUROPE IN THE NINTH CENTURY

EUROPE IN THE SEVENTEENTH CENTURY

EUROPE IN THE TWELFTH CENTURY

EUROPE DURING NAPOLEON'S EMPIRE

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Euri'pus. See CHALCIS, EUBŒA.,

Euroc'lydon, in the Authorised Version, following the ordinary Greek text, was the tempestuous wind by which St Paul's ship was wrecked (Acts, xxvii. 14). The revised translation, taking the Greek reading *eurakylōn*, has *Euraquilo*, 'a north-easter.' This is sometimes identified with the Bora (q.v.).

Euro'pa, the daughter of the Phœnician king Agenor, whom Zeus, in the form of a bull, bore off to Crete, where she became the mother of Minos, Rhadamanthus, and Sarpedon.

Europe is historically and politically by far the most important of the five great divisions of the world, though Asia vastly exceeds it in population. Geographically it should be regarded rather as a peninsula of Asia, or as a portion of the great joint Eurasian continent; in regard to physical geography, fauna, and flora, it is difficult to draw a sharp line between Europe and Asia. On three sides Europe is bounded by sea—north by the Arctic Ocean, west by the Atlantic, south by the Mediterranean, Sea of Marmora, and Black Sea. But on the east the Urals, Ural River, and Caspian, though commonly assumed as the boundary towards Asia, do not mark a precise limit in respect of climate, flora, fauna, or physical conditions generally (see this discussed at ASIA); and actually the governments of Perm and Orenburg in Russia in Europe extend far beyond the Urals. Between the Caspian and the Black Sea, the ridge of the Caucasus seems a convenient dividing line between Europe and Asia, but the Manytch depression is really, from the geographical point of view, a more correct boundary; physically the whole of the Caucasus region is part of Asia (q.v.). It is more curious that North Africa and South Europe are very closely related in many respects, geological and biological. It has even been said that the mountains of Auvergne divide northern France more sharply from Provence than the Mediterranean does southern Provence from Morocco and Algeria. But in current usage Europe is bounded on three sides by sea, and elsewhere by the Kara River, the Ural Mountains, Ural River, the Caspian, and the Caucasus.

Various etymologies have been proposed for the name Europe. The old mythological one was that it was named from Europa (q.v.)—why, was not very clear. Another was that it came from Eurus, the south-east wind. A third, given by Hermann, notes that the name is first applied, not to the whole continent, but (in the Homeric Hymn to Apollo) to the mainland of Thrace, as distinguished from the Peloponnesus and the Greek islands, and suggests that Europe therefore means Broad Land (*eurus ōps*, 'broad face'). Of late the tendency is to assume that the name was first given by Phœnician traders, and is from the word *Erebh*, 'darkness'—i.e. the land of sunset, of the west. The area to which the name of Europe was applied grew with the extension of Greek geographical knowledge.

Europe has a total length from Cape St Vincent on the south-west to the mouth of the Kara River on the north-east of 3400 miles; and from North Cape in Norway to Cape Matapan, the southernmost point of Greece, a total breadth of 2400 miles. The continent of Europe, irrespective of islands, lies within 36° 20′—71° 10′ N. lat., and 9° 30′ W.—66° 30′ E. long. Its area is estimated at 3,800,000 sq. m., being about a third of that of Africa, a fourth of that of America, and a fifth of that of Asia. It does not greatly exceed the total area of the United States. Its indented coast-line is more extensive in proportion to its size than that of any other great natural division of the globe, and is estimated to measure little less than 50,000 miles. This is caused by its great irregularity, and the number of deep inlets and gulfs which penetrate its surface. It has a population of about 400,000,000, which gives an average of about 107 for every square mile.

The body of the European continent divides itself naturally into two great portions—the great plain in the north-east, and the highlands from near the centre towards the south-west, the mountainous peninsula of Scandinavia lying apart from either. (See the accompanying physical map of Europe.) The plain occupies about two-thirds (2,500,000 sq. m.) of the entire extent of the continent. It reaches from the eastern boundary of Europe, north to the shores of the Arctic Ocean, south to the Caucasus and the Black Sea, and westward over the whole extent of the continent; gradually, however, becoming narrower towards the west. In shape this plain resembles a triangle; its base rests on the eastern boundary, and it may be said to reach its apex on the shores of Holland. It separates the two mountain-systems of Europe—the Scandinavian system (highest summit 7566 feet) on the north, and on the south the system of southern Europe. The mass of the Alps, covering an area of nearly 100,000 sq. m., forms the centre of the mountain-system of southern and western Europe, and stretches down on four sides towards France, Germany, Hungary, and Italy; the highest summit being 15,732 feet. The other chief mountain-masses are the Carpathians (8343 feet) the Balkans (9750), the Apennines (9574), the Pyrenees (11,170), and the Sierra Nevada (11,660), and in Sicily, Etna (10,758). The highest inhabited spot in Europe is, since 1882, the observatory on Etna (9075 feet), nearly 1000 feet higher than the hospice of the Great St Bernard. See ALPS, APENNINES, BALKAN, CARPATHIANS, PYRENEES, &c.

Europe is surrounded by water on three sides. The White Sea comes in from the Arctic Ocean; the German Ocean and the Mediterranean from the Atlantic. The most important peninsulas are in the north Scandinavia, and in the south the Crimea, the Balkan peninsula (with Greece), Italy, and Spain. With the exception of Iceland, the islands cluster closely round the mainland, the chief being Great Britain, Ireland, Iceland, Nova Zembla, Sardinia, Corsica, Sicily, and Crete (Candia). The lakes of Europe are small as compared with those of Africa or America, the largest being Ladoga and Onega in Russia, and Wener in Sweden. The Volga (2400 miles), the Danube (1740), the Don (1125), the Kama (1050), the Petchora (1000), the Ural (800), and the Rhine (760) are the largest rivers of Europe.

The details of the geography of Europe are given under the names of its several political divisions, and of its lakes, rivers, and mountains.

Geology.—The oldest rocks of Europe—viz. the Archæan and Palæozoic—occupy the most continuous area in the northern part of the continent. Thus, they extend over all the Scandinavian peninsula, Finland, and a considerable portion of northern Russia. In western Europe they are likewise well developed, as in the British Islands, which (if we except the midlands, and the eastern and south-eastern parts of England) may be said to be mainly composed of Archæan and Palæozoic rocks. Similar rocks cover extensive areas in Brittany, in central France, and in the Iberian peninsula. In central Europe they occur for the most part in sporadic areas of limited extent, which upon a geological map look like islands surrounded by younger strata than themselves. One of the largest of those areas is that which stretches from the north of France through the Ardennes and southern Belgium into Rheinland, Westphalia, and Nassau. Another considerable tract occupies most of Bohemia, and smaller areas are met

with in most of the mountain-ranges of Germany and central Europe. Archæan and Palæozoic rocks likewise appear to form the nuclei of the Pyrenees, the Alps, and the Caucasus, while the Ural range is exclusively composed of such rocks. In the maritime regions of the Mediterranean, crystalline schists and Palæozoic strata are sparingly met with, as in southern and eastern Spain, in Sardinia, and Corsica. Considerable tracts of schistose rocks, however, extend through the Balkan peninsula, and appear in many of the islands of the Ægean, in southern Greece, southern Italy, &c. Having mentioned the main areas at which these oldest rocks appear at the surface, it is not necessary to refer to the distribution of the Mesozoic and Cainozoic strata, save in the most general terms. They are confined chiefly to the low grounds of the continent, although now and again, as in the Pyrenees, the Alps, and the Caucasus, they rise to great elevations. It may be added also that they enter into the composition of not a few other hilly regions, such as the Carpathians, the Apennines, the high grounds of Herzegovina, Albania, &c. Accumulations of Pleistocene and Recent age are met with alike in mountainous and lowland regions. They are developed most continuously in the low grounds of central Europe —extending from the borders of the North Sea across Germany far into Russia. They likewise form enormous tracts of flat land bordering on the Black Sea, the Sea of Azov, and the Caspian. The alluvial lands through which the great rivers of Europe flow belong to the same division of geological time, while the glacial deposits which form the under-soils throughout a large part of northern Europe, and which reappear in the mountain-valleys of more southern regions, are all likewise included amongst Pleistocene and Recent accumulations.

Geologists are not yet agreed as to the origin of the Archæan rocks, and it is altogether premature, therefore, to speculate upon the physical conditions of Europe at the period of their formation. They consist chiefly of metamorphic rocks, some of which can be proved to have been originally eruptive, some volcanic, and others, again, sedimentary.

Leaving the Archæan, we find that the next oldest strata are those which were accumulated during the Cambrian period, to which succeeded the Silurian, the Devonian and Old Red Sandstone, the Carboniferous, and the Permian periods—all represented by great thicknesses of strata, which overspread wide regions.

Now, at the beginning of the Cambrian period, we have evidence to show that the primeval ridge which was subsequently to become the continent of Europe was still largely under water, the dry land being massed chiefly in the north. At that distant date a broad land-surface extended from the Outer Hebrides north-eastwards through Scandinavia, Finland, and northern Russia. How much farther north and north-west of the present limits of Europe that ancient land may have spread we cannot tell, but it probably occupied wide regions which are now submerged in the shallow waters of the Arctic Ocean. In the north of Scotland a large inland sea or lake existed in Cambrian times, and there is some evidence to suggest that similar lacustrine conditions may have obtained in the Welsh area at the beginning of the period. South of the northern land lay a shallow sea covering all middle and southern Europe. That sea, however, was dotted here and there with a few islands of Archæan rocks, occupying the site of what are now some of the hills of middle Germany, such as the Riesengebirge, the Erzgebirge, the Fichtelgebirge, &c., and possibly some of the Archæan districts of France and the Iberian peninsula.

The succeeding period was one of eminently marine conditions, the wide distribution of Silurian strata showing that, during the accumulation of these, enormous tracts of the present continent of Europe were overflowed by the sea. None of these deposits, however, is of truly oceanic origin. They appear for the most part to have been laid down in shallow seas, which here and there may have been moderately deep. During the formation of the Lower Silurian the whole of the British area, with the exception perhaps of some of the Archæan tracts of the north-west, seems to have been under water. The submergence had commenced in Cambrian times, and was continued up to the close of the Lower Silurian period. During this long-continued period of submergence volcanic activity manifested itself at various points—Great Britain and Ireland being represented at that time by groups of volcanic islands, scattered over the site of what is now Wales, and extending westward into the Irish region, and northward into the districts of Cumberland and south Ayrshire. Towards the close of the Lower Silurian period considerable earth-movements took place, which had the effect of increasing the amount of dry land, the most continuous mass or masses of which still occupied the northern and north-western part of the continent. In the beginning of Upper Silurian times a broad sea covered the major portion of middle and probably all southern Europe. Numerous islands, however, would seem to have existed in such regions as Wales, the various tracts of older Palæozoic and Archæan rocks of south Germany, &c. Many of these islands were partially, and some entirely, submerged before the close of Silurian times.

The next great period—that, namely, which witnessed the accumulation of the Devonian and Old Red Sandstone strata—was in some respects strongly contrasted to the preceding period. The Silurian rocks, as already mentioned, are eminently marine. The Old Red Sandstones, on the other hand, appear to have been accumulated chiefly in great lakes or inland seas, and they betoken therefore the former existence of extensive lands, while the contemporaneous Devonian strata are of marine origin. Towards the close of the Upper Silurian period, then, we know that considerable upheavals ensued in western and north-western Europe, and wide stretches of the Silurian sea-bottom were converted into dry land. The geographical distribution of the Devonian in Europe, and the relation of that system to the Silurian, show that the Devonian sea did not cover so broad an expanse as that of the Upper Silurian. The sea had shallowed, and the area of dry land had increased, when the Devonian strata began to accumulate. In trying to realise the conditions that obtained during the formation of the Devonian and Old Red Sandstone, we may picture to ourselves a time when the Atlantic extended eastwards over the south of England and the north-east of France, and occupied the major portion of central Europe, sweeping north-east into Russia, and how much farther we cannot tell. North of that sea stretched a wide land-surface, in the hollows of which lay great lakes or inland seas, which seem now and again to have had communication with the open ocean. It was in these lakes that the Old Red Sandstone was accumulated, while the Devonian or marine rocks were formed in the wide waters lying to the south. Submarine volcanoes were active at that time in Germany ; and similarly in Scotland numerous volcanoes existed, such as those of the Sidlaw Hills and the Cheviots.

The Carboniferous system contains the record of a long and complex series of geographical changes, but the chief points of importance in the present rapid review may be very briefly summed up. In

the earlier part of the period marine conditions prevailed. Thus, we find evidence to show that the sea extended farther north than it did during the preceding Devonian period. During the formation of the mountain-limestone, a deep sea covered the major portion of Ireland and England, but shallowed off as it entered the Scottish area. A few rocky islets were all that represented Ireland and England at that time. Passing eastwards, the Carboniferous sea appears to have covered the low grounds of middle Europe and enormous tracts in Russia. The deepest part of the sea lay over the Anglo-Hibernian and Franco-Belgian areas; towards the east it became shallower. Probably the same sea swept over all southern Europe, but many islands may have diversified its surface, as in Brittany and central France, in Spain and Portugal, and in the various areas of older Palæozoic and Archæan rocks in central and south-east Europe. In the later stages of the Carboniferous period, the limits of the sea were much circumscribed, and wide continental conditions supervened. Enormous marshes, jungles, and forests now overspread the newly-formed lands. Another feature of the Carboniferous was the great number of volcanoes—submarine and subaerial—which were particularly abundant in Scotland, especially during the earlier stages of the period.

The rocks of the Permian period seem to have been deposited chiefly in closed basins. When, owing to the movement of elevation or upheaval which took place in late Carboniferous times, the carboniferous limestone sea had been drained away from extensive areas in central Europe, wide stretches of sea still covered certain considerable tracts. These, however, as time went on, were eventually cut off from the main ocean and converted into great salt lakes. Such inland seas overspread much of the low-lying tracts of Britain and middle Germany, and they also extended over a broad space in the north-east of Russia. It was in these seas that the Permian strata were accumulated. The period, it may be added, was marked by the reappearance of volcanic action in Scotland and Germany.

So far, then, as our present knowledge goes, that part of the European continent which was the earliest to be evolved lay towards the north-west and north. All through the Palæozoic era a land-surface would seem to have endured in that direction—a land-surface from the denudation or wearing down of which the marine sedimentary formations of the bordering regions were derived. But, when we reflect on the great thickness and horizontal extent of those sediments, we can hardly doubt that the primeval land must have had a much wider range towards the north and north-west than is the case with modern Europe. The lands from which the older Palæozoic marine sediments of the British Islands and Scandinavia were obtained must, for the most part, be now submerged. In later Palæozoic times land began to extend in the Spanish peninsula, northern France, and middle Europe, the denudation of which doubtless furnished materials for the elaboration of the contemporaneous strata of those regions. Southern Europe is so largely composed of Mesozoic and Cainozoic rocks that we can say very little as to the condition of that area in Palæozoic times, but the probabilities are that it continued for the most part under marine conditions. In few words, then, we may conclude that, while after Archæan times dry land prevailed in the north and north-west, marine conditions predominated farther south. Ever and anon, however, the sea vanished from wide regions in central Europe, and was replaced by terrestrial and lacustrine conditions. Further, as none of the Palæozoic marine strata indicates a deep ocean, but all consist for the most part of accumulations formed at moderate depths, it follows that there must have been general subsidence of our area to allow of their successive deposition — a subsidence, however, which was frequently interrupted by long pauses, and sometimes by movements in the opposite direction.

The first period of the Mesozoic era—viz. the Triassic—was characterised by much the same kind of conditions as obtained towards the close of Palæozoic times. A large inland sea then covered a considerable portion of England, and seems to have extended north into the south of Scotland, and across the area of the Irish Sea into the north-east of Ireland. Another inland sea extended westward from the Thüringerwald across the Vosges into France, and stretched northwards from the confines of Switzerland over what are now the low grounds of Holland and northern Germany. In this ancient sea the Harz Mountains formed a rocky island. While terrestrial and lacustrine conditions thus obtained in central and northern Europe, an open sea existed in the more southerly regions of the continent. Towards the close of the period submergence ensued in the English and German areas, and the salt lakes became connected with the open sea.

During the Jurassic period the regions now occupied in Britain and Ireland by the older rocks appear to have been chiefly dry land. Scotland and Ireland, for the most part, stood above the sea-level, while nearly all England was under water—the hills of Cumberland and Westmorland, the Pennine chain, Wales, the heights of Devon and Cornwall, and a ridge of Palæozoic rocks which underlies London being the chief lands in south Britain. The same sea overflowed an extensive portion of what is now the continent. The older rocks in the north-west and north-east of France, and the central plateau of the same country, formed dry land; all the rest of that country was submerged. In like manner the sea covered much of eastern Spain. In middle Europe it overflowed nearly all the low grounds of north Germany, and extended far east into the heart of Russia. It occupied the site of the Jura Mountains, and passed eastward into Bohemia, while on the south side of the Alps it spread over a large part of Italy, extending eastwards so as to submerge a broad area in Austria, Hungary, and the Balkan peninsula. Thus the northern latitudes of Europe continued to be the site of the chief land-masses, what are now the central and southern portions of the continent being a great archipelago with numerous islands, large and small.

The Jurassic rocks, attaining as they do a thickness of several thousand feet, point to very considerable subsidence. The movement, however, was not continuous, but ever and anon was interrupted by pauses. Taken as a whole, the strata appear to have accumulated in a comparatively shallow sea, which, however, was sufficiently deep in places to allow of the growth, in clear water, of coral reefs.

Towards the close of the Jurassic period a movement of elevation ensued, which caused the sea to retreat from wide areas, and thus, when the Cretaceous period began, the British region was chiefly dry land. Middle Europe would seem also to have participated in this upward movement. Eventually, however, subsidence again ensued. Most of what are now the low grounds of Britain were submerged, the sea stretching eastwards over a vast region in middle Europe, as far as the slopes of the Urals. The deepest part of this sea, however, was in the west, and lay over England and

northern France. Farther east, in what are now Saxony and Bohemia, the waters were shallow, and gradually became silted up. In the Mediterranean basin a wide open sea existed, covering large sections of eastern Spain and southern France, overflowing the site of the Jura Mountains, drowning most of the Alpine lands, the Italian peninsula, the eastern borders of the Adriatic, and Greece. In short, there are good grounds for believing that the Cretaceous Mediterranean was not only much broader than the present sea, but that it extended into Asia, overwhelming vast regions there, and communicated with the Indian Ocean.

Summing up what we know of the principal geographical changes that took place during the Mesozoic era, we are impressed with the fact that, all through those changes, a wide land-surface persisted in the north and north-west of the European area, just as was the case in Palæozoic times. The highest grounds were the Urals and the uplands of Scandinavia and Britain. In middle Europe the Pyrenees and the Alps were as yet inconsiderable heights, the loftiest lands being those of the Harz, the Riesengebirge, and other regions of Palæozoic and Archæan rocks. The lower parts of England and the great plains of central Europe were sometimes submerged in the waters of a more or less continuous sea; but ever and anon elevation ensued, and the sea was divided, as it were, into a series of great lakes. In the south of Europe a Mediterranean sea would appear to have endured all through the Mesozoic era — a Mediterranean of considerably greater extent, however, than the present. Thus we see that the main features of our continent were already clearly outlined before the close of the Cretaceous period. The continental area then, as now, consisted of a wide belt of high ground in the north, extending roughly from south-west to north-east; south of this, a vast stretch of low grounds, sweeping from west to east up to the foot of the Urals, and bounded on the south by an irregular zone of land having approximately the same trend; still farther south, the maritime tracts of the Mediterranean basin. During periods of depression the low grounds of central Europe were invaded by the sea, the irregular zone of land lying immediately to the south was partially submerged, and so converted into groups of islands, and the Mediterranean at the same time extended north over many regions which are now dry land. It is in these two low-lying tracts, therefore, and the country immediately adjoining them, that the Mesozoic strata of Europe are chiefly developed.

A general movement of upheaval supervened at the close of the Cretaceous period, and the sea which, during that period, overflowed so much of middle Europe had largely disappeared before the beginning of Eocene times. The southern portions of the continent, however, were still mostly under water, while great bays and arms of the sea extended northwards now and again into central Europe. On to the close of the Miocene period, indeed, southern and south-eastern Europe consisted of a series of irregular straggling islands and peninsulas washed by the waters of a genial sea. Towards the close of early Cainozoic times, the Alps, which had hitherto been of small importance, were greatly upheaved, as were also the Pyrenees and the Carpathians. The floor of the Eocene sea in the Alpine region was ridged up for many thousands of feet, its deposits being folded, twisted, inverted, and metamorphosed. Another great elevation of the same area was effected after the Miocene period, the accumulations of that period now forming considerable mountains along the northern flanks of the Alpine chain. Notwithstanding these gigantic elevations in south-central Europe—perhaps in consequence of them—the low-lying tracts of what is now southern Europe continued to be largely submerged, and even the middle regions of the continent were now and again occupied by broad lakes which sometimes communicated with the sea. In Miocene times, for example, an arm of the Mediterranean extended up the Rhone valley, and stretched across the north of Switzerland to the basin of the Danube. After the elevation of the Miocene strata, these inland stretches of sea disappeared, but the Mediterranean still overflowed wider areas in southern Europe than it does in our day. Eventually, however, in late Pliocene times, the bed of that sea experienced considerable elevation, newer Pliocene strata occurring in Sicily up to a height of 3000 feet at least. It was probably at or about that period that the Black Sea and the Sea of Azov retreated from the wide low grounds of southern Russia, and that the inland seas and lakes of central Europe finally vanished.

The Cainozoic era is distinguished in Europe for its volcanic phenomena. The grandest eruptions were those of the Eocene period. To that date belong the basalts of Antrim, Mull, Skye, the Faeroe Islands, and the older series of volcanic rocks in Iceland. These basalts speak to us of prodigious fissure eruptions, when molten rock welled up along the lines of great cracks in the earth's crust, flooding wide regions, and building up enormous plateaus, of which we now behold the merest fragments. The ancient volcanoes of central France, those of the Eifel country and many other places in Germany, and the volcanic rocks of Hungary are all of Cainozoic age; while, in the south of Europe, Etna, Vesuvius, and other Italian volcanoes date their origin to the later stages of the same great era.

Thus before the beginning of Pleistocene times all the main features of Europe had come into existence. Since the close of the Pliocene period there have been many great revolutions of climate; several very considerable oscillations of the sea-level have taken place, and the land has been subjected to powerful and long-continued erosion. But the greater contours of the surface which began to appear in Palæozoic times, and which in Mesozoic times were more strongly pronounced, had been fully evolved by the close of the Pliocene period. The most remarkable geographical changes which have taken place since then have been successive elevations and depressions, in consequence of which the area of the continent has been alternately increased and diminished. At a time well within the human period the British Islands have been united to themselves and the continent, and the dry land has extended north-west and north, so as to include Spitsbergen, the Faeroe Islands, and perhaps Iceland. On the other hand, the British Islands have been within a recent period largely submerged.

The general conclusion, then, to which we are led by a review of the greater geographical changes through which the European continent has passed is simply this—that the substructure upon which all the sedimentary strata repose is of primeval antiquity. The dry lands are built up of rocks which have been accumulated over the surface of a great wrinkle of the earth's crust. There have been endless movements of elevation and depression, causing minor deformations, as it were, of that wrinkle, and inducing constant changes in the distribution of land and water; but no part of the continental ridge has ever been depressed to an abysmal depth. The ridge has endured through all geological time. We can see also that the land has been evolved according to a definite plan.

Certain marked features begin to appear very early in Palæozoic times, and become more and more pronounced as the ages roll on. All the countless oscillations of level, all the myriad changes in the distribution of land and water, all the earthquake disturbances and volcanic eruptions—in a word, all the complex mutations to which the geological record bears witness—have had for their end the completion of one grand design.

Climate, Flora, and Fauna.—In respect of climate, by far the greater portion of the area of Europe belongs to the northern section of the temperate zone, though parts of Norway, Sweden, Finland, and Russia lie within the Arctic Circle. The southern parts of Spain, Sicily, and Greece are some twelve degrees from the northern tropic. See CLIMATE, RAIN, TEMPERATURE.

The natural history of Europe very much agrees with that of the corresponding latitudes of Asia. The natural history of the European countries on the Mediterranean Sea is very similar to that of Asia Minor and of North Africa. The natural history of the more northern regions of Europe resembles that of the great plains of Central Asia and Siberia. The most northern regions have the strictly arctic flora and fauna common in a great measure to all the arctic and sub-arctic regions; whilst the natural history of the most southern countries assumes a subtropical character.

The temperature of the western and northern parts of Europe being raised by the Gulf Stream and the winds from the great mass of dry and desert land in Africa above what is elsewhere found in similar latitudes, the flora and fauna exhibit a corresponding character, affected, however, by the great amount of moisture derived from the Atlantic Ocean, and also to a still greater degree by the comparative uniformity of temperature which the proximity of the ocean produces. The effect of the last-mentioned causes is so great that the northern limit of some plants is sooner reached on the shores of the Atlantic than in the more central parts of Europe, where the winters are much colder, and the average temperature of the year is lower. Of this the vine and maize are notable examples. Plants which require a mild winter will not grow in the north—and scarcely even in the centre of Europe—but they advance along the western coast under the influence of the maritime climate. Thus, the myrtle—although not indigenous—grows even in the south of England. Amongst plants the date palm, and amongst animals a species of ape, are found in the south of Europe (the ape only on the Rock of Gibraltar); whilst some strictly African birds are frequent visitants, and many birds—as the cuckoo, swallow, &c.—are common to Europe and Africa, inhabitants in summer even of very northern regions, and returning in winter to the warm south.

Of the plants now most commonly associated in our thoughts with the southern countries of Europe, many have probably been introduced from Africa or from the East. This has probably been the case even with the myrtle, and certainly has been the case with the vine, the olive, the orange, lemon, &c., the fig, the peach, the almond, the apricot, &c. Some of the most extensively cultivated fruits are certainly indigenous to Europe, as the apple, pear, plum, and cherry, although even of these the first improved varieties may have been introduced from the earlier seats of civilisation in the East. Among the wild animals of Europe at the present day, the bison is still reckoned; and the ox existed at no very remote period in a truly wild state. The reindeer inhabits the extreme north of Europe; the elk, the stag, the fallow-deer, and the roebuck are found in more southern regions; the ibex or bouquetin exists on the high central mountains; two species of antelope—the chamois of the Alps, and the saiga of the Russian plains—connect the European fauna with the Asiatic and African. Of mammals peculiar to this part of the palæarctic region, the most notable are the chamois, the musk rat, the fallow-deer, the civet, ichneumon, and porcupine. Of carnivorous animals, the most worthy of notice are the bear, the wolf, the fox, and the lynx. On this head see the article GEOGRAPHICAL DISTRIBUTION, and the sections on animal and vegetable life in the articles on the various countries. The European seas afford valuable fisheries, particularly of herring and of cod in the north, and of tunny, anchovy, &c. in the Mediterranean.

Ethnology.—In very early times Europe was inhabited by races differing very greatly from any existing variety of man, as is proved by the Heidelberg or Mauer jaw and the Piltdown remains (see EOANTHROPUS). To Mousterian times belongs the widespread race of Neanderthal (q.v.), probably without descendants at the present day. In the Aurignacian appear types that are not merely human as we understand the term, but might pass unnoticed among modern Europeans, if we may judge from their skeletons, while their art shows a development of mind to a very high level indeed. Anthropologists recognise survivals of these types in secluded corners of Europe. Both the Cro-Magnon and the Brünn-Brüx or Combe Capelle type can be seen to-day in the Dordogne district; while the 'negroid' Grimaldi is seen in the slums of Mediterranean towns. The Cro-Magnon type is dysharmonic—long-skulled but short-faced—with low eye-sockets, very strong jaws and cheek-bones, and narrow nose. The name is sometimes used in a generalised way for types diverging somewhat from that of the 'old man of Cro-Magnon.' The other two races had 'high-ridged, long, narrow skull, strong cheek-bones, low, broad orbits, broad nose;' but while the Brünn race had 'strongly marked glabella and brow-ridges, and moderately projecting upper jaw,' the Grimaldi had 'weak glabella and brow-ridges, but very strongly projecting upper jaw' (Professor Fleure). These Aurignacians may have entered Europe from Africa or Asia as the ice retreated. With the Neolithic civilisation, and to some extent a little earlier, new types appear. The broad-headed Alpine people spread westwards through the mountain regions, probably from Asia Minor. Long-heads continue to north and south of the Alpine wedge. The Alpine type, as seen to-day, has usually brown hair and eyes, pallid skin, and thickset body. It includes most of the French, the South Germans, many of the Slavonic-speaking and Balkan peoples. The dark Mediterranean and the fair Nordic long-heads, whatever their origin—new-comers or modified descendants of the older inhabitants—meet in Britain, where intermediate varieties abound, either mixed or not yet differentiated. In addition to these, there are 'Mongolian' broad-heads in the north of Europe. While the general distribution seems to be very much as it was in Neolithic times, there is much encroachment of one race upon another, and secondary races may have arisen by crossing.

Language.—Of about sixty languages spoken in Europe, the most isolated is that of the Basques (q.v.). Of Semitic tongues there is only Maltese, unless Hebrew be reckoned, which survives in religious use. Finno-Tatar tongues are spoken by the Finns and their kindred in northern and eastern Europe (see FINLAND), by the Kalmuks, the Magyars, and the Turks. If the Caucasus be included the diversity is much greater; otherwise there remain only Indo-Germanic languages—Germanic, Letto-Lithuanian, Slavonic, Celtic, Italic, Albanian, Greek, and Gypsy. In central and south-eastern Europe the language-map resembles a mosaic.

Historical Geography.—The historical geography of the parts of Europe known in the oldest times is treated in the articles ROME, BYZANTINE EMPIRE, GREECE, &c. In the articles on the various countries of Europe (FRANCE, GERMANY, AUSTRIA, &c.) will be found detailed accounts of the origin and development of the several nations and countries; or in some cases (BURGUNDY, NAVARRE) of their gradual disappearance as separate states. In this place it seems desirable to give a sketch of some of the most notable changes in the political distribution and national divisions in the European area since the fall of the Roman empire, and to indicate the outstanding features of the political geography of Europe at the important periods illustrated in the accompanying historical maps.

On the death of the Emperor Theodosius (395), the Roman empire was finally divided into two

STATE.	FORM OF GOVERNMENT.	Area. Square Miles.	Population.
Albania	Till 1912 Turkish; kingdom, 1914; under a supreme council (four members) and one chamber; republic 1925	14,000–15,000	831,877
Andorra	Republic, under suzerainty of France and Bishop of Urgel	191	5,231
Austria	Till 1918 limited monarchy (empire), forming dual monarchy with Hungary; now separate federal republic; area much reduced, 1919	32,352	6,428,336
Belgium	Limited monarchy	11,752	7,462,455
Bulgaria	Till 1908 principality tributary to Turkey; now kingdom (one chamber); area extended, 1913; curtailed, 1913, 1919	39,841	4,909,700
Czechoslovakia	Republic formed 1918–20 out of Austria and Hungary	54,241	13,610,405
Danzig	Till 1918 Prussian; now free city under League of Nations	754	365,000
Denmark	Kingdom (two chambers); North Slesvig added from Germany. See Iceland, below	17,144	3,289,195
Esthonia	Till 1918 Russian; now republic (one chamber)	16,955	1,109,479
Finland	Till 1917 grand-duchy under the Tsar; republic, 1919 (one chamber)	132,510	3,366,507
France	Republic; Alsace-Lorraine added, 1918	212,659	39,209,518
Germany	Till 1918 limited monarchy (empire); now federal republic; area curtailed, 1918	182,271	59,858,284
Greece (in Europe)	Till 1924 limited monarchy (one chamber); now republic; area greatly extended, 1913, 1919	41,900	4,900,641
Hungary	Till 1918 limited monarchy (kingdom) forming dual monarchy with Austria; republic 1918–1920; kingdom (without a king), 1920; area greatly curtailed 1920	35,790	7,945,878
Iceland	Kingdom (two chambers); recognised as a sovereign state, 1918; connected with Denmark only by king and provisional arrangements	39,709	94,679
Italy	Kingdom (two chambers); area extended at Austria's expense, 1919; Fiume (free city, 1920) added, 1924	117,982	38,835,941
Lettland (Latvia)	Till 1918 Russian, now republic (one chamber)	25,000	1,850,622
Liechtenstein	Principality (one chamber)	65	10,716
Lithuania	Till 1918 Russian, now republic; Vilna seized by Poles; Memel added, 1923	42,686	2,586,570
Luxemburg	Grand-duchy (one chamber)	999	263,824
Monaco	Principality; absolute till 1911; now one chamber	8	22,956
Netherlands	Kingdom (two chambers)	13,205	6,865,314
Norway	Kingdom (two chambers elected as one); in personal union with Sweden till 1905	124,964	2,649,775
Spitsbergen	Under Norwegian sovereignty, 1923; part of kingdom, 1925	25,000	1,000
Jan Mayen	Annexed, 1920	160	Uninhabited.
Poland	Republic (two chambers) formed in 1918 out of Russia, Germany, and Austria; extended by seizure from Lithuania and conquest from Russia, 1920–21	146,821	27,092,025
Portugal	Till 1911 limited monarchy; now republic (two chambers)	35,490	5,957,985
Rumania	Kingdom (two chambers); part of Dobrudja added, 1913; Bessarabia, Bukovina, Transylvania, &c., 1918	122,282	17,393,149
Russia (in Europe)	Till 1905 absolute monarchy (empire), then more or less limited; republic, 1917; soviet federal republic; area curtailed since 1918	1,488,240	93,387,923
San Marino	Republic	38	12,027
Spain	Kingdom (two chambers)	194,800	21,347,335
Sweden	Kingdom (two chambers); in personal union with Norway till 1905	173,035	5,904,489
Switzerland	Federal republic	15,975	3,880,320
Turkey (in Europe)	Till 1923 empire (constitution from 1908); now republic; area much curtailed since 1913	10,882	1,891,000
United Kingdom	Kingdom (two chambers)	95,041	44,167,913
Irish Free State	Since 1921–2 'a co-equal member of the community of nations forming the British Commonwealth of Nations'	26,592	3,139,688
Malta	Constitution granted, 1921	118	223,741
Gibraltar	Crown colony	2	20,628
Yugoslavia (kingdom of the Serbs, Croats, and Slovenes)	Kingdom (one chamber) formed in 1918 by the union of Serbia (kingdom; extended, 1913), Montenegro (principality till 1908; kingdom; extended, 1913), Bosnia-Herzegovina (Turkish province administered, and in 1908 annexed, by Austria-Hungary), and various Austrian and Hungarian territories; with additions from Bulgaria, 1919	96,134	12,017,323

parts—the Latin empire, or Empire of the West, the capital of which was Rome; and the Greek empire, or Empire of the East, the capital of which was Constantinople. The Latin empire consisted of six dioceses—Italy, Gaul, Britain, Spain, Western Illyricum, and Africa; the Greek empire consisted of seven dioceses—the East, Egypt, Asia, Pontus, Thrace, Macedonia, and Dacia. In some of these dioceses may be traced the outlines of modern European countries.

Beyond the pale of the organised society of the Roman world lay a great barbaric society, divided into two parts—the German or Teutonic half geographically adjoining the Western empire, and the Slavonic or Scythian half adjoining the Eastern empire. The German barbarians were divided into a number of tribes and nations—Goths, Burgundians, Alemanni, Vandals, Longobards, Franks, Angles, Saxons, &c. Farther away were the nomadic Alans. The Slavs, the an-

cestors of the modern Russians, Poles, and others, had their seats still farther east, and took less share in the events of medieval history. In the destruction which preceded the resurrection of modern European society, it was chiefly the western or Latin half of the Roman empire that was involved, and the destruction was effected by the irruption chiefly of German nations; it is mainly the Germanic peoples who have created the modern nations of Europe. Amongst the Germanic peoples the Goths were most prominent (see GOTHS). The Gothic tribes were located, at the period when the movement began, in the extensive tract between the Vistula, the Danube, the Black Sea, and the Don, and were divided into Visigoths or Western Goths, and Ostrogoths or Eastern Goths.

The determining cause of the precipitation of the German races on the Latin empire was, it is well known, the sudden invasion of Europe (375 A.D.) by the Turanian or Ugrian nation of the Huns. Their movement was perhaps ultimately due to the gradual desiccation of the plateaus of Central Asia (see ASIA). Subduing the Slavonic region of Europe, and establishing there a Hunnish empire, which superseded that of its previous conquerors the Goths, these fearful Asiatic invaders produced a violent agitation among the Germanic peoples, and pressed them westward—Goths, Vandals, Burgundians, Suevi, Alemanni, Franks, Angles, and Saxons, all together. The agitations produced in Europe by the Huns, and by the consequent irruptions of the Germanic nations, sometimes in confederacy, and sometimes singly, into the provinces of the Western empire, were protracted over a whole century. It will be sufficient here to mention generally that the diocese of Gaul was overrun chiefly by Visigoths, Burgundians, and Franks; Spain, by Vandals, Suevi, and Visigoths; Africa, by Vandals crossing over from Spain; in Italy, successive invasions had left among the feeble native Italians a deposit of Visigoths, Vandals, Huns, &c.; Britain, abandoned by its Roman garrison as early as 410, had become a prey to the Angles and Saxons.

As soon as this intermixture of the two societies —the Roman or civilised, and the Germanic or barbarian—had taken place, they began to act upon each other. Modern society, in short, is the perfected result of the incorporation of Roman with barbaric society; and it derives ingredients from both. From the barbarians were derived the love of personal liberty and the sense of individual independence. From the Romans, on the other hand, were derived the forms of a regular and long-established civilisation. But more efficient still, as a means of acting on the barbarian conquerors, was the great institute of the Christian Church.

In the 6th century the Franks occupied northern France and part of central Germany; the West Goths, France south of the Loire; Burgundians, the valleys of the Rhone and the Saône and various adjoining territories; while the West Goths were dominant over most of Spain, the Suevi holding the rest. The Thuringians were established in Thuringia; the Saxons in the large territory between the Meuse in the west and the Oder in the east; the Danes and other Scandinavians in the region they still hold. The Ostrogoths held southern Europe from the Burgundian borders to the Danube, and the whole of Italy—which, however, in the latter part of the century, was occupied by the Lombards (see ITALY). The Slavonic Czechs were already in Bohemia; and the Bulgarians were between the Dnieper and the Danube.

In the latter part of the 8th century (see the first of the historical maps) the Frankish empire of Charlemagne extended from the Ebro to the Elbe, and from the North Sea to Rome, the Franks having conquered both the Goths of France and the Burgundians. The Frankish empire was repeatedly divided and reunited; but ultimately the two great divisions of Neustria (the kingdom of the West Franks) and Austrasia (the kingdom of the East Franks—Franconia, and not at all corresponding to what was later known as Austria) became the nuclei of the kingdoms and nations of France and of Germany.

In what is now Hungary were the Avars; while to the east of the northern portion of the Frankish realms was the region of Slavonia, including Bohemians, Poles, and other Slavic peoples. East of them again were that peculiar people the Khazari or Chazars (q.v.), belonging to the Finnic stock. Of the Gothic power in Spain nought was left but the little kingdom of Asturia; the rest formed the Moslem sultanate of Cordova, the Mohammedans having established themselves in Spain in 711. Most of England and part of Scotland was now occupied by the English or Anglo-Saxons. The Eastern empire had greatly shrunk.

In the 12th century (see Map II.) the kingdom of the East Franks had become the representative and successor of the Western empire, and, as the Germanic or Holy Roman empire, extended from the North Sea to the States of the Church, by this time the dominion of the popes. In the empire were the dukedoms or territories of Lotharingia or Lorraine, Francia, Swabia, Bavaria, Thuringia, Bohemia, Austria, and Burgundy (the latter lately an independent kingdom). In South Italy was the Norman kingdom of Sicily. Henry II. of Anjou, king of England, was lord of Normandy, Anjou, Brittany, and Aquitaine or Guyenne; the remainder of France being the kingdom of the successor of the kings of the West Franks. The power of the English kings was more fully established in Guyenne than in Anjou, and Guyenne remained much longer a part of the English dominions in France. England had established her power over the eastern part of Ireland. In Spain the Christian kingdoms of Leon, Castile, and Aragon were growing at the expense of the sultanate of Cordova. Poland and Russia were consolidated states, with heathen Prussians and Lithuanians for their northern neighbours. The Hungarians were in their present dominions; Bulgaria and Serbia still limited the decreasing Eastern empire on the north, while the latter was threatened on the east by the dreaded Turks.

At the Reformation in the 16th century Charles V. was not merely emperor in Germany, but king of Spain (whence the Moslems, long confined to Granada, had been driven), Sardinia, Sicily, and Naples, and ruler of the Netherlands and of the county of Burgundy. From the 15th century onwards, the imperial crown remained with the Hapsburgs. Ferdinand I., Archduke of Austria (and, after the abdication of his brother Charles V., emperor), obtained by marriage Silesia, Bohemia, and Hungary (as much of it as was not Turkish). These all became, like the archduchy and connected territories, hereditary domains of the House of Hapsburg; but while Bohemia, like the archduchy, was a fief of the empire, Hungary, with its dependencies, was no part of the empire at all. From the middle of the century till near the end of the 17th, the Hapsburgs held the northwest part of Hungary; while the Turks, who had wiped out the Eastern empire, occupied the rest, a pasha ruling at Buda. Transylvania, Moldavia, and Wallachia were three tributary principalities. Dalmatia long fluctuated between Venice and Hungary. At the peace of Westphalia in 1648 (see Map III.), which closed the Thirty Years' War, the power of the empire was weakened,

while that of France had increased, part of Alsace being given to France. By the 15th century France had acquired most of the territory of the old *kingdom* of Burgundy (between the Alps, the Saône, and the Mediterranean). It had absorbed the *duchy* of Burgundy (afterwards the French province of Burgundy or Bourgogne) in 1477; but it was not till 1674 that France seized the *county* of Burgundy (afterwards the French province of Franche Comté), and Strasburg and its territory in 1681. Avignon had become a papal possession in 1348, and did not become French till 1791. The duchy of Savoy was becoming more and more an Italian power. Spain still held the Spanish Netherlands and great part of Italy. The Protestant Netherlands and Switzerland were become independent states. Sweden had acquired territories from Germany, Poland, and Russia, and was one of the great powers. She held not merely Finland, but all the lands around the Gulf of Riga, including Esthonia and Lettland (Latvia). Sweden also held western Pomerania, Wismar, Bremen, and Verden, not as Swedish territory, but as fiefs of the empire; the ancient possessions of Denmark in the northern peninsula were acquired by Sweden in 1658. The duchy of Prussia had become independent of Poland in 1647. Poland, which early in the 16th century had been one of the most powerful states of Europe, holding under its sway a great part of Russia, now lost in power and territory, while Russia steadily grew. Turkey held part of the former dominions of the Eastern empire, the Austrian princes the rest. Venice was the most important native Italian power. Genoa held Corsica till 1768.

Before the outbreak of the French Revolution, Poland had ceased to exist as a state. Prussia had risen to greatness, and Russia had been greatly aggrandised. Sweden had fallen from her temporary hegemony of northern Europe. The Spanish Netherlands had belonged since 1713 to the House of Austria; French Bourbons held those parts of Italy that had been Spanish. The French Revolution began a series of changes in the distribution of power which culminated in the extension of Napoleon's empire over all Germany west of the Rhine, and great parts of northern Germany, the Netherlands, and most of Italy (see Map IV.); a portion being directly incorporated with the empire, another separately held by Napoleon himself as his kingdom of Italy, whilst his brother-in-law was king of Naples and his brother king of Spain. After the fall of the empire, France retired within her old limits; the minor German princes constituted their states in a loose confederation, and of this Austria assumed the presidency. Italy was parcelled out amongst numerous despotic princes, and the Venetian dominions became Austrian. The Netherlands became once more a kingdom, ultimately separated into Holland and Belgium.

Later changes on the map have been the consolidation of Germany as an empire, under the headship of Prussia, and the restitution to it of Alsace-Lorraine; the retirement of Austria out of Germany, and her absorption of Bosnia and Herzegovina; the unification of Italy as a kingdom; the gradual diminution of Turkish territory by the independence and growth of Greece, Rumania, Serbia, Montenegro, Bulgaria, and Albania; the separation of Norway and Sweden, and of Denmark and Iceland. The war of 1914–18 and the revolutions associated with it have given independence to Czechoslovakia, Poland, Lithuania, Lettland, Esthonia, separated Austria from Hungary, Finland from Russia, assigned much of the territory of the defeated states (as Alsace-Lorraine, North Schleswig, Transylvania, part of Tyrol) to their neighbours, and united the Southern Slavs.

See the *Historical Geography of Europe*, by E. G. Freeman (2 vols. 1881), his *General Sketch of European History* (2d ed. 1876), *Primer of History of Europe* (1876), and *Chief Points of European History* (1886); T. H. Dyer, *History of Modern Europe, 1453–1871* (new ed. 6 vols. 1901–7); C. A. Fyffe, *A History of Modern Europe, 1792–1878* (3 vols. 1884–90); G. P. Gooch, *History of Modern Europe, 1878–1919* (1923); Lodge, *Modern Europe* (1886); Alison Phillips, *Modern Europe;* the 'Cambridge' histories (ancient, mediæval, modern); and the works of Gibbon and Hallam. For Geography and Statistics, see Suess, Klöden, and Reclus; Lyde, *Continent of Europe* (new ed. 1924); 'Europe,' in Stanford's *Compendium of Geography* (new ed. 1924 *et seq.*); Partsch's *Central Europe* (1903); Hogarth, *The Nearer East* (1902); Philippson, *Das Mittelmeergebiet;* the *Almanach de Gotha* and *Statesman's Year Book*. For Ethnology and Archæology, see the works of Beddoe, Ripley, Sergi, Déchelette, Burkitt, Boule, Macalister, Fleure.

Eurotas (mod. *Iri*), one of the chief rivers of the Peloponnesus, flows south through Laconia, past Sparta to the Gulf of Gythion. Its course is about fifty miles in length, but it is not navigable.

Eury'alē, a genus of Water-lilies, closely allied to Victoria (q.v.), but with small flowers. Seeds and root-stock of *E. ferox* are eaten, and the plant is cultivated in China.

Eurydice. See ORPHEUS.

Eurypharynx. See PELICAN FISH.

Eurypterida (Gr. *eurys*, 'broad'; *pteron*, 'a wing'), an extinct order of Arthropods, belonging to the class Arachnida. The name was given because of the broad, wing-like character of the sixth (last) pair of head appendages. The Eurypterida were aquatic animals, breathing by gills like the Xiphosura, and these two orders are sometimes grouped in a sub-class, Merostomata, in distinction to the true Arachnida, such as the scorpions, which are terrestrial and breathe by lungs or tracheæ. In their general appearance the eurypterids resemble living scorpions. The number of segments and their arrangement into three regions of prosoma, mesosoma, and metasoma are the same. The character of the two pairs of eyes is similar. In both the prosoma carries six pairs of appendages, similar in position and general form. The leaf-like gills of the eurypterids represent the lung-books of the scorpions. In both groups the metasoma is without appendages, and ends in a telson or tail-spine. The body of the eurypterids was protected by a chitinous skeleton.

The eurypterids are confined to rocks of Palæozoic age, ranging from the Cambrian to the Permian. The only known Cambrian form is *Strabops*, which occurs in Missouri. The order reached its maximum development in Upper Silurian and Lower Old Red Sandstone times. Specimens of *Eurypterus* have been found in a remarkable state of preservation in the Silurian of the Isle of Oesel in Esthonia. The chitinous skeleton has undergone so little carbonisation that the carapaces can be detached from the surrounding marl and examined by transmitted light. Some of the finest specimens of eurypterids have been obtained from the Upper Silurian rocks of the Pentland Hills and Lanarkshire, the commonest genera being *Eurypterus*, *Pterygotus*, *Slimonia*, and *Stylonurus*. Associated with these is a primitive type of scorpion (*Palæophonus*) intermediate in character between living scorpions and the extinct eurypterids. *Pterygotus anglicus*, which occurs in the Old Red Sandstone of Scotland, attained a length of nearly six feet, and may be noted as the largest known Arthropod. *Eurypterus* also occurs in the Old Red Sandstone; it is the chief genus in the Carboniferous, and one species at least lingered into Permian times.

The earliest eurypterids were marine—they are always found associated with characteristic marine organisms; later, they adapted themselves to live

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in brackish or even in fresh water conditions. Research has shown that the Eurypterida, the Xiphosura (the only living representative of which is *Limulus*, the king-crab), and the Scorpionida are intimately related. Of these orders the Eurypterida is the most primitive, but all have probably descended from a common ancestor.

Eurystheus. See HERCULES.

Eusden, LAWRENCE. See LAUREATE.

Eusebius of Cæsarea, the father of ecclesiastical history, was born probably in Palestine about 264 A.D. He took the surname of Pamphili from his friend Pamphilus, Bishop of Cæsarea, whom he faithfully attended for the two years (307–309) in which he suffered imprisonment during the persecution of Diocletian. He then went to Tyre, and afterwards to Egypt, where he was himself thrown into prison on account of his religion. He became Bishop of Cæsarea about 313, took a prominent part in the Council of Nice, and died in 340. Eusebius was the head of the semi-Arian or moderate party in the Council of Nice. That party was averse to discussing the nature of the Trinity, and would have preferred the language of Scripture to that of theology in speaking about the Godhead. Eusebius held that the promise of everlasting life was to him that *believeth on the only-begotten Son*, not to him that *knows how He is begotten of the Father*. He was very reluctant to accept the term *homoousios*, devised by Athanasius to describe the equality of the Son with the Father, and retained the kindliest feelings towards Arius after the views of the latter were condemned (see ARIUS). His moderation and other excellent qualities procured him the favour of Constantine, who declared that he was fit to be the bishop of almost the whole world. Eusebius has the reputation of being the most learned Father of the Church, after Origen and Jerome. His *Chronicon*, a history of the world down to 328 A.D., preserved in Latin by Jerome (ed. Fotheringham, 1905, 1923), in Armenian, and in a Syriac epitome, is valuable as containing extracts from many ancient writers whose works are no longer extant. His *Præparatio Evangelica*, a collection of such statements in old heathen authors as were fitted to make the mind regard the evidences of Christianity in a favourable light, also contains specimens of writings that no longer exist; its complement is the *Demonstratio Evangelica*, in twenty books, ten of which are extant, intended to convince the Jews of the truth of Christianity from the evidence of their own Scriptures. His most important work, however, is the *Ecclesiastical History*, in ten books. This relates the principal occurrences which took place in the Christian church till the year 324, and contains the results of his studies in numerous libraries, and even in the imperial archives, the Emperor Constantine having ordered, at Eusebius' request, an examination of all documents relative to the history of martyrs. One drawback of the work is that Eusebius, on principle, withholds all account of the wickedness and dissensions of Christians, inasmuch as he did not consider such stories for the edification of the church (see CHURCH HISTORY). Besides the foregoing works may be mentioned his *De Martyribus Palestinæ*, the treatises against Hierocles and Marcellus, the *Theophania* (discovered in 1839), and a panegyrical Life of Constantine. An edition of all Eusebius' works (in Greek) was begun in 1902 by the Berlin Academy.

Eusebius of Emesa was born at Edessa, and studied under Eusebius of Cæsarea, and at Alexandria and Antioch. Averse to all theological controversies, he declined the bishopric of Alexandria, vacant by the deposition of Athanasius. He was afterwards, however, appointed Bishop of Emesa, in Syria, but was twice driven away by his flock, who accused him of sorcery on account of his astronomical studies. He died at Antioch about 360. The homilies extant under his name are probably spurious.

Eusebius of Nicomedia, Patriarch of Constantinople, related to the Emperor Julian by the mother's side, was appointed Bishop of Beryta (Beyrout) in Syria, and afterwards of Nicomedia. He appeared as the defender of Arius at the Council of Nice, and afterwards placed himself at the head of the Arian party. He baptised the Emperor Constantine in 337, became Patriarch of Constantinople in 339, and died in 342. His enemies are our only sources of information as regards his character and opinions; yet, making the ordinary allowance for partisanship, there would seem to be sufficient reason for concluding that Eusebius was cunning and double-tongued when occasion required, and imperious and violent when he had power in his hands. Athanasius considered him not the disciple, but rather the teacher of Arius. See ARIUS.

Euskarian. See BASQUES.

Eustachio, BARTOLOMMEO, an Italian anatomist, who was physician-in-ordinary to the popes, and professor of Medicine in Rome, where he died in 1574. His name is indissolubly associated with anatomical science through his discoveries of the tube in the auditory apparatus (see EAR) and the rudimentary valve at the entrance of the inferior vena cava in the Heart (q.v.), which are called after him. These and other discoveries are recorded in his *Opuscula Anatomica* (Venice, 1564); his *Tabulæ Anatomicæ* were edited by Lancisi in 1714.

Eustathius, a celebrated Greek commentator on Homer and the geographer Dionysius, was born at Constantinople. He was at first a monk, then a deacon and teacher of rhetoric in his native city; he was Archbishop of Thessalonica from 1160, and of Myra from 1174, and died at an advanced age some time posterior to 1185. Eustathius was profoundly versed in the ancient classic authors, and a man of prodigious acquirements; and the value of his quotations is heightened by the consideration that most of the works from which he extracts are no longer extant. His most important work is his commentary on Homer (1st ed. Rome, 1542–50), a rich mine of knowledge. Of a similar character is his commentary on Dionysius, first printed by Robert Stephens (Paris, 1547). Of his commentary on Pindar, only the *Prœmium* has come down to us, a part of his theological and historical treatises, letters, &c. was published by Tafel in 1832.

Eutaw Springs, a small affluent of the Santee River, in South Carolina, near which the last serious battle in the American war of independence was fought, 8th September 1781. The Americans, under Greene, drove the British from their first position, and on their retreat during the night took many prisoners. The British claimed a victory because they held their position unmolested during the afternoon.

Euter'pe (i.e. 'she who delights'), one of the nine Muses (q.v.). She was the muse of lyric poetry, and is represented in ancient works of art with a flute in her hand.

Euterpe, a genus of Palms (q.v.). *E. oleracea* and *E. edulis*, closely related species called Palmeto or Cabbage-palm, are cultivated in Brazil (Para, &c.), both for the cabbage (the stem then serving for palisades), and for the sake of the fruit, which yields the basis of a refreshing drink. See ASSAI.

Euthana'sia (Gr.), an easy death, or a painless method of putting to death. The use of narcotics or other means for shortening life in disease has never become a subject of discussion in modern civilised countries, but it is often a very practical

question how far such means are admissible for soothing the last hours of life, when the approach of death does not itself dull the consciousness and the sensibility to pain.

Eutin, Weber's birthplace, near Lübeck.

Eutropius, a Latin historian, concerning whom we only know that he filled the office of secretary to the Emperor Constantine, fought against the Persians under Julian, and died probably about 370 A.D. His *Breviarum Historiæ Romanæ*, giving a short narrative of Roman history from the foundation of the city to the time of the Emperor Valens (364 A.D.), is written in an extremely simple style, and appears to have been originally intended for the use of schools. It became very popular as the taste for original investigation declined, and is either copied or followed by the early monkish annalists; it was twice translated into Greek, and was continued by others down to the 9th century. The History existed in three distinct forms at the revival of letters: the genuine work of Eutropius in ten books; the expanded editions of Paulus Diaconus and others; and a complete but largely interpolated copy contained in the *Historia Miscella*. The *editio princeps*, printed at Rome in 1471, was from the impure text of Paul.

Eutyches, an archimandrite at Constantinople, from whom the Eutychian controversy took its name. His christological views were an exaggeration of those of Cyril of Alexandria. He held that after the incarnation of Christ everything human in him had become merged in his divine essence, and that Christ therefore had but *one nature*. His personal enemies Domnus of Antioch and Eusebius of Dorylæum denounced him to Flavian, Archbishop of Constantinople, and at a synod held there in 448 A.D. he was condemned as a Valentinian and Apollinarian heretic. An œcumenical council was, through the influence at court of Dioscurus, Cyril's successor at Alexandria, called to Ephesus for a renewed investigation of the matter in dispute. Leo, Bishop of Rome, at the critical moment reversed the policy of the Roman see (his predecessor Celestine had favoured Cyril), and wrote to Flavian his famous epistle, in which he set forth authoritatively the doctrine of the two natures and one person. The council met at Ephesus in August 449, under the presidency of Dioscurus, and, under fear of the fists of his fanatical monks, decided everything exactly as he wished. Eutyches was restored, and Flavian, Eusebius of Dorylæum, Theodoret, and Domnus of Antioch were deposed. On the death of Theodosius II. the government passed into the hands of his sister Pulcheria and her husband Marcian (28th July 450). The fourth œcumenical council met at Chalcedon (q.v.), 8th October 451, and, though the greater number of the five or six hundred bishops shared the views of Dioscurus, the imperial authority insured the acceptance of the formula of Leo, and the resolutions passed in 449 by the 'Robber Council' (*latrocinium Ephesinum*)—the name given it by Leo—were annulled, as having been extorted by fear. Eutyches, who had previously been a second time excommunicated by Anatolius, Patriarch of Constantinople, was removed from the neighbourhood of the capital by Marcian before the meeting of the council. Afterwards, on the advice of Leo, he was transported to some remote place, but his subsequent history is unknown. The Eutychian sect was from 452 put down by penal laws.

For the later history of the opponents of the decrees of Chalcedon, see GREEK CHURCH.

Euxine. See BLACK SEA.

Evagrius, surnamed SCHOLASTICUS, a church historian, was born at Epiphania in Syria in 536. An advocate by profession, he filled more than one administrative office under the Roman emperors. His *Ecclesiastical History*, covering the period from 431 to 594, forms a continuation of that of Eusebius. Although marred by the credulity of its age, it is on the whole fairly trustworthy.

Evander, son of Hermes by an Arcadian nymph, called in Roman traditions Carmenta or Tiburtis. About sixty years before the Trojan war he is said to have led a Pelasgian colony from Pallantium, in Arcadia, to Italy, and to have landed on the banks of the Tiber, and near the foot of the Palatine Hill. Here he built a town, naming it Pallantium after the one in Arcadia. At a later period it was incorporated with Rome, and is falsely affirmed to have originated the names Palatinus and Palatium. He did much to introduce the habits of social life among his neighbours; he prescribed for them milder laws, and taught them, among other arts, those of music and writing. To him is also ascribed the introduction of the worship of the Lycæan Pan, with that of Demeter, Poseidon, and other deities. Virgil represents him as being still alive when Æneas arrived in Latium after the sack of Troy, and as having sent him aid under his son Pallas, who fell by the hand of Turnus. Evander was worshipped both at Pallantium, in Arcadia, and at Rome.

Evangelical (lit., 'according to the gospel,' Gr. *euangelion*), a designation originally claimed by all Protestants, on the ground that their tenets were derived solely from the Evangel (in the widest sense)—i.e. the Bible, but in later times more particularly attached to the school that insists especially on the total depravity of unregenerate human nature, the necessity of conversion, the justification of the sinner by faith alone, the free offer of the gospel to all, and the plenary inspiration and exclusive authority of the Bible—views largely held by the Presbyterians of Scotland, the Nonconformists in England, and the corresponding churches in America and the British colonies. The adherents of this view within the Anglican communion are (with others) called the 'Low Church.' In Germany it is the special designation of the United Church, as distinguished from the old Lutheran and Reformed churches, but the title has been assumed by the pietistic party within the Protestant churches, on the ground of their superior orthodoxy and absolute faith in Scripture. See CHURCH HISTORY, and ENGLAND (CHURCH OF); also G. R. Balleine, *History of the Evangelical Party* (1908); G. W. E. Russell, *Short History of the Evangelical Movement* (1915); S. Baring-Gould, *The Evangelical Revival* (1920); and *Liberal Evangelicanism*, by members of the Church of England (1923).

Evangelical Alliance, an association of evangelical Christians belonging to various churches and countries, which, in the words of the circular issued by members of different churches in Scotland, 5th August 1845, and originating the movement for its formation, seeks 'to associate and concentrate the strength of an enlightened Protestantism against the encroachments of Popery and Puseyism, and to promote the interests of a scriptural Christianity.' At a meeting held at Liverpool, October 1–3 of that year, the scope of the association was extended to the means to be used for counteracting religious indifference. In 1846 (19th August–2d September) the first general conference was held in London under the presidency of Sir Culling Eardley, and was attended by 921 members from all parts of the world, representing as many as fifty different denominations. The association was instituted a free union, not of churches or sects, but of individual Christians,

and the membership was confined to those holding 'the views commonly called evangelical' on the following nine points of doctrine: (1) The divine inspiration, authority, and sufficiency of Holy Scripture; (2) the right and duty of individual believers to exercise their judgment in the interpretation of Scripture; (3) one God and three Persons in the same; (4) human nature utterly corrupted by the fall; (5) the Son of God made man, His work of reconciliation for men's sins, and His mediatorial intercession and reign; (6) the justification of the sinner by faith alone; (7) the work of the Holy Spirit in the sinner's conversion and sanctification; (8) the immortality of the soul, the resurrection of the body, the judgment of the human race by Jesus Christ, together with the eternal felicity of the righteous and punishment of the wicked; (9) the divine institution of the Christian ministry, and the obligatory and perpetual ordinance of baptism and the Lord's Supper.

Evangelical Association, a sect closely akin to the Methodists both in government and doctrine, founded by Jacob Albrecht or Albright, who was born in the State of Pennsylvania, 1st May 1759. Originally a Lutheran, he travelled through several States as an evangelist, and in 1800 organised his adherents in 'classes' after the Methodist manner. In 1807 he was appointed bishop, and down to his death, 18th May 1808, he was the leader of the sect, which in 1818 assumed the name Evangelical Association of North America. Since 1843 it has drawn many adherents from the English-speaking population.

Evangelical Union, the name assumed by a religious body constituted in Scotland in 1843 by the Rev. James Morison (1816–93) of Kilmarnock (afterwards of Glasgow), and other three ministers, along with the congregations adhering to them. They had been separated from the United Secession Church on account of their doctrinal views, and were soon increased by a number of ministers and churches expelled from the Congregational Union of Scotland for holding similar doctrines. Their ecclesiastical system was a modified independency. Their doctrine is expressed in a *Doctrinal Declaration*, issued in 1858 as an explanation, not a fixed creed. In 1896 they were incorporated with the Congregational Union of Scotland (see INDEPENDENTS).

Evangelist (Gr., 'a bringer of good tidings') denotes in the New Testament a preacher of the gospel. In Ephesians, iv. 11, 'evangelists' are distinguished on the one hand from the apostles and prophets, and on the other from the pastors and teachers, and hold a rank between both. They were not, like the latter, attached to individual congregations, but preached as *missionaries*, without having the authority of the apostles chosen as witnesses from the beginning by Jesus himself, or of the prophets, who testified from special inspiration. Philip and Timothy were such evangelists.—The term evangelist is also applied to the authors of the gospels (Gr. *euangelion*).

Evans, SIR GEORGE DE LACY (1787–1870), general, was born in Ireland, and served in India and the Peninsula, in the American campaign of 1814, and at Waterloo. An advanced Liberal, he sat in parliament in 1831–41 and 1846–65. During 1835–37 he commanded the 'Spanish Legion,' 10,000 strong, for the young Queen Isabella against the Carlists. In command of a division in the Crimea, he was wounded in the battle of the Alma, and repelled a Russian attack before Sebastopol. In 1855 he received the thanks of the House of Commons, and was created G.C.B. He died 9th January 1870.

Evans, SIR JOHN, K.C.B., F.R.S., and D.C.L. (1823–1908), was born at Market Bosworth, and after a successful career as a paper-manufacturer, became eminent as numismatist and antiquary. He was president of the British Association, of the Society of Antiquaries, and of the Geological, Numismatic, and other learned societies, and wrote standard books on the coins (1864) and of the stone (1872) and bronze (1881) implements of ancient Britain.—His son, Sir ARTHUR JOHN EVANS, was born at Nash Mills, Herts, in 1851, was educated at Harrow, Brasenose, and Göttingen, travelled in the Balkans, and in 1884–1908 was keeper of the Ashmolean Museum at Oxford. In 1909 he became professor of prehistoric archæology. He has been since 1893 singularly successful in his excavations in Crete (q.v.), where he disclosed a great civilisation hitherto unknown, whose importance, from the point of view of world-history, can hardly be over-estimated. He has written on Bosnia, Illyria, Mycenæ, and Crete.

Evans, MARIAN. See ELIOT, GEORGE.

Evans, OLIVER, an American inventor, born in Newport, Delaware, in 1755, made several notable improvements in flouring-mills, and is said to have invented the first steam-engine constructed on the high-pressure principle, the drawings and specifications of which he had sent to England in 1787 and 1795. In 1804 he completed a steam-dredging machine, which propelled itself on wheels to the river Schuylkill, a distance of a mile and a half, and thus is considered the first land-carriage worked by steam in America. Evans also projected a railway between New York and Philadelphia, which his narrow means never allowed him to realise. He died in New York, 21st April 1819.

Evanston, a city of Illinois, on Lake Michigan, 12 miles N. of Chicago, with a number of handsome residences, the Garrett Biblical Institute, the North-western University (Methodist), and various colleges; pop. 37,000.

Evansville, a port of entry and capital of Vanderburg county, Indiana, on the Ohio, 162 miles ESE. of St Louis by rail, with a city hall, a court-house, a handsome post-office and custom-house, and a public library and art gallery. Coal and iron ore abound near by, and the town has a large number of factories of various kinds, besides a very considerable trade in tobacco, flour, &c. Pop. (1870) 21,830; (1900) 59,007; (1920) 85,264.

Evaporation, or VAPORISATION, is the process by which a substance changes into the state of vapour. Some solids visibly evaporate—e.g. solid ice or snow gradually disappears though the temperature may be considerably below the freezing-point. The characteristic smell of certain metals, such as copper or iron, is supposed to be due to slow evaporation (see SUBLIMATION). The change of a liquid into the state of vapour may go on at all temperatures; but the rate of change is greater the higher the temperature is, until at last boiling—i.e. free evaporation—occurs (see BOILING). Slow vaporisation at temperatures below the ordinary boiling-point is used on a large scale for commercial purposes, when it is wished to crystallise out a substance which is held in solution. The rate of evaporation depends upon the amount of surface exposed. It depends, too, upon the pressure under which the vapour is developed, and thus evaporation goes on quickly if the vapour is removed as rapidly as it is formed, as is the case when wind blows over the surface of water or snow. The temperature at which boiling occurs also depends upon the pressure. This may readily be shown by boiling water in a glass flask until the steam has driven out most of the air. If the flask be now corked, and the source of heat be withdrawn, the boiling will cease. But if cold water be poured on the flask the boiling will recommence at once. This is due to the fact that the lowering of tempera-

ture causes condensation of some of the steam, and this lowers the vapour-pressure so far as to allow of free evaporation at the reduced temperature. At any given temperature evaporation ceases when a certain pressure of the vapour is arrived at, or, more correctly, a state of equilibrium is reached in which condensation balances evaporation. Condensation occurs at all pressures; but, if the proper pressure corresponding to the temperature is not reached, evaporation exceeds condensation; while, if the vapour-pressure is too great, condensation exceeds evaporation. The presence of another gas or vapour, such as ordinary air, has no effect upon the final value of the pressure which is attained; but the time taken to reach this final pressure does depend very greatly upon the presence of another gas. The time becomes greater as the amount of gas present increases. This state of equilibrium is disturbed at once by any variation of vapour-pressure or of temperature. A vapour is said to be *saturated* when it is in equilibrium in contact with its liquid.

A considerable amount of heat is absorbed in the process of evaporation. The amount depends upon the nature of the liquid, and also upon the temperature of evaporation. Regnault gives for 'total heat' of steam the formula $606{\cdot}5 + 0{\cdot}305t$, in which t represents the temperature in degrees Centigrade. This means that a pound of saturated water-vapour at 0° C. gives out 606·5 units of heat when it condenses to water at 0° C., while a pound at 100° C. would give out 606·5 + 30·5—i.e. 637 units in changing to water at 0° C. The heat given out by a pound of saturated steam at any temperature when it condenses to water at the same temperature is called the *latent heat* of the steam at that temperature. The term is not a good one. It has reference to the fact that the heat which is required to evaporate a substance without change of temperature disappears so far as ordinary thermometric methods of determining its presence are concerned. If we take into account the variation of the specific heat of steam with temperature, Regnault's measurements of the total heat show that at 0° C. the latent heat is 605·5 units, at 100° C. it is 536·5 units, and at 200° C. it is 464·3 units. It thus decreases very rapidly with rise of temperature. It vanishes at the Critical Temperature (q.v.). The following is the latent heat of vaporisation of a few liquids at a pressure of one atmosphere: water, 536·0; alcohol, 202·4; ether, 90·5; bromine, 45·6. It is evident from these figures that the latent heat of vaporisation of water is relatively large. Were it not for this fact we might have rapid condensation of moisture in the atmosphere in consequence of a very small fall of temperature, and in this way destructive floods might be caused.

Practical use is frequently made of the latent heat of evaporation. Thus, in order to keep water cool it should be stored in vessels of porous earthenware. Some of the water passes through the pores, and evaporates at the outer surface. The latent heat necessary for this is drawn largely from the rest of the water, which is thus kept cool. It is even possible, as was first done by Sir John Leslie, to freeze water by this process. He put some water contained in a shallow earthenware vessel inside the receiver of an air-pump along with a dish of strong sulphuric acid. When the air was exhausted, rapid evaporation resulted; but the vapour was absorbed by the acid as quickly as it was formed, and thus the evaporation was kept up continuously, so that the remaining water was rapidly cooled down to the freezing-point.

The same principle is used in the formation of solid carbonic acid and the like. A jet of liquid is allowed to escape from a strong vessel containing it. The outer parts of the jet evaporate, and in consequence the inner parts are solidified. Faraday froze mercury in a white-hot vessel by placing it in a little capsule which rested upon a mixture of solid carbonic acid and ether in the spheroidal state.

Evarts, William Maxwell, American lawyer and statesman, was born in Boston, 6th February 1818, graduated at Yale, and was admitted in 1841 to the New York bar, where he afterwards built up a notable practice, receiving in some cases $25,000 or $50,000 for an opinion. He was chief counsel for President Johnson in the impeachment trial in 1868, and filled the office of United States attorney-general to the end of Johnson's administration. He was United States counsel before the Alabama tribunal in 1872, and senior counsel for Henry Ward Beecher in 1875. In 1877–81 he was secretary of state, and in 1885–91 sat in the United States senate. He died 28th February 1901.

Eve. See Adam and Eve.

Evection, a lunar inequality resulting from the combined effect of the irregularity of the motion of the perigee, and alternate increase and decrease of the eccentricity of the moon's orbit. See Moon.

Evelyn, John, was born of wealthy parentage at Wotton, near Dorking, in Surrey, 31st October 1620. He was brought up by his maternal grandmother at Lewes (1625–37), then entered Balliol College, Oxford, having already been admitted at the Middle Temple, where, without a degree, he took up residence in 1640—the year of his father's death. Having witnessed Strafford's trial and execution, he resolved to absent himself 'from this ill face of things at home,' and so travelled for three months in Holland and Flanders. Back in London, 'studying a little, but dauncing and fooling more,' in November 1642 he joined the king's army, only to leave it in three days' time, lest both himself and his brothers should be 'expos'd to ruine, without any advantage to his majestie;' and the Covenant being pressed on him, he travelled for four years in France, Italy, and Switzerland. At Paris in 1647 he married the ambassador's daughter, Mary Browne (1635–1709); and, returning for good to England in 1652, settled at Sayes Court, Deptford, the home he did so much to beautify. A thorough, if prudent royalist, he was much at court after the Restoration; acted on several public committees; during 1685–87 was one of the commissioners of the privy seal, during 1695–1703 treasurer of Greenwich Hospital; and from the first was a prominent member of the Royal Society. In 1694 he removed to his brother's at Wotton, and let Sayes Court to Admiral Benbow, who sublet it to Peter the Great (a 'right nasty' inmate). In 1699 he succeeded his brother; and, vigorous in intellect to the very last, he died at Wotton, 27th February 1706.

'Almost perfect' is Mr Wheatley's estimate of Evelyn, who was indeed a right worthy gentleman, as active and intelligent as he was honest and God-fearing, yet neither a Sage nor a Hero. His pen was a busy one, and dealt with a multitude of subjects—'architecture, painting, engraving, numismatics, history, politics, morals, education, agriculture, gardening, and commerce.' Of all his thirty-five works the chief are *Sculptura, or the History and Art of Chalcography and Engraving on Copper* (1662); *Sylva, or a Discourse of Forest-trees* (1664); and his delightful *Diary* (first published in 1818). It is to the last that Evelyn owes his present celebrity. Written by one who had accustomed himself to habits of close observation, it covers a period of more than seventy years—and these the most memorable in English history. It is, indeed, of inestimable value; Scott said that he had 'never seen a mine so rich.' See the Life by

Henry B. Wheatley, prefixed to the sixth edition of the *Diary* (4 vols. 1879; reprinted 1906).

Evening Primrose. See ŒNOTHERA.

Everest, MOUNT, a peak of the Himalayas on the Tibet-Nepal border, the highest ascertained point on the surface of the globe, rises to a height of 29,141 feet above the sea, in 27° 59′ 12″ N. lat., and 86° 58′ 6″ E. long. It was named in honour of Sir George Everest (1790–1866), surveyor-general of India, who completed in 1841 the great trigonometrical survey, and, having retired in 1843, published in 1847 his principal work, *An Account of the Measurement of Two Sections of the Meridional Arc of India.* Everest was elected a Fellow of the Royal and other scientific societies, and was knighted in 1861. The Royal Geographical Society and the Alpine Club sent a reconnaissance party in 1921; and in 1922 a climbing party attacked the mountain from the East Rongbuk glacier on the Tibetan side. Messrs Mallory, Somervell, and Norton reached 26,800 feet without artificial supply of oxygen (some 2200 feet higher than the Duke of the Abruzzi's 'record' on K2); and Messrs Finch and Bruce with a Gurkha later reached 27,200 feet with oxygen. In 1924 Somervell and Norton reached 28,128 feet without oxygen; Mallory and Irvine (with oxygen) were lost, and were last seen at 28,226 feet. See books by Bury and others (1922), and Bruce and others (1923).

Everett, (1) a city of Massachusetts, a residential suburb of Boston, with some manufactures; pop. 40,000. (2) A city and port of Washington, with great lumber and other industries; pop. 28,000.

Everett, ALEXANDER HILL (1792–1847), diplomatist and author, born at Boston, Massachusetts, was minister at The Hague in 1818, at Madrid in 1825. Four years afterwards he returned to the United States, where he became proprietor and editor of the *North American Review* (1830–35), and also occupied a seat in the legislature of Massachusetts. In 1840 he was confidential agent of the United States government in Cuba. Commissioner to China in 1845, he died in Macao. Besides poems and several political works, he published two series of *Critical and Miscellaneous Essays* (Boston, 1845–47).—His younger brother, EDWARD EVERETT, was born at Dorchester, Massachusetts, 11th April 1794, and graduated at Harvard in 1811. At the age of nineteen he had already gained a high reputation as a Unitarian preacher in Boston. In 1815 he was elected professor of Greek in Harvard College; and to qualify himself more thoroughly for his work he spent four years in Europe. Victor Cousin pronounced him 'one of the best Grecians he ever knew.' In 1820 Everett became editor of the *North American Review*, and in 1824 a member of the United States congress, sitting in the House of Representatives for ten years. In 1835–38 he was four times elected governor of Massachusetts; and in 1841–45 he was minister plenipotentiary at the court of St James. On his return to America he was elected president of Harvard College; on the death of Daniel Webster (of whom he wrote a memoir) he became secretary of state; and in 1853 a senator. In 1860 he was nominated by the Constitutional Union party for the vice-presidency of the United States, receiving 39 electoral votes out of 303. He died 15th January 1865. Everett's principal works are *A Defence of Christianity* (1814); several fine poems; and his eloquent *Orations and Speeches* (4 vols. 1836–59), covering a wide range of subjects, and indicating a varied, vigorous, and flexible genius. See Life by P. R. Frothingham (1925).

Everglades, a large shallow lake in southern Florida, enclosing thousands of islets, covered with dense thickets, and containing great numbers of alligators. Its area is diminishing. From this district Florida (q.v.) is sometimes called the Everglade State.

Evergreens are those trees and shrubs of which the leaves do not fall off in autumn, but retain their freshness and verdure throughout the winter, and which may perform their functions during more than one year. Evergreen leaves are generally of thicker and firmer texture than the

A, Ardisia; B, Holly (*Ilex*); C, Skimmia.

leaves of deciduous trees and shrubs. The habit most common among the larger-leaved forms is indicated in the figure—these three distinct and unrelated evergreens, Ardisia (*Primulaceæ*), Holly (*Aquifoliaceæ*), and Skimmia (*Rutaceæ*), having not only the same type of leaf, but very similar small white flowers with red berries. Evergreen leaves are sometimes very small, as in firs and heaths; sometimes pretty large, as in rhododendrons, laurels, magnolias, &c. See ECOLOGY.

Everlasting Flower, the popular name of certain plants, the flowers of which suffer little change of appearance in drying, and may be kept for years without much diminution of beauty. They are plants chiefly of the order Compositæ, having their flowers (heads of flowers) surrounded with an involucre, the scales of which resemble the petals of a corolla, but are rigid, membranous, and contain little moisture. Some species of Cudweed (q.v.) (Gnaphalium) are often called everlasting flowers, and the other plants which bear the name belong to nearly allied genera, but particularly to Helichrysum, Rhodanthe, and Acroclinium, which are mostly annuals and natives of Africa and Australia. *Helichrysum arenarium* is frequent on dry, sandy soils in many parts of Europe and the central latitudes of Asia. It is covered with a gray felted down, and has yellow flowers, which, when rubbed, emit a faint aromatic odour. It is often worn on the continent of Europe as an ornament in the hat, particularly by wagoners. *H. angustifolium* and *H. Stœchas* — shrubby species, natives of the south of Europe—have larger yellow flowers. Some of the species have a powerful and pleasant aromatic odour. Several kinds of everlasting flowers are frequently to be seen in our gardens; others, such as Phœnocoma and Aphlexis, natives of the Cape of Good Hope, are of shrubby habit, and choice and beautiful greenhouse plants. As an instance of everlasting flowers in other orders than Compositæ

Everlasting Flower (*Helichrysum bracteatum*).

may be mentioned the genus Statice; the coloured calyx in nearly all the numerous species of which it is composed is dry, membranous, and very persistent. The French call everlastings *Immortelles*, and often weave them into circular wreaths, which are placed beside recent graves, as emblems of immortality or of loving memory. A very extensive trade is now carried on by France, Germany, and Italy in growing and preserving everlasting flowers for exporting to Britain and America.

Eversley, a village of NE. Hampshire, 13 miles NE. of Basingstoke. Charles Kingsley was curate of the parish from 1842, and rector from 1844 till his death there on 23d January 1875, and he lies buried in the churchyard.

Evesham, a municipal borough of Worcestershire, on the right bank of the navigable Avon, 15 miles SE. of Worcester. It lies in a beautiful and fertile vale, and the chief industry is market-gardening. There are a fine modern bridge, public gardens, water-works (1884), a 16th-century guild-hall, &c.; but the stately Benedictine abbey (709) is represented chiefly by a beautiful Perpendicular belfry (1533). Till 1867 Evesham returned two members to parliament, till 1885 one. Simon de Montfort was defeated here, 4th August 1265. Pop. (1851) 4605; (1891) 5836; (1921) 8685. See May's *History of Evesham* (1845).

Eviction, in Law, means the dispossession of one person by another having a better title of property in land. In Scotland, the term is applied also to dispossession of movables, although in England and the United States it is restricted to lands and tenements. As popularly employed, eviction generally means the forcible expulsion of a tenant from lands and houses. The technical legal terms for this process are Ejectment (q.v.) in England, and Removing (q.v.) in Scotland. The law of Ireland as regards evictions is in a different position from that of Great Britain, from the favour shown to tenants by the Irish Land Acts. A tenant's interest in the land can be attached by creditors other than his landlord, and the tenant be evicted for failure to pay his debts, or by foreclosure of mortgage; but the great majority of cases are cases of eviction by the landlord. This eviction proceeds upon the tenant's failure to perform some part of his contract of lease—in general, the agreement to pay rent at stated periods, or the obligation to remove voluntarily when the lease has expired. Under the statutes in question, no tenant in Ireland can be evicted for non-payment of rent unless he owes at least a year's rent. Where proceedings are taken with a view to have a tenant evicted from a holding for which a judicial rent has not been fixed, the tenant may apply to the court to fix a fair rent. If a tenant has been decided by the court to be entitled to compensation for improvements, he cannot be compelled by process of law to quit his holding until the amount due to him as compensation has been made good. After a landlord has obtained his judgment, six weeks must pass before he proceeds any further, in which time the tenant may pay the amount due, and thus stay the eviction. Before the passing of the Land Act of 1887, the eviction then took place if the tenant had failed to settle; and the evicted tenant had a right to redeem for six months, and during this time the landlord was liable to him for the crops on the land. It became a widely prevailing custom for landlords, in these circumstances, to reinstate the tenant immediately after his eviction, as caretaker of the holding. After the period of redemption had run out, this caretaker might again refuse possession of the land, and be again physically removed. If he paid the amount due to the landlord, he became tenant again. The Land Act of 1887 made law such of the rules of this custom as were in favour of the tenant. With reference to holdings of not more than £100 a year of rental (and the greater number of Irish holdings are such), it enacted that, when a landlord had obtained judgment entitling him to evict for non-payment of rent, he should (instead of proceeding to evict the tenant as formerly) serve upon him an eviction notice. The notice informs the tenant that a decree for the recovery of the land for non-payment of rent has been obtained by the landlord; that any person entitled by law to redeem the said land must do so within six months from the service or posting of the notice, by paying to the landlord, or his agent, the sum specified in the notice as rent arrears and costs; and that on service or posting of the notice the person in possession of the land, to whom the notice is addressed, is deemed to be in possession as caretaker only, and not as tenant. A return of such notices filed in court is presented from time to time to parliament, and their number is often mistaken for the number of actual physical ejections from lands which take place in Ireland. But the tenant may redeem his right within six months, and meantime remains in possession of the land as caretaker. He cannot be removed as caretaker until a month after service of the notice, unless by special leave of the court. When a warrant has been applied for for his removal as caretaker, the justices may put a stay upon the issue of the warrant for a month or less, if they think that, by reason of the illness of the caretaker, or any other cause, the proceedings ought to be delayed.

Evidence. Evidence may be defined as the means of proving an unknown or disputed fact. In ordinary legal usage the term has two meanings which should be distinguished. In one it denotes testimony as to the existence of facts; in the other it denotes relevancy to an issue, as when it is said that 'hearsay is not evidence.' Evidence is divided into (1) oral or parole evidence, statements made by word of mouth by witnesses in court; (2) documentary evidence, the testimony derived from writing, or the use of any conventional symbols which, like letters, serve to express ideas; (3) real evidence, the testimony of things, as where footprints in a field give evidence that some one has been there. Another distinction is drawn between direct and circumstantial evidence. Direct evidence is the testimony of witnesses to what they have themselves observed or know of their own knowledge regarding the fact to be ascertained, as when A testifies that he saw B stab C with a knife. Circumstantial evidence is testimony given by witnesses to what they have observed or know regarding facts more or less remotely connected with the unknown or disputed fact, as when A testifies that he found upon B a blood-stained knife. The relative value of direct and circumstantial evidence as proof of fact has been much discussed. Direct testimony is generally esteemed the stronger; but witnesses may be mistaken, deceived, or deliberately false; while circumstances 'cannot lie,' and the conclusion forced upon the mind by an unbroken train of circumstances pointing in the same direction is often more forcible than positive direct testimony.

Instances may be found in which combinations of facts and circumstances are morally satisfactory as grounds of assurance and judgment, and, in many cases where a conviction has proceeded upon circumstantial evidence alone, the prisoner has afterwards confessed his guilt. A good example is the case of Courvoisier, the valet and murderer of Lord William Russell (1840). Here there was no direct testimony whatever to connect the accused with the crime, and there were circumstances designed by the accused to suggest that it was the

work of burglars. It was proved, however, that the prisoner had an opportunity of committing the crime, that some of the abstracted property had been concealed in his pantry, and that he personally had disposed of other portions of it. The evidence, besides, excluded the reasonable belief that any other than the prisoner was guilty, and upon these grounds he was convicted, and afterwards confessed. On the other hand there have been cases, happily rare, in which a miscarriage of justice, and the conviction of the innocent instead of the guilty, have resulted from a reliance by the jury upon circumstantial evidence. The most remarkable of these that has occurred in recent times arose out of a burglary committed at the rectory of Edlingham in 1879. Two burglars, one of whom shot at the rector, were seen on the night by the rector and another person. Two men were arrested and tried for the crime at Northumberland Assizes in 1879. Neither the rector nor the other person who had seen the burglars was able to identify the prisoners, and the defence was that the case for the prosecution was wholly one of mistaken identity. But a chisel found in the room where the crime was committed was traced to the possession of the prisoners; a piece of newspaper picked up in the same room was found to correspond with a piece in the coat of one of the prisoners; and footmarks found near the scene of the crime corresponded with those of the prisoners. The jury on this evidence found them guilty, and they were sentenced to penal servitude for life. They served in the convict settlement at Portsmouth for nine years; when, in 1888, the true burglars, two other men than those who had been convicted, confessed to the crime. Inquiries were made by the authorities, with the result that the men who had been convicted on the evidence of the chisel, the newspaper, and the footmarks, were set at liberty.

Judges and juries are not allowed by law to proceed upon their private knowledge of facts at issue before them, and must decide according to the evidence adduced. Of some facts, however, a judge takes 'judicial notice,' and these do not require to be proved by evidence. Such are all public acts of parliament, the proceedings and privileges of parliament, the course of proceeding and all rules of practice in force in the Supreme Court of Justice, the ordinary course of nature, natural and artificial divisions of time, the meaning of English words, and many other matters which judges are by statute specially directed to notice. Judges are also bound under the rules of law called presumptions to draw a certain inference from a certain fact unless the truth of such inference is disproved. A *presumptio juris et de jure* does not allow its inference to be disputed. For example, the law presumes that a minor is incapable of managing his own affairs; and, when a man is proved to be a minor, he will be held so incapable without regard to the question whether in truth he is so or not. A *presumptio juris* may be rebutted, as thus: the law presumes that when a woman is married, her husband is the father of her children; but evidence may be adduced to prove the contrary. A third kind of presumption has been distinguished, the *presumptio judicis vel hominis*, but this is merely another name for an argument or inference of logic. With regard to disputed facts that are not matter of judicial notice or legal presumption the general rule is that he who affirms a fact must prove it; and the burden of proof lies in the first instance on the party against whom judgment would be pronounced in the absence of evidence on either side.

The general rule governing questions as to what facts may be proved in judicial proceedings is that facts in issue (or those upon which the existence of the legal right in question depends) and facts relevant to the issue—i.e. those from which the facts in issue may be inferred—may be proved to the exclusion of all other facts. Facts collateral to the issue are not allowed to be proved—e.g. in a question whether A committed a crime, the fact that he formerly committed another crime of the same kind is held to be irrelevant, and not allowed to be proved. Hearsay evidence—i.e. testimony to the fact that a statement was made by a person not called as a witness—is similarly deemed to be irrelevant, the reason generally assigned being that the best evidence must be given. But the rule excluding hearsay suffers exceptions. Thus, voluntary confessions of crime and declarations by persons accused of crime are admitted as evidence against themselves; and declarations made by witnesses at the point of death, or in fear of death, are received as evidence against others. The opinion of a witness, as distinguished from his testimony to a fact, is generally held to be irrelevant; but the opinion of skilled persons or experts as to matters coming within their special province is admitted. Thus, in a question whether a man was sane when he made his will, the testimony of a witness to the fact that the deceased wrote his will in different coloured inks upon medicine labels would be deemed relevant, while the same witness's opinion that 'no sane man would make a will in that way' would be deemed irrelevant; but in a question whether A was poisoned, the opinion of medical men is admitted as to the effects of the poison of which A is said to have died. Evidence as to a person's character is deemed to be relevant in an inquiry regarding his conduct.

Admissible facts may be proved by documentary or by oral evidence. When the contents of documents are proved by the production of the document itself in court, the evidence is said to be primary. When copies are produced, the evidence is said to be secondary. As a general rule the documents themselves are necessary, as being the best evidence; but copies are accepted in certain settled cases—as where the original is in possession of the adverse party, who refuses to produce it; where it has been destroyed or lost; or where it is of such a nature as not to be easily movable, as in the case of a libel written on a wall. Public documents, such as the records of the realm, the acts of parliament, and the like, are proved by copies variously authenticated. When the law requires writing as proof, or where, e.g., a contract is *de facto* written, oral evidence in contradiction will not be admitted. Such evidence will, however, be received for the interpretation and construction of documents where they are obscure or couched in language used out of its ordinary sense.

The old rules which restricted or excluded the admissibility of a witness on the ground of religion, of interest, and of character have been gradually swept away by legislation. Objections of interest and character do not now affect the admissibility of witnesses, but are urged against their credibility when their testimony has been received. As a general rule all persons who are capable of giving rational evidence are admissible as witnesses. Extreme youth and mental infirmity will exclude if it is such as to prevent the witness from understanding questions or giving rational answers, or from knowing that he ought to speak the truth. In criminal cases the accused was formerly not admissible as a witness, nor the husband or wife of the accused, except where he or she was the person injured by the crime. Some exceptions were made, e.g. by the Criminal Law Amendment Act, 1885, which allowed persons accused of offences under it

and their husbands or wives to be competent witnesses. The rule itself was abolished by the Criminal Evidence Act, 1898, by which 'every person charged with an offence, and the wife or husband, as the case may be, of the person so charged, shall be a competent witness for the defence,' whether the accused is charged solely or jointly with others. Such evidence cannot be compelled, and its absence may not be made subject of comment by the prosecution. Witnesses are in the ordinary case examined in open court by word of mouth, after taking an oath to tell the truth. If any witness is unwilling to be sworn from conscientious motives, the judge may permit him to make a solemn Affirmation (q.v.). Any person who has made such declaration and wilfully and corruptly gives false evidence may be prosecuted and punished as if he had committed Perjury (q.v.). Witnesses are first examined by the party who calls them into court. After this examination-in-chief they are cross-examined on behalf of the opposite party, and then re-examined. Leading questions—i.e. questions which suggest their own answer—may be put in cross-examination, but not in the examination-in-chief. No witness is bound to answer any question if the answer would expose him to a criminal charge; but if the result of his answer would be to render him liable to a civil suit for debt or otherwise he must answer notwithstanding. Questions may be put in cross-examination to test the accuracy or credibility of the witness, and to shake his credit by injuring his character; but the judge may disallow questions which he considers to be vexatious and not relevant to the issue. Every witness may be examined as to whether he has ever made a different statement regarding the matter of his examination; and, if he denies, proof may be led to contradict him. Spouses cannot be compelled to disclose communications made to one another during the marriage. Confidential communications between parties to legal proceedings and their legal advisers are similarly protected. Medical men and clergymen, on the other hand, may probably be compelled to disclose communications made to them in professional confidence, although the point remains doubtful (see CONFIDENTIALITY). Except in cases of treason and perjury, the evidence of one witness is held sufficient by the law of England to support a conviction; but proof of circumstances to corroborate such witness is usual. The rule runs the other way in Scotland, where no libel can be proved by the unsupported testimony of a single witness; but, as one witness is held sufficient to prove each of a chain of connected facts, the practical effect of the two rules is the same in both countries. See Sir James Fitzjames Stephen's *Digest of the Law of Evidence* (6th ed. 1904), and Kirkpatrick's *Digest of the Scottish Law of Evidence* (2d ed. 1886).

In the United States, state laws prescribe the rules of evidence which govern the state courts, and, in the absence of congressional enactments, federal courts. The effect of recent acts of congress is that there is now no restriction as to the admission of testimony based upon the colour or nationality of the witness; and in general the party in interest both in civil and criminal cases may be a competent witness, subject to the general rule that a party is not compelled to criminate himself, nor shall his silence upon any question create a presumption against his innocence, and subject also to the general rule that a husband shall not be allowed to testify against his wife, nor the wife (unless the offence has been committed by the one against the other) against her husband. Where the evidence relates to the remedy, as in the proving of an instrument by subscribing witnesses, state rules govern both in federal and state courts; hence the practice varies with the locality. Circumstantial evidence is admitted by courts with great reluctance, and in criminal cases, if not corroborated by the positive evidence of at least one witness, it must be of such a character as to be equivalent in weight of evidence to direct and positive evidence, and be entirely inconsistent with the innocence of the party accused.

A belief in God and in divine rewards and punishments, here or hereafter, for deeds done is essential to the admissibility of a witness; and this belief must have no reference to the punishment for perjury by human law; hence one having no belief in God cannot be a competent witness, and no form of oath which he declares to be binding upon his conscience cures this defect. The jury are the judges of the fact, and, as such, of the credibility of the witnesses; hence no jury in the United States is obliged to reject a statement of a witness because uncorroborated by positive testimony, either direct or circumstantial. The general rules as to relevancy; the relative value of written and oral evidence, and the control of the one by the other; and the taking of an oath or affirmation are to the same effect as those observed in England. —For the evidences of religion, see APOLOGETICS.

Evil may be generally defined as that which is opposed to the divine order of the universe. It requires only a superficial observation to perceive that there are many apparent exceptions to the pervading harmony and happiness of creation: there are convulsions in the physical world; there are suffering, decay, and death throughout the whole range of organic existence; and the appellation of Evil is commonly applied to such phenomena. In the face of the human consciousness, such phenomena appear to be infractions of the general order and good, and it pronounces them *evil*. Every form of religion testifies to the recognition of evil in the external world, and superstition in all its shapes mainly rests upon it.

But it is in the sphere of moral life alone that the conception of evil is most deep-seated—evil in human life and manners and history. There is in the moral consciousness of man a sense of violated order, of transgression of divine law, or what is called *sin*, which is *evil* in its essential form. This fact of evil is everywhere appealed to by the Christian religion; it is the aim of this religion to deliver men from its power and misery. Every ethical and judicial code is based upon its recognition, and is designed to protect human society from its injurious consequences.

The question of the *origin of evil* has been greatly discussed, and has received various answers. The simplest and most direct of these answers is that which maintains a double origin of things, or a system of *dualism*. This conception lies at the basis of many forms of religion; it may be said to be the fundamental conception of all mere nature-religions. Interpreting the obvious appearances of nature, these embody in divine personalities its contending manifestations of light and darkness, benignity and terror. The opposition of Ormuzd and Ahriman in the old Zoroastrian faith is one of the most conspicuous examples of this religious dualism. Manichèism, which spread so widely in the 4th and 5th centuries, and the Syrian gnosticism from which it sprang, though accounted amongst Christian heresies, are also historical illustrations of the same principle.

The dualistic theory of the origin of evil, however, could not maintain itself with the advance of speculation and the truer appreciation of Christian truth. It was at once a postulate of the cultivated reason and a dictate of divine revelation that the world proceeded from One absolutely

Divine Creator, holy and good, of whom, and through whom, and to whom are all things. It was necessary, therefore, to reconcile the appearance of evil with this fundamental admission.

The doctrine of the Fall, especially in the later form of development which connects it with the existence of a devil or evil spirit, tempting man in the shape of the serpent, was supposed to explain the appearance of evil in human history. Being tempted of the devil, man sinned, and so fell from his obedience to the divine law. This is the doctrine of orthodox Christian theology, and the answer which it gives to the inquiry, how sin came into the world. And many minds never think of carrying the inquiry further. It is clear, however, that this explanation of the historical origin of evil leaves the question of its real and absolute origin unsettled. The devil being assumed as the cause of man's sin, the further question arises, whence the devil? Is he an absolute personality? in which case we are landed in the old theory of dualism; or is he, according to the traditionary Christian conception, a fallen angel? in which case the question just returns, whence the spring of evil in him? (See DEVIL.) There is no real explanation gained by this removal of the question; it is still the same difficulty—whence the origin of evil in the creation of an all-perfect Being, almighty as well as all-wise and good?

Speculation may please itself with ingenious answers to this question, but in truth it admits of no satisfactory solution. Some, for example, have argued that evil, like darkness or cold, is an indispensable element of alternation or contrast in human life. All individual reality is only the product of opposite forces working together. Character could only arise from the interaction of opposing ethical influences of good and evil. In nature we have attraction and repulsion, rest and motion, positive and negative electricity; why should it be different in the sphere of morals? Here, too, there must be polarity. Good can only exist in contradistinction to evil; the one no less than the other is necessary to constitute the drama of human life and history. Others, again, have argued that evil is the result of what is called metaphysical imperfection. God alone can be perfectly good. The creature in its very nature is limited, defective; and evil is nothing else than the evidence of this limitation in man. It is not something real or positive, but only a privation. It is in morals what cold and darkness are in physics, a pure negation. Thus have argued such profound thinkers as Augustine and Leibnitz. But it requires but little penetration to see that such arguments, however ingenious and so far well founded, do not meet the essential difficulty of the problem. If evil be, according to such views, a necessary element of human life, in the one case in order to develop its activity, in the other case as clinging to its creaturely limitations, then plainly it is not, in the orthodox sense of the word, *evil*. It is not and cannot be a contradiction of the true idea of human life, and at the same time a necessary element of it. Whatever necessarily belongs to life must help its true development, and not injure and destroy it; must be *good* in short, and not *evil*. Such theories, therefore, only solve the problem by eliminating the fact. The origin of evil must remain for ever inscrutable; nor is it wonderful that it should. It is only in its ultimate sense conceivable as a quality of moral freedom, and moral freedom in man or any created being is a profound mystery. It is something which 'we apprehend, but which we can neither comprehend nor communicate.'

The problem of the origin and existence of evil is dealt with by the most notable philosophers, as by Kant and Hegel, but assumes special prominence in the pessimistic philosophers, Schopenhauer and Hartmann. According to Schopenhauer, not merely does pain greatly outbalance pleasure, but existence as such is necessarily evil (see PESSIMISM). John Stuart Mill, in his posthumous essays (1874), held that, in the presence of so much and so great evil, physical and moral, in the universe, it was impossible for him to believe in a deity at once omnipotent and all-benevolent. He felt therefore driven to regard God as a Demiourgos limited in power by the materials on which he had to work. See also SIN, WILL; Julius Müller, *The Christian Doctrine of Sin* (trans. 1868); and Rashdall, *The Theory of Good and Evil* (1907).

Evil, KING'S. See SCROFULA.

Evil Eye, the power of exerting an evil influence or fascination on any one by a glance from the eyes, one of the most venerable and widespread of human beliefs, sanctioned alike by the classical authors, the Fathers of the Church, the medieval physicians, savage races everywhere, and modern usage in many countries within the range of Christianity. Readers of Virgil will remember the complaint of Menalcas in the third *Eclogue* that some evil eye has bewitched his tender lambs, and every one is familiar with St Paul's bold metaphorical use of the idea to express the spiritual perversion of the Galatians (iii. 1). By the ancient Greeks it was called *Baskania*, by the Romans *Fascinum;* and to both it was an integral part of the popular belief. Amulets of very various forms—the most common those shaped like horns, like a frog, or like a hand—were worn to counteract its effect, and such devices adopted by way of safeguard as spitting on the ground or on the breast, showing something ridiculous to the fascinator, dissimulating good fortune, or doing something unpleasant by way of a counter-penance, like Polycrates of Samos throwing his ring into the sea. It was supposed that fascination was most often due to envy; hence the philosophy of overcoming it, and converting it into laughter and safety, by the exhibition of some ridiculous amulet, often of most indecent description. Such also were the *oscilla* or little masks of Bacchus hung upon fruit-trees to avert the *fascinum* and keep them fertile, and the *phallus* borne about in procession at the Dionysia. Of similar origin is the fact that stated numbers are particularly liable to the *fascinum*, and hence the deep-rooted Jewish disinclination to number flocks or the like, and the no less strong objection of Neapolitan and Scottish fishermen to state the number of their catch. In the folklore of almost every people it is considered unlucky to be praised with any particular warmth, and it is a point of prudence to use certain formulas immediately thereafter. We find this not only among the ancient Greeks, Romans, Celts, and Teutons, but among such people as the Turks, Italians, Spaniards, as well as the Chinese, Japanese, Negroes, and Red Indians. Thus, in Carniola and Corsica a mother does not care to hear her baby praised or a farmer his crops, while even in England here and there sick people still feel uneasy at being told that they are looking much better.

Nowhere at the present day has the belief in the evil eye a more real power than among the Neapolitans. The *Jettatura* is one of the common dangers incident to life, and every one wears his amulet against it. These are usually of silver, in the form of an antelope horn, a hand with the first and little finger doubled down, a key with a heart in its handle, a crescent moon with a face in it, or a sprig of rue. Other very common forms are the *cimaruta*, an emblem combined of all the foregoing, none of which are directly Christian symbols, and the *cavallo marino* ('sea-horse') and *sirena*, the last two being very common in Pompeian

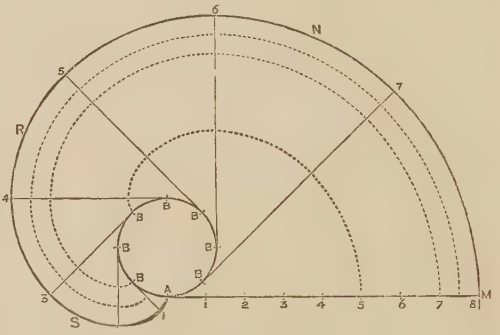
paintings. The horror of this fatal gift of fascination with its blighting influence is deepened by the fact that it is exerted upon any object upon which the eye may first light, often, if not indeed usually, in opposition to the will of the person who is cursed with it. Men now possess it more commonly than women—nay, the *jettatore* is often a priest or monk, and it was long a matter of common belief that it was an unhappy attribute of Pio Nono himself. In ancient times, on the contrary, it was more common in women than men, and was possessed most often by little old women with squint or deep-set eyes, especially those who were lean and melancholy, and had double pupils. The Neapolitan *jettatore* is traditionally a morose and sallow man, eager to cast his blighting influence over men and women, but most commonly children, and usually he is a mean-looking personage, totally unlike the portentous figure idealised in the *Corricolo* of Dumas. Many of the medieval philosophers have seriously discussed the rationale of the evil eye, with its relations to the poisonous rays emitted by toads and basilisks, and the fascination of terror exerted by the serpent upon the bird through keeping its eyes fixed steadfastly upon it. Grimm notes as one of the best means of recognising a witch, that when you look into her eyes you see your image reflected upside down, and suggests that the peculiar conformation may have had something to do with her evil eye. At anyrate this baneful property is characteristic of witches everywhere, of none more than in those of Teutonic mythology.

See FASCINATION; the learned discussion in W. W. Story's *Castle St Angelo and the Evil Eye* (1877); G. Pitrè, *La Jettatura ed il Mal'occhio in Sicilia* (Kolozsvar, 1884); chap. vi. of E. N. Rolfe and H. Ingleby's *Naples in 1883* (1888); Tuchmann on 'Fascination' in *Mélusine* (1884-89); Elworthy, *The Evil Eye* (1895); R. C. Maclagan, *The Evil Eye in the Western Highlands* (1902); and, for Eastern evidence, papers by John de Cunha and Purushottam Balkrishna Joshi in part iii. of the *Journal of the Anthropological Society of Bombay* (1888).

Evil Merodach. See BABYLONIA.

Evolute, Involute, correlative terms first applied to the tracing of curves by Huygens. Under this distinction every mathematical curve is considered as one of a pair which are mutually produced. To measure the curvature at any point, or the amount of bending or deflection from the tangent, we find a circle which coincides with the curve for an elementary distance. This circle of curvature or 'osculating circle' must evidently diminish its radius as the curvature increases, and increase its radius as the curvature diminishes. The centre of this circle is called the centre of curvature for that point; and the successive points of any given curve have in general different centres of curvature, because the amount of deflection is constantly varying. When we trace, for example, an ellipse, the varying centre of curvature is at the same time tracing a companion curve of quite a different shape. The latter is called the evolute and the former the involute. Or we may begin with the evolute. Take a circular disc of metal or wood and wrap a thread round the circumference, which is now to serve as the generating curve. When the disc is held fast to any plane, and the string unwrapped under tension, any point of the latter will describe on the plane an involute of the circle. At any particular moment of the process the straightened or unwound part of the string is the radius of curvature of the outer curve. Thus, (1) the tangent to the evolute at any point is the normal to the involute at the corresponding point; (2) any curve as involute can have but one evolute, but any curve regarded as an evolute has an infinite number of involute companion curves, which are all parallel; (3) the length of any arc in the evolute is the difference between the tangents at its extremities. When the circle is evolute, its involute (see fig.) is obviously spiral; and, when it is itself involute, the corresponding evolute has the exceptional form of being diminished to a point. The evolute of the cycloid is also exceptional, being another equal cycloid, a fact first observed by Huygens. A practical application of the involute of the circle occurs in theoretical mechanism in connection with the shape of the teeth of wheels, under certain circumstances.

From A, the beginning of the involute, draw a tangent AM = length of circumference of the circle.



Circle, BBB, as Evolute and its Spiral Involute, MNRSA.

Divide AM into eight equal parts (as figured) and the circumference into the same number at B, B, B, &c. At these points draw tangents so that line B1 = line A1, B2 = A2, B3 = A3, B4 = A4, &c. The extremities of the tangents show the curve called the involute of the circle. The dotted curves show three of the companion involutes, all parallel to the first. They obviously admit of indefinite extension, however small the generating circle may be.

Evolution, in Arithmetic. See INVOLUTION.

Evolution. Upon every developing mind, whether infantile or consciously philosophic, there presses at times the question of the origin of things. The attempt to answer this is to construct a cosmogony; and is alike the earliest and the latest extension of our common-sense account of things into complete and more orderly form as science. In seeking to do this the greater and more permanent phenomena at first impress us; and our speculative restlessness, if not lulled altogether, may seek to satisfy itself by postulating the existence of the universe substantially unchanged during an infinite past. But this philosophy of things is not only incapable of being really grasped by the highest effort of the intellect, but is incessantly contradicted by experience; it has hence never gained any real acceptance from the simplest common sense, much less any confirmation from science. The alternative then arises of drawing an explanation of the origin of things from our experience not of permanence, but of change. Here it is naturally the most changeful phenomena, the most marked and sudden contrasts, which first and most deeply arouse our attention, and this not only in nature, but still more in human life and affairs. The conception of uniformity among superficially different phenomena has hardly arisen, and the demand for explanations in terms of cause and effect, other than in terms of personal volition, is proportionately weak. The hypothesis of a sudden and unexplained, of a mysterious appearance or creation of things, thus next presents

itself; and the subsequent explanation of this as an act of external will is rendered easy by our personal consciousness. As our practical and industrial powers develop, and the perception of phenomenal order deepens and extends, the original simple association of a simultaneous appearance of all phenomena with a flash of volition is modified. Phenomena are becoming classified and interconnected in larger and larger groups, with which a higher anthropomorphism can henceforth associate a conception of detailed design. The older view only remains provisionally so far as order is not yet apparent; such later creationist theories become increasingly supplemented by a recognition of the changes in progress around us. The importance of these is found steadily to increase, and the conception of evolution, nascent since the crudest view of creation had given place to a more gradual and causal explanation, now becomes independently formulated in each order of phenomena. Human affairs become more and more obviously interpretable than of old, and there arises in their place the characteristically modern idea of progress. Natural science meanwhile has become more active, the very astronomical and geological phenomena from which our ideas of permanence were most derived are seen to be in process of change. Changes which seemed to be catastrophic in their vastness are proved to be only the cumulative product of natural agencies in daily operation; and the idea of the present as the product of the past also becomes extended to the world of organic life. The details, the general mechanism and direction of the processes of change, thus become inquiries of paramount interest to each body of scientific specialists and still more to the philosopher. It is at this period that we find ourselves, and to the brief discussion of these questions therefore that we must pass; but it is useful from the outset to recognise that instead of having well-defined and sharply-opposed theories of creation and evolution, these are but phases of an incomplete evolution. Hence the controversies so active during the middle half of the last century have practically ceased; it is admitted on all hands that the evolution theory only supersedes those cruder anthropomorphisms of arbitrary creation and of mechanical contrivance which presented the universe as a mere aggregate of finished products, without excluding that higher and more unified teleology which interprets it as the orderly unfolding of a cosmic drama. And as we see the evolution theory to be an orderly development beyond its predecessors, mere destructive criticism of these becomes no longer necessary.

Mode of Treatment.—The student of theology or philosophy, or the man of general education, is usually inclined at once to plunge amid the conflicting currents, the perplexing eddies of past cosmogonic speculations. He hence sets out by reviewing the oriental theories of the universe, and comparing these with Hellenic ones; he develops mingled types of both through early Christian thought into the elaborate compromise of the scholastic world; and finally endeavours to trace the modifications and survivals of these in contact with the thought-streams of the Renaissance and the Revolution before reaching the theories of modern times. But it would be a grave mistake to suppose that these last are the product of any continuous development from the preceding course of speculation. They have arisen independently and upon a distinct line, and present themselves as the most generalised result and expression of our concrete studies of natural science. Hence such historic inquiries, in all cases difficult, if not actually misleading, would be in any case premature; whereas, when we have grappled with the scientific theories of evolution, we may then profitably note the analogies or parallelisms, the survivals of, or reversions to, earlier modes of thought which these present.

Scientific conceptions of evolution may themselves be approached from various sides. Minds of the more abstract type or training tend to begin with such a highly generalised analysis and exposition of the subject as that with which the labours of Herbert Spencer were so pre-eminently concerned. After accepting or modifying this dynamic view of the universe as a whole, we should then seek to satisfy ourselves as to the applicability of our principles to the genesis of the physical world, and thence pass to the phenomena of life, mind, and society. We should then be accustomed to regard the universe no longer as a mere phantasmagoria, nor even merely as an orderly succession of events, but as a process of becoming. And, since this orderly flux of evolution is still in progress, scientific prevision thus becomes possible, and with it a corresponding degree of practical prevision as well. We thus reach a transition from the cosmist to the humanist attitude; the essential step from an evolutionary system of science towards an evolutionary system of ethics would then be made. These general conceptions reached, and an evolutionary philosophy in its broadest outlines being thus settled, we are in a position to review the earlier systems of different historic periods, and rationally criticise and interpret them in the light of our own conceptions; it may be even to recognise defects or deficiencies in these, and to obtain suggestions how to correct or supply them.

A less arduous and more popular method, concrete and inductive moreover, and consequently more in harmony with the modern spirit, is to begin as a scientific specialist, artificially isolating in thought one order of phenomena at a time from the complex unity of nature. Reviewing in this way the physical sciences, next the biological, and finally the mental and social, we shall be able to trace the parallel rise of evolutionary interpretations in each order of phenomena. And, after adequate detailed study of physical and organic processes, we may not only discuss the broader generalisations with fuller grasp and certitude, but proceed to inquire into the evolutionary process in higher sciences with ampler preparation; and thus ultimately approach the philosophic ideal of clearest and completest general view.

In this way we should have again completed the same cycle of thought as that sketched in the preceding section, but this time inductively instead of deductively: we have, as it were, worked our way upwards from our scientific primers instead of down from Spencer's *First Principles* or the like. In short, then, the most simple, safe, and fruitful scientific method of studying the problem of evolution we find to be to reverse the order of the three distinct methods above outlined; to commence with the concrete study of evolution as manifested in the universe as a whole, in the earth's crust, and among plants and animals; gradually to rise toward more abstract expression and more deductive grasp, then to pass to mental and social evolution. Within the present compass the utmost that can be attempted is to sketch out a few of the leading lines of thought and still more briefly indicate others.

Evolution in the Physical Sciences—Astronomy.—Here, as in other sciences, early conceptions of the universe agree in viewing it as being, as far as possible, in permanence and at rest, and not in change and motion. Such static views may be only tacitly implied, but are more usually directly avowed: thus the earth was long viewed as a

plane stably supported, and till very recently the stars were viewed as fixed. But as the static universe of the ancient astronomer passes into that of Copernicus and Kepler, Galileo and Newton, Herschel and Leverrier, dynamic, or more accurately *kinetic*, conceptions have henceforward an assured prominence in at least one science, and that the one most obviously concerned with the universe as a whole. For although evolutionary speculations of more or less vagueness seem to have arisen once and again in almost every science, the first well-developed theory of evolution which has attempted to cope with the observed facts of any science must be credited to astronomy (if not to the professed astronomer) in the famous Nebular Hypothesis (q.v.), of which the suggestiveness to all other departments of science must be freely admitted. For the mind which has once fairly grasped the conception of stellar and planetary evolution cannot readily stop there.

Evolution in Chemistry.—In chemistry kinetic conceptions must naturally have been rife from the earliest times. The records of ancient chemistry are indeed largely those of the speculative exaggerations of kinetic hypotheses by the alchemists; as its history in more modern times bears the trace of a strong, and in some respects excessive reaction from these, albeit to occupy the more certain ground afforded by the conception of the permanence of matter. But the analytic researches, the studies of atoms and elements, of valencies and molecular constitutions viewed as absolutely definite, are again being used only as starting-points for new dynamic departures, such as those of thermo-chemistry; while new speculations, essentially evolutionist, such as those of Crookes and others, have arisen on various hands around the well-known periodic law (see CHEMISTRY, PHYSICAL CHEMISTRY). The similarity in composition of our planet with that of sun and stars, and the intimate relation between organic and inorganic compounds, are also suggestive; while the actually observed genesis of many species of minerals by the action of natural causes, and the frequent transmutation of one species into another when some definite change takes place in the surrounding conditions, are not without evolutionary interest. See also RADIUM, ELECTRON.

The recent movement in chemistry above alluded to is indeed only the counterpart of what had been taking place earlier and more fully in physics, thanks largely to astronomy and to the mechanical arts, not to speak of other influences. The laws of motion, the conception of gravitation, are steps of the same progress, as are also the sublime conceptions of the conservation and dissipation of energy throughout the universe, and the revision of these conceptions required by further study of the electrical nature of Matter (q.v.). And as the analytic task of the chemist and physicist rises from that of weighing and grasping at the atom to that of watching and measuring the wave or the electron, our general conceptions are inevitably changing also. The idea of a static universe, essentially constructed once for all of so many different masses and kinds of matter, upon which man of science, philosopher, and theologian alike formerly agreed, is on all hands fully giving place to that of a dynamic unity which owes its manifold and unceasing differentiation to the varying modes or moods of the universal energy.

Evolution in Geology.—That the last-century mineralogist was here and there already widening his interest to the rocks and even meditating as to their nature and origin is well evidenced by the penetrating speculation of Linnæus: 'It may be that the solid rocks are not primeval, but the daughters of time.' As subsequent generations of research have shown us, this solid rock is the product of igneous and that of aqueous action, here reaching back to an incalculable antiquity, or there evolved within the period of human occupancy; while others consist in great part, or even completely, of the remains of extinct animals or plants. These are conceptions now so familiar that it is difficult to realise their once revolutionary appearance and effect. But when we take into account the transition from the cataclysmal and essentially creationist theories which at first prevailed to the uniformitarian, or evolutionist, interpretation of geological phenomena which centres round the work of Lyell, we cannot wonder that such a revolution in geological doctrine should have exercised an influence upon general thought only second to that of the Copernican astronomy itself. More detailed studies, too, would be of no little service to our general theories; note, for instance, how the geologist takes from the astronomer, now a stellar evolutionist, the cooling planet, and outlines its primeval sunderings of land and sea, its wrinkling hills and vales, how he proves that the pulse of ocean is but the dying ripple of a once fiftyfold mightier tidal wave, or how the glacial period is the inexorably recurrent winter of a year of ages. The mineralogist no longer merely measures and analyses, but deciphers the origin and transmutation of mineral species, and of the rocks they form under the forces of the environment (see MINERALOGY); and the typically changeful phenomena of climate and atmosphere are rendered the subject of a typically dynamic sub-science (see METEOROLOGY).

Modal Explanation of Physical Evolution.—We must sooner or later inquire whether any general principle can be found to verify and rationalise the process of evolution in the physical world, and to this the answer has been specially elaborated by Herbert Spencer. His essential principle or Law of Evolution must be stated in his own words: 'Evolution is an integration of matter and concomitant dissipation of motion during which the matter passes from an indefinite incoherent homogeneity to a definite coherent heterogeneity, and during which the retained motion undergoes a parallel transformation.' The deductive and inductive establishment of this principle, and its comprehensive verification and fruitful application throughout the fields of the higher sciences as well, are necessarily left for fuller separate exposition (see SPENCER). And although the student who seeks to follow Spencer in grappling with the riddle of evolution in higher orders of phenomena may not admit that his uncompromising application of the principles of physical evolution to higher categories is so exhaustive and satisfactory as he claims, there can be no doubt that this general treatment has been on the whole amply justified so far as it goes, alike in unifying the sciences, and in the separate organisation of these.

Evolution in Biology.—This portion of the subject demands special attention and fullest outline for many reasons. Not only is the transition from static to evolutionary conceptions of comparatively recent, indeed almost contemporary interest; but the progress of the doctrine of evolution as a general theory of the universe has been most closely connected with progress in biology. And while we can at best merely speculate as to the direct continuity of evolution from the inorganic to the organic world (see BIOLOGY, SPONTANEOUS GENERATION), we are constantly impressed by the fundamental unity of the process in the simplest and most complex forms of life, and by the thoroughness with which the same principles may be traced into the highest 'superorganic' phenomena of mind and society.

At the outset we require some such conception of

the actual historic progress of our concrete knowledge of plants and animals as is outlined in the articles BOTANY and ZOOLOGY, and also of that rise of our more abstract kinetic and static (physiological and morphological) interpretations of the phenomena of life as is given under BIOLOGY and BOTANY. The general argument for evolution appended by Darwin to the classic statement of his theory of Natural Selection in the Origin of Species has been already summarised under DARWINIAN THEORY, and its separate heads are also to be found under separate articles; only the briefest reference to these need here be made. We must keep, for instance, in view the conceptions of the actual evolution of the individual which have become systematised in the sub-science of embryology (see EMBRYOLOGY). Suffice it, however, here to recall that, although it is in this connection that the term *evolution* first makes its appearance, it is used along with *development*, in a sense diametrically opposed to its present significance, as the mere enlargement and unfolding (*evolutio*, *evolution*, *Entwickelung*) of a form and structure in all essential respects a perfect miniature of that of the adult.

Without recording or analysing the various conceptions of species (see SPECIES) it is sufficient again to note how the belief in their objective constancy and practical definableness is shaken by such facts as (1) that pre-evolutionary systematists differ hopelessly upon the number and limits of the species of all the more variable groups of plants and animals; (2) that the mere numerical increase of the number of specimens in our museums is constantly compelling us to recognise that great numbers, sometimes even scores or hundreds, of 'type-specimens' of irreproachably described 'species' are but so many individual members of a series linked by the most infinitesimal gradations, yet of which the extremes differ by characters of specific, it may be even generic rank. And when (3) the assumption of the general sterility of hybrids is proved experimentally (see HYBRID) to be an exaggeration, it becomes, to say the least, increasingly difficult seriously to support the dogma of the constancy of species.

Leaving the general external form with which the species-maker is mainly concerned, we must accompany the anatomist through each level of his deepening analyses and comparisons, through organ-systems and organs, tissues and cells, to the ultimate protoplasm itself (see BIOLOGY, MORPHOLOGY). To realise how fully this analysis results in the demonstration of an unsuspected unity of structure not only between species and genera, but far larger groups, some actual study of the concrete facts is indispensable; as also to appreciate the same beautiful unity of type in individual structures so differentiated as the appendages of a lobster (see CRUSTACEA) or the parts of a flower (see FLOWER). Yet here again we have an instance of the tenacity of static conceptions; for although it could not be actually denied that the hypothesis of descent from common ancestors at least *might* explain the structural unity observable under classification, as from a simpler ancestor, that observable under the individual structure, the conception of conformity to a purely ideal 'archetype,' was long maintained. Rudimentary organs, such as the teeth of fœtal whales, were thus explained not as reduced survivals of structures ancestrally useful, but as purely intellectual necessities of this arbitrary 'conformity to type.' This ingenious revival of Platonic ideas in conjunction with scholastic nominalism could not, however, very long survive the demonstration of the frequent absence of rudiments necessary for archetypal purposes; and the alternative evolutionary explanation has thus inevitably succeeded to its place.

It is much to learn from the taxonomist that his classification of species and genera, even the whole world of plants or animals, assumes the form of a vast genealogical tree; and it is no small confirmation of the evolutionary view to note how every new fossil-trove throws some fresh light upon the order in which the branches or branchlets of this tree have historically developed. With all the missing links we can imagine or desire between the modern horse and his simple five-toed ancestor (see PALÆONTOLOGY, FOOT, HORSE), not to speak of other examples, we have indeed evidence which may well satisfy us of the historic fact of evolution; but this brings us no nearer comprehending the rationale of the process. Leaving the morphological sciences, we must pass with Darwin to the study of what we may call the higher physiology. Assuming what is known of the functions of the individual, we must note not only the relations of the species unit (in higher forms usually of course the pair), and so familiarise ourselves with the phenomena of reproduction and sex, of heredity and variation, breeding and relation to offspring, the results of intercrossing, the modification by environment, &c.; we must also consider the wider relations among the members of the same species, between allied species, and finally between practically unrelated ones, whether here of struggle or there of adaptation. He thus introduces us to this vast and practically new field, and gives us a glimpse of the living, whole nature in that magistral series of volumes, which we may as it were group into a *Vita Naturæ*, complementary to the static *Systema Naturæ*, and no less epoch-making for our day than was that of Linnæus for his.

We see how natural it is that the student of biology who thus becomes an evolutionist so largely by help of Darwin, should accept the lucid and comprehensive modal explanation so vitally associated with his whole evolutionary attitude, and thus also become a thoroughly convinced Darwinian, a natural selectionist without more ado: and we can readily understand that the assent of the majority of the intelligent public should have gradually followed the same course during the generation after the publication of the *Origin of Species*.

It is necessary, however, to refer more precisely to the history of opinion both as regards the fact of evolution and the factors in the process. The history of the two questions—of the empirical fact, and of the actual mechanism of evolution—can hardly be separated, though it is of course well known that the former was virtually settled by the demonstrations of Spencer, Darwin, Wallace, Haeckel, and others soon after the middle of the 19th century, while we are still in the midst of keen debate as to the relative importance of the diverse factors. The history of the theory of evolution, so far as the organic world is concerned, is essentially modern, for in spite of vague hints and *a priori* speculations from Thales and Empedocles onwards, it was not till the 18th century that evolution began to be very definitely suggested as a modal explanation of the origin of our fauna and flora, or that inquiry began to be seriously directed to what we now call the etiology of organisms.

What was for so long only a germ-idea at length took shape in the mind of Buffon (1749), who not only urged the general conception with diplomatic skill and covert irony, but sought to show how new conditions evoked new functions, how these in turn reacted upon the structure of the organism, and how, most directly of all, altered climate, food, and other elements of the environment might be

the external conditions of internal change, whether for progress or the reverse. Erasmus Darwin (1794), with a truly living conception of nature, emphasised the organism's inherent power of self-improvement, the moulding influence of new needs, desires, and exertions, and the indirect action of the environment in evoking these. To Treviranus (1802–31) organisms appeared almost indefinitely plastic, especially, however, under the direct influence of external forces, nor did his analysis of possible factors fail to recognise what Brooks, Weismann, and others have since elaborated, that the union of diverse sexual elements in fertilisation was in itself a fountain of change. His contemporary Lamarck (1801–9) is well known to have emphasised the importance of changed conditions in evoking new needs, desires, and activities, while urging also the perfection wrought by practice and the degeneration which follows as the nemesis of disuse. Evolution seemed to him the interaction of two fates—an internal progressive power of life, and the external force of circumstances in the two-fold struggle with the environment and with competitors. Among the philosophers also, especially in the minds of those who had been disciplined in physical or historical investigations, the speculations of the ancients were ever taking fresh form, gaining moreover in concreteness; witness the contributions of Kant and Herder. In Goethe's epic of evolution the adaptive influence of the environment is clearly recognised, while the misty theories of his contemporary Oken chiefly interpret the organic progress in terms of action and reaction between the organism and its surroundings. Wells in 1813 and Patrick Matthew in 1831 forestalled Darwin in suggesting the importance of natural selection, but their buried doctrines were of much less practical importance than those of Robert Chambers, the long unknown author of the *Vestiges of Creation* (1844–53). His hypothesis of evolution emphasised the growing or evolving powers of the organisms themselves, which developed in rhythmic impulses through ascending grades of organisation, modified at the same time by external circumstances acting with most effect on the generative system. In France, Geoffroy and Isidore St Hilaire, father and son, supported the thesis of definite variation under direct environmental influence. And before reaching even the contemporaries of Darwin a complete history would have to take account of the conclusions of many naturalists, such as Von Buch, Von Baer, Schleiden, Naudin, and Wagner. The environmental factor was subsequently recognised with greater clearness and with less exclusiveness by Spencer; while Darwin and Wallace, recognising some truth in most of the above positions, but believing them wholly insufficient, left the problem of the origin of variations alone, and devoted their strength to establishing the theory of the origin of species by means of natural selection, a view which emphasises the destructive or eliminating and the conservative or selective action of the animate and inanimate environment in the struggle for existence.

Even from the above brief sketch of representative conclusions, it will be seen that successive authors accent diverse factors in the evolutionary process: in the view of one the organism has a motor power of variation inherent in its very constitution, or gained by the intermingling of sex-elements from which the individual life starts; to another the moulding power of changed function, the perfecting influence of exercise, the degenerating nemesis of disuse are all important; while to a third organisms seem to have been hammered from one shape into another by the action of that complex series of external influences which we briefly term the environment. Among modern naturalists we find champions of each of these three positions respectively emphasising (*a*) the organism itself, (*b*) its function, and (*c*) its environment; a few remain more or less exclusive Natural Selectionists, with or without theories of the origin of the variations which they postulate; while the majority more and more incline to an eclectic but not yet synthetic view, differing chiefly in regard to the relative importance of the various factors recognised.

The difficulty will be obvious of even briefly discussing so many positions, many of which are better dealt with under the separate articles Environment, Heredity, Reproduction, Sex, Variation; and it is undesirable here to stereotype any one position as final during an unended controversy. That criticism will be certainly more temperate, and probably not less fruitful, which for a time seems to withdraw from the actual field of battle; which, instead of joining issue on this point or upon that, seeks rather to recognise all the leading points of view from which the subject may be approached, and thence to clear up the various lines on which a modal explanation is or may be offered, or to which it must at anyrate be capable of satisfactory application. We should thus even be able to do more justice to the older naturalists' positions.

Evolution in Psychology.—The psychologist admits the same inability to derive psychical processes and states from the nutritive and reproductive functions and structures which form the subject-matter of biology that the biologist does to derive these from inorganic processes. This fact does not of course interfere with the investigation of the parallelism of each of these higher orders of phenomena (see Biology), still less with the detailed study of evolution in mind, for which, as Herbert Spencer especially demonstrated, evolution in the preliminary sciences of biology and physics is so suggestive. What most concerns us here is to note how largely the science of psychology, or what stood for it, was wont to be a matter of deduction from that time-honoured axiom that human nature is for practical purposes always and everywhere the same; which, as evolutionists, we now see to have been an erroneous postulate. The older psychology was concerned especially with less or more scientific analyses of the adult mind, and this usually of the isolated 'typical' one (usually of the psychologist himself), but in a form too generalised to admit of much practical application. The modern school recognises the necessity of unravelling the vast complexity of the actual details of psychical processes, and not only eagerly investigates the development of the infantile mind, but scrutinises the kindred though humbler phenomena of animal cerebration. Psychology is drawing new light from the long discredited study of hypnotic states (see Animal Magnetism); since here psychical functions can be analysed at various levels, and this apart from the perturbing action of the will. Again, it finds a rich source of knowledge in those morbid variations towards excessive or deficient cerebration and neuration which we group under the complex term Insanity (q.v.). Yet that it reaches also the most complex concrete products of evolution is evidenced by the rise and progress of criticism in literature and art. That we have here the closest parallelism to biology and its progress is manifest, as our current phrases of comparative psychology, of mental physiology, pathology, variation, and the like clearly show. We see, indeed, that the science of psychology is now more biological, more evolutionary, and more unified than biology itself, which is still so largely limited by the numerous and confused dispersive and analytic specialisms from which it has arisen, and which it

is still so far from having reorganised. The transition from the static to the kinetic attitude is thus more nearly complete. The debt of science to practice is here obvious in the gain from education and mental hygiene; while the return of the science into practice, as yet only incipient, promises results of the vastest kind. Education would at length have to be viewed and practised in an evolutionary sense, as the process of assisting the entire development of the individual into, it may be beyond, the actual living powers, into the stature and beauty, of the race; instead of smothering the development under the mere accumulation of its dead results in certain fields of detail. Nor is the parallelism of psychical and physiological processes, which enables us to modify more and more mind through body, failing to open up subtler possibilities of modifying body through mind.

Evolution in the Social Sciences.—Leaving fuller treatment to the article SOCIOLOGY, and such special articles (POLITICAL ECONOMY, &c.) as are therewith connected, we may note that the social science of the pre-evolutionary period, although represented on its concrete side by history, and its abstract side especially by political economy, was essentially static. History was necessarily a record of occurrences at specified dates, which, although sometimes set forth in their minor relations of cause and effect, did not admit of any large co-ordination in scientific terms; though the continual attempt by theologians and metaphysicians to construct a philosophy of history indicated at least the need of this. Upon the abstract side we have those attempts to formulate a purely deductive 'science of political economy,' which still so largely survives; although its pretended laws, deduced from postulates of the archaic psychology, such as that of action exclusively arising from self-interest, or from metaphysical abstractions such as utility, are now being replaced by generalisations drawn from the inductive study of social phenomena, actual and historic, and by principles firmly established in the preliminary sciences. The derivation of our whole body of social knowledge from social practice is here of course absolute, all the phenomena being human ones; and the reaction of theory upon practice can only at first sight seem disproportionately small when we lose sight of the importance of the past thought systematised in legal and religious systems. In the world of material interests static views have as yet essentially prevailed: witness the incomparable antiquity of law as compared with that of the modern process of law-making and unmaking which we call internal politics—a form of activity which, however disappointing in its practical results, has at least had something to do with the even more recent emergence and popularisation of the idea of social progress. This characteristically modern idea became increasingly systematised, on the one hand through special studies, and on the other through the unparalleled progress of the mechanical arts. We must note also that the recent foundation of sociology as a distinct and unified science depended upon the attainment of a synthetic interpretation of the history of western Europe both material and intellectual as the central process of the general evolution of humanity; while no subsequent labours on behalf of the nascent science have been greater than those of that later thinker who has been as much concerned as any other with the general philosophy of evolution.

That the idea of evolution has originally been projected from the social plane into that of the other sciences, is a proposition which can only be doubted by the specialist who has not inquired into the history of his ideas; evolution in social affairs has not only suggested our ideas of evolution in the other sciences, but has deeply coloured them in accordance with the particular phase of social evolution current at the time. The hermit not unnaturally supposes his cosmist meditations to be wholly unspotted by the world he has left behind, but this cannot prevent the historian from rigorously viewing his whole thought and conduct as a product of that world. Nor is absolute demonstration difficult even from the strictest biological specialist's own postulate—that life is interpretable merely as a biological phenomenon. Be it so: then science is the summed (phylogenetic) experience of the race, and the investigator's contribution to it is of course measured by his own development (ontogeny). But the development of an organism, functional and cerebral, is so far *pari passu* with its adaptation to the world around it, but still more in relation to its own species. In other words, the measure of individuation attained by the individual of any species as compared with its fellows is dependent in the first place upon sexual maturity, (2) upon the relations to offspring towards which this tends to develop, and (3) upon the measure of sociality which in so many species arises through the widening of this direct reproductive relation into that of a larger aggregate. This is a proposition which the biologist should be the last to dispute; hence, while arguing for the evolution of the human species by the same agencies which have shaped the lower ones, it is impracticable permanently to retain the absurd assumption, inherited from pre-evolutionary psychology, that mental development goes on as it were in *vacuo*, without reference to the expansion of the organic functions of self-maintaining and species-maintaining. But as this survival becomes outgrown the pure biologist will of course be the first to emphasise and elaborate the proposition that all human developments, like those of any other species, are in terms of these.

Modal Explanation of Organic Evolution.—The conception thus reached of the measure of evolution of a species being expressible in terms of the progress of its (1) self-maintaining and (2) species-maintaining functions is equally capable of statement in biological, psychological, sociological, or indeed also, as moralists are now agreeing (see ETHICS), in ethical terms; what are termed egoistic or altruistic actions being respectively self-maintaining or species-maintaining ones, of course at different levels of evolution. Here, then, we have a basis for the required inquiry as to the mechanism of the evolutionary processes. The evolutionist at anyrate will not dispute this parallelism between the non-ethical aspects of organic evolution, nor deny that the results and processes of evolution in their highest manifestations may be of service in elucidating or criticising the similar ones which must be supposed to exist in less developed forms. Hence he would be in some respects even better justified in tracing the evolutionary process down from the highest aspects to the more simple ones, and from the human species to humbler ones, than conversely: thus the limitations of the doctrine of natural selection may be better understood, and this on two or three distinct sides. It is not altogether easy to meet the criticism sometimes urged by the economist that the process which kills off the weakest of the race weakens and deteriorates those which survive, and that, while some struggle for existence is needful for individuation, human progress is yet observably associated with an advance of the subsistence fund over the requirements of maintenance. Without

insisting upon the difficulties urged by Wallace, Mivart, and other evolutionists as to the descent of man (see MAN, DESCENT OF), the ethical difficulty so common to all inquiries respecting evolution and natural selection in general, but human evolution in particular, cannot be escaped. For we have as yet little beyond the cheerful optimism which sets off the cumulative gain to the species against the incessant sacrifice of the weak to the strong which is in constant progress alike in nature and in human society. And if this be indeed the spring of human progress, how can we resist the logic which calls upon us to remove those adjustments for the mitigation of the struggle for existence for the protection of the weaker, with which, however, not only our feelings and what we have been accustomed to call our higher instincts, but our whole civilisation, material and moral, are inextricably bound up? A classical statement of the central difficulty, of which the Darwinism and the morals are alike unexceptionable, and the resultant dualism therefore clearly set forth, may be quoted from Huxley: 'From the point of view of the naturalist the world is on about the same level as a gladiator's show. . . . We must say that its governing principle is intellectual, and not moral, that it is a materialised logical process accompanied by pleasures and pains. . . . Society differs from nature in having a definite moral object. . . . The ethical man tries to escape from his place in the animal world founded on the free development of the principle of non-moral evolution, and to found a Kingdom of Man, governed upon the principle of moral evolution. For society not only has a moral end, but, in its perfection, social life is embodied morality. But the effort of the ethical man to work to a moral end, by no means abolished, perhaps has hardly modified the deep-seated organic impulses which impel the natural man to follow his non-moral course.'

The natural selectionist sometimes seeks (as Darwin indeed himself did) to escape this frank return to a pre-evolutionary ethical dualism by reminding us that, since on his view 'nature trusts to the chapter of accidents for variation,' favourable ethical variations may spontaneously have arisen at the social plane. But even if the dawn of similar variations in lower species did not raise a probability of the definite rather than fortuitous nature of such variations, the unity of all the four aspects of organic evolution is none the less given up.

The theory of natural selection is now, however, itself undergoing an evolution which promises fair for an escape from these difficulties, and this on all hands In its classic form it assumed selection to operate upon an indefinite number of individual variations, which Darwin, at least in some moods, was quite ready to admit might be produced by environment, increased by function, and the like; but which, once selected, were preserved by heredity and frequently increased by new spontaneous variations in the same direction. Now, however (see HEREDITY), we have an ultra-Darwinian school founded by Weismann, and followed by Lankester and many others, which, denying the heredity of acquired characters, pushes back the origin of all variations of species-making importance into the protoplasm of the sex-elements, and so seems to leave natural selection as the only factor of evolution which we can really hope intelligently to grasp, variation seeming inscrutable. The neo-Lamarckian school, on the other hand, with which Spencer must also be reckoned, holds a very different doctrine, that of the importance of individual function and the transmission of its modifications; while the influence of environment is also coming to be studied with not only speculative acuteness but experimental detail. Variation is again being more and more frequently regarded as taking place on a few definite lines; and the origin of species is viewed as a literal development of internal conditions in the species as in the development of the individual, which environment can only bend and colour, and natural selection no more than prune. Such views (see VARIATION), too often formulated with excessive generality and indeed vagueness, yet on the whole with increasing concrete application to detail, are maintained by Nägeli, Cope, Eimer, and many others, including the present writer. It will at anyrate be recognised that there is ample room for such inquiries, and that the importance claimed by natural selection cannot be safely established until they have been disposed of in favour of that hypothesis of indefinite variability upon which this importance essentially depends. It is becoming more and more apparent that it is the problem of variation which is fundamental to selection.

Amid so many various opinions Dr Wallace came to stand almost alone as an avowed exponent of the theory of natural selection in its classic form; yet even he not only made the reserve as to human descent above alluded to, but sought to replace Darwin's sexual selection (see SEX) by a new hypothesis, and so enlisted the services of that heresy of definite variation which is so irreconcilable with Darwin's general argument.

The general drift of the contemporary discussion has thus become more apparent; all theories and criticisms have hitherto started with the individual as the unit, and the origin and differentiation of the self-maintaining structures and functions as the primary problem; after which the origin and differentiation of reproductive and species regarding processes have been left only a secondary and subsequent place. But we are beginning to discover that this method of approach, however natural to the individual thinker, is artificial as respects nature; we have above been noting how many different lines of research are turning from the self-maintaining to the species-maintaining process; and the centre of gravity of the science is in fact undergoing a revolutionary change. In thinking of a species we have been wont to call up and investigate the individual type, and to recognise the process of reproduction subsequently only as giving us a less or more varied repetition of this type; but this is a survival of the static and anatomical view. What the general physiologist is now coming to recognise in the species, and what accordingly the evolutionist *a fortiori* must keep in view, is primarily its living continuity, no longer the details of its separate links. From this most general point of view both are coming to see the most complex individual lives, in Foster's phrase, as but the 'by-play of ovum-bearing organisms.' The species is a continuous undying chain of unicellular reproductive units which indeed build out of and around themselves transient multicellular bodies; but the processes of nutritive differentiation and other individual development of these is the secondary, not the primary question.

Instead, therefore, of beginning with the origin and adaptation of the details of self-maintaining advantage, coming later to those of reproduction and sex, and only recognising the mysterious control of the principle of correlation of organs in the background of the whole process, as Darwin and other evolutionists have been wont to do, a fuller initial recognition of the reproductive process raises the question of correlation between the reproductive and individual functions at the outset. We see the sexual development of animal, and still more obviously of plant, everywhere becoming a most

potent determinant of its adult character, and one of classificatory importance far deeper than the mere individual characteristics of the separate species. We see again how the nature and degree of relation to offspring gives a new key to the larger aspects of classification. Thus it is the central generalisation of botany that despite the individual differentiation of fern, selaginella, cycad, conifer, and flower, these turn out on deepest analysis to be but the surviving phases of a continuous and definite increase in the subordination of the sexual parents to their asexual offspring (see FLOWER). Or in the same way, while we define the orders and sub-orders, genera and species of the mammalia by help of the individual apparatus for maintenance or struggle, the larger question of the characteristics of the mammalia, and of their main subdivisions, does not depend upon any mere accumulation of these, as Darwin's very natural application of Lyell's well-known argument would require: for not only the mammal but its essential types, monotremes, marsupial and placental, and even again the subdivisions of the latter, express so many stages in the progress of maternal sacrifice for offspring. In the same way with the evolution of sociality which arises from reproductive aggregation in so many species, we see this subordinating struggle, greatly facilitating not only the increase in numbers of the species, but their higher specialisation as well. We escape from the conception that progress depends primarily upon internecine struggle for existence—i.e. the subordination of the species to the individual, instead of primarily upon that of the individual to the maintenance of the species in sex, offspring, and society. Thus our ethical difficulty at length disappears, since the greater steps of advance in the organic world compel us to interpret the general scheme of evolution as primarily a materialised ethical process underlying all appearance of 'a gladiator's show.'

The corresponding progress in the historic and individual world from sex and family up to tribe or city, nation and race, and ultimately to the conception of humanity itself, also becomes increasingly apparent. Competition and survival of the fittest are never wholly eliminated, but reappear on each new plane to work out the predominance of the higher, the more integrated and associated type; the phalanx being victorious till in turn it meets the legion. But this service no longer compels us to regard these agencies as the essential mechanism of progress, to the practical exclusion of the associative factor upon which the victory depends, as economist and biologist have too long misled each other into doing. For we see that it is possible to interpret the ideals of ethical progress—through love and sociality, co-operation and sacrifice, not as mere utopias contradicted by experience, but as the highest expressions of the central evolutionary process of the natural world. To continue the generalisation of the process of evolution, organic and super-organic, which Spencer, repeating on a higher spiral the thought-cycle of many an earlier thinker, reopened, is to raise anew all the problems of philosophy. The evolutionary reorganisation of thought implies the leavening of art and practical life.

See books cited at DARWINIAN THEORY; articles on the subjects above mentioned, particularly CELL, EMBRYOLOGY, HEREDITY, MIMICRY, PROTOPLASM, and VARIATION; those on special authors, as HAECKEL, HUXLEY, LAMARCK, SPENCER, WALLACE (A. R.), WEISMANN, &c.; also Romanes, *Darwin and after Darwin* (1892–95); H. F. Osborne, *From the Greeks to Darwin* (1894); Weismann, *The Evolution Theory* (trans. 1905); Jordan and Kellogg, *Evolution and Animal Life* (1907); Kellogg, *Darwinism To-day* (1907); Poulton, *Essays on Evolution* (1908); *Darwin and Modern Science*, by various authors (1909); Geddes and Thomson, *Evolution* (1911).

Evora (ancient *Ebora*), one of the most interesting cities of Portugal, capital of the province of Alemtejo, is charmingly situated on a fertile and well-cultivated plain, 72 miles E. of Lisbon by rail. It is surrounded by ancient walls long since in a hopelessly ruinous condition, and to some extent by modern fortifications as yet unfinished. It is a very ancient city; Quintus Sertorius took it in 80 B.C., and it was also conquered by the Moors in 715, but recovered from them in 1139. Among the supposed Roman antiquities of Evora are the temple of Diana, with fine Corinthian columns; an aqueduct said to have been erected by Quintus Sertorius, and rebuilt in the 16th century, which till recently supplied the city with water; and the beautiful tower, surrounded by Ionic columns, which rises in the city at the extremity of the aqueduct. The aqueduct and the tower have been partially demolished. The town itself is not well built, and the streets are narrow, winding, and dirty. It has a cathedral, founded in 1186, and afterwards restored in the Gothic style. It has been the see of an archbishop since 1540, and has an archiepiscopal library, containing several pictures of great merit. There are some manufactures of cotton, cloth, and hats, and a trade in wine. Pop. 16,000.

Évremond, CHARLES MARGOTELLO. See SAINT-ÉVREMOND.

Évreux (ancient *Mediolanum*, later *Eburovices*), the capital of the French department of Eure, is situated in the fertile valley of the Iton, a feeder of the Eure, 67 miles by rail WNW. of Paris. The cathedral, of various dates from the 11th to the 18th century, is a cruciform structure, with Italian façade, a central spire, and fine painted glass. Other buildings are St Taurin's, with a 13th-century shrine, which once contained the relics of that saint, the first Bishop of Évreux; the episcopal palace (1484); and the 'Tour de l'Horloge,' of the same century. Évreux has extensive manufactures of paper, linen, &c., and a trade in grain, seeds, timber, and liqueurs. Population about 18,000. Évreux has sustained innumerable sieges, having been sacked in 892 by the Northmen under Rollo, burned by Henry I. of England in 1119, and in 1194 and 1199 captured by Philip Augustus of France. It was frequently taken and recovered in the wars between France and England during the reigns of our Henry V. and VI.—At the neighbouring village of VIEIL ÉVREUX, supposed to mark the site of *Mediolanum*, excavations have disclosed remains of a theatre, an aqueduct, baths, &c.

Ewald, GEORG HEINRICH AUGUST VON, the famous Orientalist, was born 16th November 1803, at Göttingen, where his father was a cloth-weaver. From 1820 he studied at the university, under Eichhorn, theology and philology, devoting himself especially to the oriental languages; in 1823–24 he was a teacher at the gymnasium at Wolfenbüttel; in the latter year he published his first work, *Die Komposition der Genesis*, and was appointed a theological tutor in his own university of Göttingen. After this he became in 1827 an extraordinary professor, and in 1831 ordinary professor of Philosophy, and in 1835 nominal professor of Oriental Languages. For his share in the protest of the seven Göttingen professors against the annulling of the Hanoverian constitutional law he was deprived of his chair by a rescript of the 12th December 1837; and after spending some months in England he was called to a chair at Tübingen, where he remained for ten years and a half. He was ennobled by the king of Württemberg in 1841, and in 1848 was recalled to Göttingen, where he spent the remainder of his life. In consequence of his refusal to take the oath of allegiance to the

Prussian government, he was at his own request pensioned off in 1867. His earlier works, chiefly devoted to the grammar and metres of the oriental languages, include *De Metris Carminum Arabicorum* (1825), *Versuch über einige ältere Sanskritmetra* (1827), *Grammatica Critica Linguæ Arabicæ* (2 vols. 1831–33), and his *Kritische Grammatik der hebräischen Sprache* (1827), which he reproduced in an abbreviated form in his *Grammatik der hebräischen Sprache* (1835, 3d ed. 1838), and with greater fullness of detail in his *Ausführliches Lehrbuch der hebräischen Sprache* (8th ed. Gött. 1870). The scientific results of his travels are partly contained in his *Abhandlungen zur orientalischen und biblischen Litteratur* (1832), and in his *Zeitschrift für die Kunde des Morgenlandes*. The rich fruit of his lifelong study of the Old Testament is stored in *Die Dichter des Alten Bundes* (2d ed. 3 vols. 1866–67; Eng. trans. of Psalms, 2 vols. 1880–81, of Job, 1882), *Die Propheten des Alten Bundes* (2d ed. 3 vols. 1867–68; Eng. trans. 5 vols. 1875–81), *Beiträge zur Geschichte der ältesten Auslegung und Spracherklärung des Alten Testaments* (3 vols. 1844), and finally in his magnificent masterpiece, *Geschichte des Volkes Israel* (3d ed. 7 vols. 1864–68; Eng. trans. in 8 vols. 1867–86), with the supplement, *Die Alterthümer des israelitischen Volkes* (3d ed. 1866; Eng. trans. 1876). To the study of the New Testament Ewald contributed his *Jahrbücher der biblischen Wissenschaft* (12 parts, 1849–65), *Die drei ersten Evangelien* (1850), *Die Sendschreiben des Apostels Paulus* (1857), *Die Johanneischen Schriften* (2 vols. 1862), *Uebersetzung und Erklärung aller Bücher des Neuen Testaments* (7 vols. 1870–72). Of his other works the most noteworthy are his *Erklärung der grossen phönikischen Inschrift in Sidon* (1856), *Ueber die phönikischen Ansichten von der Weltschöpfung* (1857), *Die Sibyllinischen Bücher* (1858), *Das vierte Ezrabuch* (1863), *Sprachwissenschaftliche Abhandlungen* (1861–71), *Abhandlung zur Zerstreuung der Vorurtheile über das alte und neue Morgenland* (1872), *Die Lehre der Bibel von Gott* (3 vols. 1871–75). In his scientific studies, Ewald followed his own way. His hand was against every man, and he was impatient of contradiction. He was an equally vigorous adversary of the 'Tübingen School' and of the orthodoxy of Hengstenberg and Delitzsch. In the prefaces and postscripts of his books, and in his year-books for biblical science, he frequently took occasion to express his uncompromising views on the political and ecclesiastical questions of the day, and frequently shows an entirely unjustifiable severity in criticising those from whom he differed. From 1869 he represented Hanover in the Reichstag, and was a decided opponent of the ambition of Prussia. He died of an affection of the heart, 4th May 1875. An autobiography, which he wrote in the last months of his life, remained unpublished. A monument was erected by his disciples over his grave at Göttingen. Ewald brought to the interpretation of the Hebrew prophets a spirit akin to their own—Hase describes him as a prophet with backward gaze. His patriotism and courage, his poetic fire and energy, his spiritual insight and marvellous power of sympathetically reproducing primitive experiences by the divinations of genius, and the indefatigable industry with which he applied his perspicacity and insight to understand the Hebrew nation and its sacred literature have secured for him the highest place among the biblical scholars of his century. See two admirable critical papers on the life and work of Ewald by Professor Cheyne, in the *Expositor*, third series, vol. iv. (1886).

Ewald, Johannes, a Danish poet, was born 18th November 1743, at Copenhagen, where his father was a pastor of the strictest pietistic views. Before his father's death he went to a school at Sleswick, from which he ran away to seek an uninhabited island like that of Robinson Crusoe, but did not get farther than Hamburg. In 1758 he began to study theology at Copenhagen. His love of adventure led him to Magdeburg, where he entered an infantry regiment. He soon deserted to the Austrian army, in which he was first a drummer, then an under-officer. After taking part in several engagements in 1759–60, he obtained his discharge, and returned to theological study at Copenhagen. A disappointment in love was the turning-point of his life. After this he gave his attention solely to poetry. To this also he attributed the irregularities of his life, which bore bitter fruit in the poverty and ill-health of his later years. The allegorical poem, *Lykkens Tempel*, published in 1764, was well received; but it was not till two years later, in his elegy on the death of Frederick V., that he gave clear proof of his lyrical power. The biblical drama, *Adam og Eva* (1769), shows clear traces of the influence of Klopstock. His other writings include a series of satiric plays; the prose tragedy, *Rolf Krage* (1770); and the two masterpieces, *Balders Död* and *Fiskerne*, the latter containing 'Kong Christian stod ved höjen Mast,' which has become the national song of Denmark. He died on the 17th March 1781, leaving an incomplete autobiography, *Johannes Ewalds Levnet og Meninger*. Though he was scarcely thirty-eight years old at his death, Ewald's work has taken a pre-eminent part in the development of Danish literature. Oehlenschläger has testified in some of his finest poems that Ewald was the creator of the modern poetry of Denmark. As Holberg was the father of Danish comedy, so Ewald was the founder of Danish tragedy. Yet his noblest productions are his lyrical poems and odes, the pure beauty of which is scarcely to be surpassed. The best edition of his works is that of Liebenberg (8 vols. Copenhagen, 1850–55). See the Lives by Hammerich (1860) and Dolleris (1900).

Ewell, Richard Stoddert, Confederate soldier, was born in Georgetown, D.C., in 1817, served in Mexico and against the Apaches, and was actively engaged throughout the civil war. In 1862 he fought with distinction under Jackson, losing a leg near Bull Run in August; and, having been promoted lieutenant-general, he served gallantly at Winchester, Gettysburg, and the Wilderness. At Sailor's Creek, however, he was captured, with his entire force, 6th April 1865. He died 25th January 1872.

Ewing, Juliana Horatia Orr, writer for children, was the daughter of the Rev. Alfred Scott Gatty and his wife, Margaret Gatty (1809–73), the author of *Parables from Nature*, &c. Born at Ecclesfield, Yorkshire, in 1841, she early began to compose nursery plays for her brothers and sisters, which were performed with her brother, Alfred Scott Gatty, as musical conductor. But she also became proficient in her youth in the modern languages and classical literature. Her nursery stories are said to have suggested to her mother the starting of *Aunt Judy's Magazine* (1866), to which Mrs Ewing became a contributor. After Mrs Gatty's death, she edited the magazine with her sister for a time, and published in it many of her charming stories. These include *Mrs Overtheway's Remembrances*, *Jackanapes*, *Jan of the Windmill*, *A Flat Iron for a Farthing*, *We and the World*, *Lob-lie-by-the-Fire*, *Six to Sixteen*, *A Great Emergency*, *Old-fashioned Fairy Tales*, and *The Story of a Short Life*. In 1867 she had married Major Alexander Ewing, the author of a number of translations from the Turkish and the German. She died at Bath, 13th May 1885. See *Juliana Ewing and her Books*, by Horatia Gatty (1885).

Ewing, THOMAS, American statesman, was born in Virginia in 1789, and in 1816 was admitted to the Ohio bar, of which he afterwards became the unquestioned leader. He sat in the United States senate in 1831–37, was secretary of the treasury in 1841, and in 1849–50 organised the newly-created department of the interior, afterwards returning for a time to the senate. He died at Lancaster, Ohio, 26th October 1871.

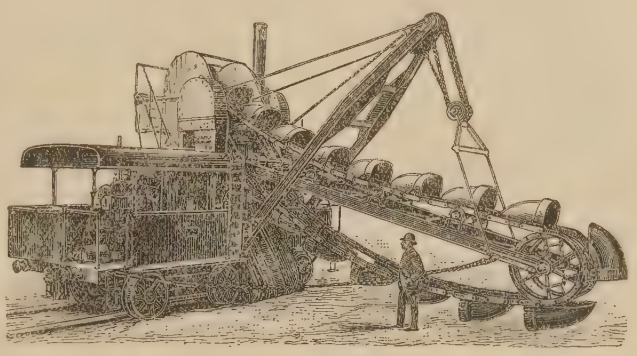
Exanthemata (from a Greek verb, 'to effloresce,' or come out in a rash), a class of febrile diseases (see FEVER) attended by distinctive eruptions on the skin, appearing at a definite period, and running a recognisable course. To this class belong smallpox, chicken-pox, measles, scarlet fever, typhoid, roseola, erysipelas, glanders, dengue, and cerebro-spinal fever.

Exarch was the title conferred by Justinian on his commander-in-chief and vicegerent in Italy, Narses, who reconquered Italy from the Goths (554). The seat of the exarchs was Ravenna. The extent of the *exarchate* was gradually diminished until it embraced only the country about Ravenna (q.v.). This was brought about by the conquests of the Longobards, whose king, Astulf, in 752 put an end to the Byzantine rule at Ravenna; but in 755 he was compelled to resign the exarchate to Pepin, king of the Franks, who gave it over to the Bishop of Rome, Stephen II.—Other Byzantine viceroys were called exarchs; and the title was conferred on certain archbishops, especially the head of the Bulgarian Church. The Bulgarian exarchate was removed in 1913 from Constantinople to Sofia, and the exarch was housed in the palace of the Holy Synod. See GREEK CHURCH.

Excalibur, the famous mystic sword of King Arthur, which was given him as Merlin promised by the Lady of the Lake, and at his death was flung into the river and caught up by a hand which rose above the waters.

Excambion (from the same source as 'exchange'—Lat. *cambire*, 'to barter'), in Scotland, is the legal name of the contract whereby one piece of land is exchanged for another. The contract usually gives to the parties the right to recur to the original property in case of eviction from the land excambed. Heirs of entail may, with the same consents as are necessary to enable them to disentail, excamb all or any portion of the entailed estate. Where excambed lands are burdened with debts, they are freed of these by the excambion, and burdened with the debts previously affecting the lands acquired in exchange for them. See EXCHANGE (DEED OF).

Excavators. These machines have been brought into use in the making of docks, railway-cuttings, canals, &c. Excavators are made of two kinds, each adapted for different kinds of work, although in some cases they work together very effectively. In making a long 'gullet' or cutting, the first to come into operation has the appearance and all the functions of the ordinary steam-crane, such as is used for loading railway trucks, with the exception that it is mounted on wheels to move on rails, and that, instead of the hook on the end of the chain, there is a large and strong plate-iron bucket or 'scoop,' with a very heavy handle or lever to which a second chain is fastened. The lever is heavy enough to counterbalance the scoop when filled with clay. The machine begins by lowering the scoop, and the two chains are made to push it into the bank until it is full. The suspension chain then lifts the scoop over the wagon, while the chain on the handle lifting it up empties it. The machine now swings round on its centre to renew the operation. The largest size can excavate two cubic yards per minute. As the excavator advances over its rails, those behind are brought to the front. The cutting is made as wide as the arm or 'jib' will reach on both sides of it, which leaves sufficient room for the men to work round it freely, and for wagons to pass. When the cutting has been made the requisite distance forward, the second class of excavator (shown in the engraving) is brought forward to make the cutting wider. The original conception of this is clearly derived from the Dredger (q.v.), which has long been in use in deepening harbours and the mouths of rivers. Its sides are made sloping to an angle of 45 degrees, and on the top of the bank a temporary line of rails is laid a few feet from the edge. The machine is placed on the rails at



Steam Excavator.

the end of the cutting; the jib is lowered until the row of buckets it carries can cut into the clay; these scrape up the bank, reaching the top of it full of soil; they next pass over the machine, and are emptied into the wagons beyond it. The excavator and wagons move forward simultaneously, the latter receiving, in the case of some excavators, a continuous stream of clay equal to about four cubic yards, or two wagon-loads per minute. It will be evident from the foregoing explanation that the first kind of machine is best adapted for docks, and preparing the way in long and deep cuttings for the second kind to follow. It may be said that the first will perform a greater variety of operations, while the second cannot be surpassed in the quantity of material it will remove in a given time. All the movements of excavators are effected by the power of the engine, and two men manage each machine.

Excellency, a title now given to Ambassadors (q.v.), as representing not the affairs alone, but the persons of sovereign princes, to whom it was formerly applied.

Exchange, in Political Economy, is based on the elementary fact that we are ready to give what we do not want for what we do want, or what we want less for what we desire more. Even in very old communities we find a considerable exchange. As soon as the primitive division of labour into agriculturist, weaver, smith, and carpenter was established, there must have followed a mutual exchange of the produce of these callings. But the early exchange was practicable only under very restricted local conditions, for the means of transport and communication were for long not suffi-

ciently developed to convey the staple commodities of industry over very great distances. Indeed, until the means of transport and communication were revolutionised by steam and electricity, all articles that have a considerable weight and bulk in proportion to their value were in general consumed at the place where they were produced. The grain was ground at the village mill, and consumed by those who had produced it; the village smith attended to the iron-work, the village carpenter did the same for the carpentry-work. In the village the wool was spun and woven into cloth, which in general was worn by the people of the locality. The village, parish, or district was an economic unit, within which the business of exchange was for the most part confined.

On the other hand, there had existed from very early times an exchange on a wider scale of commodities which possess a high value in proportion to their bulk and weight, and which are not readily perishable. Gold and silver, precious stones, spices, silk, &c. were the objects of a commerce which was carried on between the Mediterranean countries and the distant East. As civilisation with the corresponding industrial development advanced along the Mediterranean, a more varied and active exchange grew up among the peoples near that great highway of early commerce. Later on it found further scope on the seas and rivers of western and north-western Europe, and along various land routes, especially on those between Italy and Germany. The discovery of America and of the sea-way to India opened up an exchange which has now become universal.

The growth of exchange has simply followed the general social and industrial development. Exchange is based on differences of soil and climate, on differences of social development, on the distinction between town and country, on the growth of the division of labour—in fact, on the wide organic development of the great human society over the different areas of the world. It has particularly depended on the improvement of the means of transport and communication, on the construction of roads and canals, on the development of navigation, and, above all, on the development of steam and electricity. The means of transport are now so perfect that heavy and bulky commodities, such as grain and coal, can be profitably carried half-way round the globe. Exchange has become a dominating principle in economics. Production is only to a very slight degree carried on by the producers for the direct supply of their own needs. Under the large system of industry now prevalent, the outlet for the consumption of any article offered by the producers of it themselves is ridiculously inadequate. Production is carried on for exchange, for a market which may be co-extensive with the world; and through the vast and intricate mechanism of that world-market the consumer obtains the supply for his needs.

The growth of a world-wide exchange has naturally led to a corresponding development of what may be called the instruments and institutions of exchange. First of these is the medium of exchange. In primitive communities we find barter, the simplest method of exchange, still extant; even in the English colonies in North America it was common during the 18th century. The exchange of the civilised world is conducted through the medium of a very elaborate currency. The business of exchange in all the miscellaneous articles known to the civilised world is most largely concentrated in the great markets and exchanges, notably those of London, New York, Paris, Berlin, and Vienna.

Exchange, which to the end of the 18th century at least was hampered by innumerable restrictions and regulations, may now be generally described as *free;* it is managed by the free competition of buyers and sellers. But there are very important exceptions and modifications which have been indicated in the article COMPETITION.

In exchange the agreement between buyer and seller is reached by a process of bargaining, which has been called the higgling of the market. It is an adjustment of supply and demand, and ultimately of the interests of producers and consumers. The proportion in which things exchange for each other is their Value (q.v.), but this value is generally expressed in money, the medium of exchange, which is their price. But, while the value is expressed in money, exchange itself is always one of commodities against commodities.

It is an evidence of the prominence attained by exchange in the economy of the civilised world that so high an authority as Whately recommended that the science of political economy should be called Catallactics (from Gr. *katallassō*, 'I exchange'). The effect of such a name would be to confound the fundamentals of a science with one of its salient characteristics. Production is a more important department of economics than exchange, while distribution and consumption are fundamental. The chief end of economics is the satisfaction of human needs, production and exchange being alike subsidiary and subordinate to this.

Such is the general doctrine of political economy regarding exchange; but there are some special applications of the word that require notice. Thus, exchange is specially applied to the conversion of the money of one country into its equivalent in the money of another—as by stating the relation which French francs or German marks bear to pounds sterling. It also refers to the difference between the actual value of money, taken by the standard of bullion, in any two places with relation to each other. If in London it costs more than £100 to pay £100 in St Petersburg, the rate of exchange is against the former town, and in favour of the latter; an inhabitant of which will be able to pay a debt of £100 in London with less than £100 worth of bullion in St Petersburg. The process will be best explained by analysing it through means of simple examples. If Thomson & Co. of London buy £100 worth of wine from De la Rue of Paris, and De la Rue, on the other hand, buys £100 worth of cotton goods from Thomson & Co. of London, the two debts, *were there no others between the merchants of the same towns*, would extinguish each other, and there would be no necessity either for transmitting money or drawing bills of exchange. Suppose, however, that it is not De la Rue, but his neighbour Bonchamp who has bought the £100 worth of cotton goods from Thomson & Co., then the debts of all will be settled by Bonchamp paying £100 to De la Rue on Thomson & Co.'s account. Suppose, next, the case of De la Rue being due nothing to Thomson and Co., and Bonchamp being due them only £50, a like sum has to be otherwise found. Van Pradt of Amsterdam is due precisely this sum to Thomson & Co., while either De la Rue or Bonchamp is due the same amount to Van Pradt for a purchase of Gouda cheeses; then it is clear that the several debts can be adjusted among them without the transmission of bullion. It will cost some trouble to adjust the payments, however, and this trouble will have to be paid for. As in paying Thomson and Co. their debt of £100 De la Rue will have to pay for this trouble; the rate of exchange will be against him. If the debt, or any part of it, cannot be met by such an adjustment out of cross debts and credits, it will be necessary for the debtor to send bullion to his creditor; and, this being an expensive process, it throws the rate of exchange

against the debtor who so pays. For instance, if the sum due by the Frenchmen to Van Pradt was only £25 instead of £50, then De la Rue would have had to be at the expense of sending £25 to London in bullion.

No such actual transactions take place in the existing mercantile world, because the accounts in debtor and creditor connected with the three towns above referred to are to be counted in thousands, and ramify into other towns; but the above examples may be held to represent the groups of debtors and creditors, as algebraic signs represent quantities. The individual merchants in one trading town have no idea how the surplus of debit or credit may lie between them, far less can they tell how it may be adjusted by debits and credits in other towns; but, through the agency of bankers, bill-discounters, and other persons who deal in money, the relations of all trading-places towards each other are in a constant state of shifting and adjustment; and any one who has to pay a debt in any trading-place can find out how much he has to give to get that debt paid, and can pay it accordingly. When, through the operation of these complicated transactions, you require to give more than £100 in London to get that amount paid in Paris, then the rate of exchange is against London, and is in favour of Paris, where less than £100 in cash will pay a debt of £100 in London. The difference will generally depend on the difficulty of adjusting questions of debt and credit throughout the field of European commerce in such a manner as to get the debt paid. If it cannot be paid by adjustment, then bullion must be sent; and thus it is generally said that the rate of exchange against any place is limited by the charge of transmitting bullion to it. The rate of exchange is liable to be brought to a level also by commercial exportation and importation, since, whenever it is expensive to get money sent to a country, goods may be sent to that country to compensate the debt. In the general circle of transactions of this kind, the state or town which has the largest amount of transactions will have the largest number of debtors and of creditors, and will thus afford the chief facility for each compensating the other. For this and other reasons London is the centre of the money-market, where all the debts and credits in the world may be said to meet and extinguish each other (see BILL OF EXCHANGE). While the old notions about the Balance of Trade (q.v.) existed, it was supposed that the nation which the exchange was against was going to ruin, while that which it was in favour of was prospering through the other's loss. Such general statements must be tested by a comprehensive analysis of all the relevant facts. Gold-producing countries find bullion their most advantageous export, and the same is the case with countries into which gold has flowed in excess.

Exchange, a term applied to buildings or places of resort for merchants. The name *Bourse* (Lat. *bursa*, 'purse') is applied in France and Belgium to a resort of this kind; and in Germany, *Börse*.

Exchanges originated in the commercial cities of Italy, Germany, and the Netherlands; and Sir Thomas Gresham, who had resided as English agent at Antwerp in 1550, chose the Bourse of that city as a model for the Royal Exchange of London. Gresham's Burse, for so it was originally called, was built on Cornhill in 1566–67. It consisted of a quadrangle with an arcade; above was a corridor (called the *pawn*) with stalls, for the sale of wares; outside were shops. On January 23, 1571, the Burse was ceremoniously opened by Queen Elizabeth, who, by herald and trumpet, caused it to be proclaimed 'The Royal Exchange.' This first exchange of London was almost entirely destroyed by the great fire of 1666. A new exchange was forthwith erected on the spot, and opened in 1669; but it also was destroyed by fire, in 1838. The foundation-stone of the third exchange was laid in 1842; and completed at a cost of £180,000, from the designs of Tite, it was opened October 28, 1844, by Queen Victoria.

The term exchange seems to have been naturally adopted from the circumstance that buying and exchanging of merchandise, and also exchanging and paying away of money, formed the chief object of concourse. In the present day, early intelligence in matters affecting commerce and public finance forms a principal attraction of this kind of resort. Although open daily, there are usually certain days and hours of meeting when the throng is considerable. The meeting is familiarly called 'Change.' The two great days of meeting at the Royal Exchange, London, are Tuesday and Friday, and the busiest time is from three to four o'clock.

In London there are several other exchanges, but for special purposes; among these are the Corn Exchange in Mark Lane, the Coal Exchange in Lower Thames Street, the Hop and Malt Exchange in Southwark, the Hide and Skin Exchange or Market in Bermondsey, and the Stock Exchange, near the Bank of England. Amongst the exchanges in the large towns of England and Scotland, those of Manchester, Liverpool, and Glasgow are specially noteworthy. There are exchanges, many of them for special purposes, in Augusta, Baltimore, Boston, Brooklyn, Buffalo, Charleston, Chicago, Detroit, Louisville, New Orleans, New York, Philadelphia, Richmond, St Louis, San Francisco, and other cities of the United States. See CHAMBER OF COMMERCE, STOCK-EXCHANGE.

Exchange, DEED OF, in English law, a common law assurance, whereby persons severally seised of lands mutually grant them in exchange, each his own land for that of the other. The two subjects must be of the same nature, as lands for lands, chattels for chattels, but not real for personal estate. The parties must take an equal estate—thus, an estate in fee cannot be exchanged for an estate tail; and the word 'exchange' must be used. There must also be entry, and if either party die before entry his heir may avoid the transaction. Exchange must now be made by deed, but this form of conveyance is seldom used, the same purpose being effected by two separate deeds of grant. A mutual warranty and right of entry was formerly implied in an exchange. This effect of the deed has been taken away by an Act of 1848. By the Common Enclosure Act of the same year the commissioners are empowered to make exchanges for the better carrying out of the purposes of the act. A deed of exchange closely resembles in its particulars an Excambion (q.v.) in Scotland. The law as to exchange in most of the American states is founded on and similar to that of England.

Exchanges, MILITARY, are certain arrangements made between officers of the British army to enable them to change their regiments or stations. Officers exchanging must be of the same rank. Artillery, engineer, marine, or departmental officers can only exchange in their respective corps, and do not lose seniority by doing so. Officers of other branches may exchange with each other, but, if they change regiments, go to the bottom of the list of officers of corresponding rank. Exchanges are ordinarily arranged by the Army Agents (q.v.), and others who make it their business to carry them out: but each exchange

requires the sanction of the Army Council, and of the two commanding officers affected by it. Considerable sums are often paid by one officer to another to induce him to exchange.

Exchequer. The ancient Exchequer in England was a branch of the King's Court, in which sheriffs and others were held to account for the revenues they received, and questions relating to the royal revenue were decided. The name exchequer (Fr. *eschequier* in the 12th century, from *eschec*, 'check' at chess) was derived from the checkered tablecloth on which money was counted, a practice which was continued in the Scottish Court of Exchequer down to modern times. In England the financial department of the court was called the receipt of the Exchequer. The Chancellor of the Exchequer was originally appointed as under-treasurer, to check the proceedings of the Lord High Treasurer (see TREASURY). He sat as a judge on the 'equity side' of the Court of Exchequer, or on the rehearing of cases in which the other judges of the court were equally divided in opinion. But in modern times his position has been that of first finance minister of the crown; the office is sometimes held by the prime-minister, when he is a member of the House of Commons. The last case in which the Chancellor of the Exchequer sat as a judge was in 1735; the decision then given by Sir Robert Walpole is said to have caused great satisfaction; but his successors have not figured among the judges except on occasions of state and ceremony. The receipt of public revenue now belongs to the several revenue departments, under the supervision of the Exchequer and Audit Department and the Treasury. See books by Madox (1711), J. H. Round, Hubert Hall, and R. L. Poole (1913). For exchequer tallies, see TALLY.

The Court of Exchequer was originally, as has been stated, a revenue court, but it obtained a general common-law jurisdiction by means of the writ of *Quominus*, wherein it was set forth that the plaintiff, by reason of the wrong done to him by the defendant, was deprived of the means of discharging his debt to the crown. This fiction was abolished in 1832. The ordinary judges of the court were the Chief Baron and three puisne Barons, so called, according to Selden, 'because they were anciently made of such as were barons of the kingdom.' The equity jurisdiction of the court is said by Coke to date from a statute of 1542; it was transferred to the Court of Chancery in 1842. In 1875 the Exchequer became a division of the High Court of Justice. The Exchequer Division is now merged in the King's Bench Division; the office of Chief Baron has been abolished, and no judges are now appointed with the title of Baron. See COMMON LAW, and Coke's *Fourth Institute*.

The Court of Exchequer Chamber was formerly a court of all the judges in England assembled for decision of matters of law. The ordinary jurisdiction of the Court of Exchequer Chamber was as a court of error, in which capacity it revised the judgments of the three courts of common law; the decisions of each court being revised by the judges of the other two. An appeal now lies from each division of the High Court of Justice to the Court of Appeal.

In Scotland, before the Union, the Exchequer was the king's revenue court. It consisted of the treasurer, the treasurer-depute, and as many of the lords of Exchequer as the king was pleased to appoint. The Scottish Court of Exchequer was continued by the 19th article of the treaty of union, until a new court should be established, which was effected in 1707. A privative jurisdiction was conferred on the court as to questions relating to revenues and customs of excise, and as to all honours and estates real and personal, and forfeitures and penalties arising to the crown within Scotland. But questions of *title* to lands, honours, &c. were reserved to the Court of Session. The judges of the court were the high treasurer of Great Britain, the chief baron, and four other barons; and English barristers as well as Scotch advocates were allowed to practise in the court. In cases of difficulty, and where there was a collision of jurisdictions, it was formerly not unusual to hold conferences with the barons; and the form of desiring the conference was to send the Lord Advocate, and, in his absence, the Solicitor-general, to request a meeting, though it has been doubted whether they were bound to carry the message. In 1832 it was enacted that successors should not be appointed to such of the barons as should retire or die, and that the duties of the court should be discharged by a judge of the Court of Session. And in 1886 the Court of Exchequer was abolished, and the jurisdiction transferred entirely to the Court of Session.

The Court of *Exchequer Chamber* in Ireland was established in 1800, but was abolished as an intermediate Court of Appeal between the Irish Courts and the High Court in England.

Exchequer Bills, bills issued at the Exchequer under the authority of acts of parliament, as security for money advanced to the government. They contain an engagement on the part of the government for the payment of the principal sums advanced, with interest. These once formed the chief part of the unfunded debt of the country. They were first issued in the reign of William III., in the year 1696, and were drawn for various amounts from £100 to £5. At that time they bore interest at the rate of 3d. per day on £100. The interest was reduced to 2d. during the reign of Anne. During the war 1793–1814, the rate of interest was usually 3½d. Holders of these bills were exempt from all risk, except that arising from the amount of premium or discount they might have given for them. The bills passed from hand to hand as money, and were payable at the Treasury at par. They might also be paid to government in discharge for taxes. When it was intended to pay off outstanding Exchequer bills, public notice was given by advertisement. The advances of money to government by the Bank of England were made on Exchequer bills. These bills were a convenient means whereby government could meet a sudden demand for unusual expenditure. They went out of use in 1897. See NATIONAL DEBT.

Exchequer Bonds, issued by the government, are promises to pay a specified sum after a stated time, the rate of interest being fixed.

Excise, the name of a tax on commodities, from the Latin *excisus*, 'cut off,' as being a portion of the value of the commodity cut off and set apart for the revenue before the commodity is sold. This is not its actual nature, however, for the manufacturer who looks to a profit on his product does not give part of the value to the revenue; he merely counts the tax as part of his expenditure, or, in other words, includes it in the price, the tax being really paid by the consumer. An inland tax on commodities sold and bought for consumption in the country is a very ancient one, but it has generally appeared in the simple shape of a toll or *octroi* on goods brought to market. The complicated arrangement for officially watching the process of a manufacture, for the purpose of seeing that none of the dues of the revenue are evaded, is of comparatively modern origin. It was first introduced into England, upon the Dutch model, by the Long Parliament, which established an excise on liquors in 1643, and in subsequent years on articles of

food, salt, silk and stuffs, and other commodities in general use. Though unpopular, the excise in some form or other has ever since continued to be a material element in the taxation and revenue of Britain. In the earlier part of the 18th century Sir Robert Walpole entertained the notion of enlarging its productiveness, while mitigating its proportional pressure by the bonding system, which suspends the exaction of the duty until the goods are sold, and thus leaves the manufacturer with all his capital to be devoted to production (see BONDED WAREHOUSES). But the rumour of an enlargement of the unpopular excise duty created a general excitement, and the memorable cry of 'Liberty, Property, and No Excise,' compelled Walpole to abandon his project.

An excise, when compared with other taxes, has its good and its bad features. It is a method of extracting money for national purposes from personal expenditure on luxuries, and is especially serviceable when received from those luxuries the use of which in excess becomes a vice. On the other hand, it renders necessary a system of inquisitorial inspection not very agreeable to a free people, and open to abuse and fraud; while at the same time excessively high duties, and duties on commodities strictly of domestic manufacture, lead to smuggling and all its demoralising consequences. The evils of an excise were formerly aggravated by the practice of farming the duties—i.e. by letting them to the highest bidder, whose interest it became, like any other contractor, to make the greatest possible profit by his speculation, and consequently to exact the duties in the most rigorous manner. In every well-regulated revenue system it is, of course, only fair to all parties that the duty, as the law lays it on, should be fully exacted; but in the age of farming the arrangements were all slovenly, and there was much latitude of power in the hands of the farmers. The farming system became very oppressive in France, especially in the *gabelle* or excise on that necessary of life, salt. It is a curious fact, however, that when the farming of the excise was abolished in Scotland by the Union the people grumbled, saying they were easier under the farmers, their own neighbours, who acted on the principle of 'live and let live,' than under the officers sent down from England, who rigorously collected the impost.

An excise works most easily when it is laid on some commodity manufactured on a large scale. In a great distillery the excise officer is almost a portion of the establishment; he has an eye on every step of the process, with the object of seeing that the commodity does not get into the market without government obtaining its proper share—sometimes far the greater part—of the market price. The social influence of such an arrangement is very different from that of the old candle and salt duties, which made it the function of the exciseman to pounce on a farmer melting the surplus tallow of the last killed sheep, or on a fisherman boiling sea-water to procure salt for his potatoes. The manufacturer, however, though he has the benefit of the bonding system, feels the excise regulations to be a considerable drag and hindrance in his operations, since there are numerous minute operations which he cannot perform without sending special notice to the excise department, or having an officer actually present. This renders it necessary, too, that all the steps of the process should not merely be defined as between the manufacturer and the officer, but should be set forth in an act of parliament; and hence deviations for the purpose of economy, or by way of experiment, become difficult, and sometimes impracticable. As difficulties with which the producer has to contend, these things require him to lay on the selling price of the commodity a larger addition than the actual amount of the duty. This objection, however, is less potent than it formerly was, for the introduction of machines and special apparatus, such as alcoholometers, saccharometers, &c., has greatly facilitated the collection of excise duties.

No method of taxation requires a nicer adjustment to the social condition of a country than an excise. While it is now admitted that necessaries of life should be free, yet some form of tax upon consumption is the only method by which certain classes of the people can be made to contribute their share to the revenue of the country. But for the excise and customs dues on beer, spirits, and tobacco, and some licenses, many persons would evade all share in the national burden.

Excitants. See STIMULANTS.

Exclusion Bill, a measure brought forward by Shaftesbury in 1679 to exclude the Duke of York, afterwards James II., from the succession to the throne, on account of his avowed Catholicism. It thrice passed the Commons, and as often Charles II. resorted to a dissolution, till, after March 1681, he ruled without parliamentary control.

Excommunication. The word 'excommunication' denotes exclusion, whether temporary or permanent, from fellowship in religious rites, involving also, where participation in such rites is required in the civil order, privation of the rights of citizenship. It is not peculiar to the biblical religions, but is found in most of the systematised cults, whatever be their origin. Thus, Cæsar describes its operation amongst the Gauls, stating that contempt of the decisions of their judges was visited with interdiction from the sacrifices. 'This is a most severe penalty with them. For those so interdicted are counted as sinful and wicked; all keep aloof from them, and avoid approaching or addressing them, lest they should incur some injury by contact; they are granted no right which they claim, nor is any honour bestowed upon them' (*Bell. Gall.* vi. 13). The absence of any remark as to a corresponding usage amongst the Romans and Greeks of the time is enough to show that Cæsar was not familiar with the practice; but slight indications are discoverable of analogous usages, so far as regards exclusion from common acts of worship, amongst which the Latin word *profanus*—signifying that which is 'outside the temple'—may be specially cited. The clearest analogy, however, to the Christian discipline of excommunication is that furnished by the Rabbinical code. This is ultimately based on the legislation of the Pentateuch, which excluded the ceremonially unclean, as well as offenders of a graver kind, both from religious and civil fellowship (Lev. xiii. 46; Numb. v. 2, 3; xii. 14, 15); and the penalty is recorded in Ezra, x. 8, as enforced against such Jews of the captivity as disobeyed the proclamation to assemble at Jerusalem. The offender first received a public admonition, and seven days later, if he did not make satisfaction, the lesser excommunication, *Niddui*, was pronounced against him, whereby he was isolated during thirty days from contact with all save his wife and children, being obliged to keep at least 4 cubits' distance from all others; and although the sentence did not technically include expulsion from the synagogue, yet this provision practically enforced it. At the expiration of the 30 days, a second term of like duration was enjoined in case of continued impenitence; and the contumacious were then visited with the greater excommunication of *Cherem*, which excluded both from the synagogue and from all social inter-

course, and the offender was treated as a leper. These two grades of excommunication were the only ones anciently in use; but the later Rabbins added a third and severer one, styled *Shammatha* or *Anathema Maranatha*, which was lifelong, attended with solemn imprecations, and sometimes entailing forfeiture of goods.

The Christian system of excommunication is based doctrinally on the precept of Christ (Matt. xviii. 15–18) and on the precepts and practice of St Paul (Rom. xvi. 17; 1 Cor. v. 3–5, 11; 2 Thess. iii. 14) and St John (2 John, 10, 11); while its practical method was borrowed from the synagogue, and formulated certainly by the 3d century, perhaps as early as the 2d. It was primarily, as the word denotes, exclusion from communion in the eucharist and the *agape* or love-feast, including also suspension from office in the case of clerical offenders; and it was distinguished as major and minor, each having various degrees of severity. Thus, the lightest form of excommunication permitted the offender to join in all acts of public worship except to make oblations and actual reception of the eucharist; the grade next below was not suffered to be present during the latter part of the liturgy, but only during the preliminary prayers and the remaining public offices; below this class again came those who were excluded entirely from the prayers, but permitted to enter church to hear the Scriptures read and sermons preached; while the lowest grade of all was refused permission to enter church, being obliged to remain outside the doors until the expiry of their term of penance. Similarly, the major excommunication, besides its exclusion of offenders as well from social intercourse as from all participation in church fellowship and ordinances, which applied in all cases, had also the graver form of anathema, fulminated against the most obstinate offenders, and chiefly such as taught or abetted heresy, or, at a somewhat earlier date, those who had lapsed in time of persecution, and had either sacrificed to idols or obtained certificates alleging them to have done so. The controversy as to the possibility of readmitting such persons to communion at all—denied by the Novatianist or rigorist school—was one of the most serious which agitated the church in the 3d century; and, though the milder course ultimately prevailed, yet even the moderate party insisted upon very severe and prolonged penalties, seldom pardoning the offender till the very close of life, unless at the personal intercession of a martyr. Notice of such greater excommunication was sent by circular to all churches in the case of clerical offenders or laics in official positions, to insure the universal incidence of the penalty; and intercourse with any one underlying it involved the same punishment as the original offence, the lesser excommunication being incurred *ipso facto*, and the greater by persistence in such intercourse after admonition. At a very early date the aid of the civil power was invoked in support of the spiritual sentence, not only by preventing resistance thereto, but by superadding a temporal penalty. Thus, the fifth canon of the Council of Antioch in 341, after enacting that any cleric setting up a schismatical place of worship shall be deposed for life, adds: 'And if he persist in troubling and disturbing the church, let him be corrected by the civil power as a seditious person.' And in the third Council of Carthage in 397 a canon (xxxviii.) was passed to petition the governor of the province to remove an intruding bishop who had disregarded the ecclesiastical censures passed upon him; which was embodied later in the general code of the African Church, as well as two others of a like nature (lxvii. and xciii.) directed against the Donatists. In the Theodosian Code there is a law imposing a fine of ten pounds of gold upon all heretical persons conferring or receiving ordination, further confiscating the place where the act occurred, if done with the knowledge and assent of the owner; and many such enactments appear in later history, such as the decree of Childebert in 596, the Capitularies of Pepin in 755, and the Constitutions of Lothar I. in 825, whereby excommunicated persons were put to the ban of the empire; while a constitution of Frederick II. in 1220, alleging that the material sword is appointed for the aid of the spiritual sword, enacts that, in the event of excommunicated persons not making satisfaction within six weeks from the sentence, the civil ban is to issue thereupon, and not to be revoked until the previous removal of the excommunication. The theory that the spiritual sword might be turned against the civil power itself, and that excommunication deprived sovereigns and other magistrates of their authority, voiding, indeed, all civil rights, is peculiar to Latin Christianity, and is a development of the Hildebrandine era and policy (see ALLEGIANCE), first put into actual execution by Gregory VII. against the Emperor Henry IV. in 1076, and again in 1080, renewed in 1084 by Urban II., and in 1102 by Paschal II.; and later against the Emperor Philip of Swabia, and in favour of his competitor Otho IV. by Innocent III. in 1210. It is compendiously stated thus by Cardinal Francis de Toledo (1532–96) in his *Instructio Sacerdotum*, a work of much repute, recommended by Bossuet: 'An excommunicated person cannot exercise an act of jurisdiction without sin; nay, if the excommunication be publicly made, his sentences are null' (lib. i. cap. 3). Instances of the kind are the excommunication of Napoleon I. by Pius VII. in 1809, and that of Victor Emmanuel II. by Pius IX. in 1870. But the omission of their names in these documents, which are vaguely and indefinitely fulminated against enemies and oppressors of the holy see, barred the full operation of the sentences in canon law, and left the question of allegiance untouched.

In the actually current discipline of the Roman Catholic Church a distinction is drawn between such sentences of excommunication as are incurred *ipso facto* (technically known as *latæ sententiæ*) and such as do not take effect till after the formal sentence of an ecclesiastical court (called *ferendæ sententiæ*); and those subject to such sentences are distinguished as *tolerati* and *non-tolerati*, the former of whom are still eligible for social and civil intercourse, while the latter are absolutely excluded from all such communion, as well as from the ordinances of religion. In theory the right to pronounce the greater excommunication is limited to the pope solely, as also the power to absolve therefrom; but in practice this authority is conveyed to all bishops in their quinquennial faculties, for local exercise within their dioceses, and by them to the clergy under their jurisdiction, so far as regards absolution, but not for pronouncing sentence, which is never committed to any one below the rank of bishop or judge. In most Roman Catholic countries, if excommunication involves any civil disabilities, it cannot be published without the sanction of the civil power, and in some of them there is an appeal to the law-courts on the merits, to obtain fresh examination of the case at the hands of the ecclesiastical authorities. It is a mistake to ascribe to Roman Catholics the doctrine 'that excommunication may be pronounced against the dead.' The contrary is expressly laid down by all canonists (Liguori, *Theologia Moralis*, lib. vii. n. 13, 1). In the cases in which this is said to have been done, the supposed 'excommunication of the dead' was merely a declaration that the deceased

individual had, *while living*, been guilty of some crime to which *excommunication is attached by the church laws*. Roman Catholic writers, moreover, explain that the civil effects of excommunication in the medieval period—such as incapacity to exercise political rights, and even forfeiture of the allegiance of subjects—were annexed thereto by the civil law itself, or at least by a common international understanding in that age. Examples are alleged in the law of Spain, as laid down in the Sixth Council of Toledo, a mixed civil and ecclesiastical congress (638); in the law of France, as admitted by Charles the Bald (859); in the Saxon and in the Swabian codes; and even in the English laws of Edward the Confessor; all which, and many similar laws, proceed on the great general principle of these medieval monarchies—viz. that orthodoxy and communion with the holy see were a necessary condition of the tenure of supreme civil power; just as by 1 Will. and Mary, sect. 2, chap. 2, profession of Protestantism is made the condition of succession to the throne of England. Hence, it is argued, the medieval popes, in excommunicating sovereigns, and declaring their subjects released from allegiance, did but declare what was, by the public law of the period, the *civil* effect of the exercise of what in them was a *spiritual* authority.

By the discipline of the Roman Catholic Church, kings or queens, and their children, are not included in any general sentence of excommunication, unless they be specially named.

Certain 'reserved cases' are limited to the pope alone, and are enumerated in the brief 'Apostolicæ Sedis,' promulgated by Pius IX. in 1869, which also contains a list of those sentences, *latæ sententiæ*, now in force within the Roman Church; but an ordinary priest is permitted to absolve those at the point of death from even the reserved excommunication.

The oriental discipline is much less elaborate, and more nearly accords with ancient practice; but the distinction between the greater and lesser excommunication is retained, and no fewer than 115 offences, involving various degrees of excommunication, are specified in the office-books, ranging from twenty years' exclusion, for such crimes as murder or magical practices, down to bigamy, with its penalty of one year and merely ceremonial disqualifications, yet briefer in effect. The greater anathema is fulminated yearly throughout the Eastern Church on Orthodoxy Sunday (first Sunday in Lent) against about sixty forms of heresy, for the most part extinct; but in the Russian Church they have been cut down to twelve still prevalent types of opinion.

In the Church of England the medieval practice conformed in the main to the current western usage, save in this one important respect, that an excommunication *ipso facto* was not really in operation; for though the term occurs frequently, yet what it denotes is only that, given a certain offence, excommunication must follow as the penalty, but a declaratory sentence of a competent court must precede the actual excommunication.

Various civil disabilities attended excommunication, and were continued after the Reformation, such as inability to hold a benefice, to practise as an advocate or attorney in the courts, to be admitted as a witness, and to receive Christian burial. By a canon of 1597 the ordinaries were to provide for the public denunciation monthly in the cathedral of the diocese and the parish church of the offender, in all cases where an excommunicated person had not made satisfaction and obtained absolution within three months after incurring sentence; and this was embodied in the canons of 1604 (lxv.), with the alteration to a half-yearly denunciation, but with the further provision that those present should be induced to apply for a writ *De excommunicato capiendo*, 'thereby to reduce them to due order and obedience.' This writ was issued by the Court of Chancery on the application of the diocesan, and addressed to the sheriff or other officer, and warranted the imprisonment of those arrested under it. The disabilities attending excommunication were abolished for England by the Act 53 Geo. III. chap. 127, and for Ireland by the 54 Geo. III. chap. 68; while all remaining penalties against persons dissenting from the worship and doctrines of the Church of England were repealed by 7 and 8 Vict. chap. 2, and 9 and 10 Vict. chap. 59. The most notable exercise of the power of excommunication in the modern Anglican Church was when Bishop Gray, as Metropolitan of Capetown, deprived and excommunicated Bishop Colenso of Natal in 1863, which sentence, approved by the Convocations of Canterbury and York, the General Convention of the American Episcopal Church, the Episcopal Synod of Scotland, and the Provincial Council of Canada (as well as by a large majority of the bishops assembled at the first Lambeth Conference in 1867), was reversed by the Judicial Committee of Privy-council in 1865, on the ground that the crown had no power to erect the see of Capetown into a metropole, nor to give Bishop Gray the coercive jurisdiction on which he had relied as empowering him to try one of his suffragans and pass sentence upon him.

In the Established and other Presbyterian churches of Scotland, the lesser excommunication, involving deprivation of all 'sealing ordinances,' can be pronounced by the kirk-session. The greater excommunication can be pronounced by authority of the presbytery only; it is now very rarely heard of, and since 1690 it does not carry with it any civil consequences.

A very singular kind of excommunication is that connected with the usage of *tabu* amongst the islanders of Polynesia. Tabu is a species of interdict which may apply to persons or things; in the latter case making any use of the interdicted article, or even contact with it, unlawful and penal; in the former cutting off the interdicted person from all intercourse or contact with others, and even prohibiting him to use his hands to feed himself; a chief or noble being allowed a servant, also put under tabu, to feed him, and a man of lower rank being obliged to pick up his food with his mouth only, like a beast.

Islam forms an exception to the almost universal incidence of the practice of excommunication. Under the Moslem code every religious offence carries with it a temporal penalty, such as fines, scourging, stoning or other mode of death, and only in this last manner can an offender be cut off from the congregation. See BELL (for 'Bell, book, and candle'); also INTERDICT.

Excretion. See SECRETION; and for the excretory organs, see RESPIRATION, SKIN, KIDNEY, URINE, &c.

Exe, a river of Somerset and Devon, rising in Exmoor, and flowing 54 miles south-eastward and southward to the English Channel at Exmouth. The lower 5 miles form a tideway a mile broad at high-water, with wooded and picturesque shores, and navigable for large vessels. An ancient canal connects the estuary with Exeter (q.v.). The chief tributaries of the Exe are the Barle, which also rises in Exmoor, and is 24 miles long, Batham, Loman, Culm, and Creedy. The Exe passes Dulverton, Bampton, Exeter, and Topsham. The greater part of its course is through wooded and romantic vales.

Execution, in Law, is the act of completion

or carrying into effect. Thus a writ is executed by obeying the instructions contained in it; a Deed (q.v.) is executed when it is signed, sealed, and delivered; a power is executed when it is exercised; a judgment of a court is executed when it is enforced. Judgments are usually enforced by writs of execution, which direct the officers of the law to do what is necessary, or to compel a defendant to perform some act. The term 'execution' is used now technically to denote execution to recover a debt—the kind that occurs most usually in practice. In Scotland, the term execution is also applied to the written attestation under the hand of the executive officer that he has carried his warrant into effect, as by serving a summons or giving a citation. It corresponds to the affidavit of service of writ in England.

Execution, in civil law. In civil cases the common law of England allows four different writs to issue against refractory debtors—viz. a *fieri facias* (called commonly a *fi. fa.*), a *capias ad satisfaciendum* (*ca. sa.*), *levari facias*, and *elegit*. These writs issue from the court of the Division in which the proceedings are grounded, and are addressed to the sheriff of the county. By a *fi. fa.* the goods and chattels of a debtor may be attached. This writ lies against all proprietors, peers, &c., and is by far the commonest form of execution. A writ of *ca. sa.* is directed against the person of a debtor, and authorises his detention until the debt has been satisfied. But though probably still competent in certain cases, it has been in practice obsolete since the abolition of imprisonment for debt; and practically the only forms of execution against the person now in use are writs of attachment and committal. These are both founded on contempt, and are very similar. The terms are, indeed, used loosely as interchangeable, and the distinction between them is narrow and technical, lying merely in the service necessary and the officer charged with execution. A *levari facias* is now seldom used. It is directed against a man's goods and the profits of his lands. The writ of *elegit* is of very ancient date (see ELEGIT). In the Chancery Division of Court, execution against the estate is effected by writ of *fieri facias* or writ of *elegit*. Execution against the person is by writ of attachment. Should this latter writ be returned *non est inventus*, the party prosecuting has it in his option to take out a writ of sequestration of the estate, with issues of course, or to obtain an order for the serjeant-at-arms. An attachment does not lie against a peer or other privileged person, but an order called a sequestration *nisi* is issued. In cases of contempt, the High Court in each division has also the power to order personal commitment. In all cases execution may issue immediately, each writ being renewable after a year, within six years; but the court or judge can stay execution to a time fixed—or subject to conditions.

In the United States, the law of execution is complicated by the rules which define the local jurisdiction of district and state courts and of the United States courts. The writs of execution in use are *fieri facias*, *levari facias*, &c.; the writ of *elegit* is now little used. In some states the homestead and other property of a debtor are exempted from execution; and congress has enacted that execution issuing out of United States courts must follow the provisions of these local laws.

In *Scotland*, execution for debt, or, as it is technically expressed, diligence in execution, is either real or personal; by the former, the debtor's lands may be attached; by the latter, his person or his movables. In order to entitle a creditor to use diligence against the person or estate of his debtor, the debt on which the diligence proceeds must be duly constituted by a liquid document, or by a decree, or by an action in which decree is sought. In this last case, the law, as a rule, allows diligence on the dependence of the action, in order that a party may not be deprived of his remedy during the currency of the action, but such diligence depends for its effect upon the judgment in the cause. In the case of bonds and other instruments registered for execution (see REGISTRATION), the law allows summary diligence to proceed; that is to say, execution may proceed without the need of further application to the court. Diligence against heritage includes Inhibition, which is a writ passing under the signet, and prohibiting the debtor from contracting any debt which may become a burden on his heritage to the prejudice of the inhibitor's debt; Adjudication (q.v.); Ranking and Sale, a process of law by which the heritable property of an insolvent is judicially sold, and the proceeds divided among his creditors; and Poinding of the Ground, which is an action proceeding on a heritable security, and attaching all the goods on the lands over which the security extends. Personal diligence is (1) by Horning and Caption, where letters of horning—i.e. letters running in the sovereign's name, and passing the signet—are issued instructing messengers-at-arms to charge the debtor to pay, and on his failure a caption or warrant for his apprehension is granted; (2) by the simpler form of Warrant to Charge under the Personal Diligence Act, which replaces the old process of horning and caption; (3) by Arrestment (q.v.); (4) by Poinding; (5) by Mercantile Sequestration.

Execution, in criminal law, is the infliction on criminals of the punishment of death in conformity with legal decree (see CAPITAL PUNISHMENT). The modes of execution have varied greatly, both in the progress of time and in different countries. On the whole, the manner of executing the death-penalty, as of decreeing and inflicting punishment in general, has tended to grow more humane with the advance of civilisation. Among the Jews a frequent form of execution was stoning, while burning alive appears (Genesis, xxxviii. 24) to have been practised in their patriarchal history, and is sanctioned by Mosaic law. Casting from a rock was a mode recognised by the Jews and the Twelve Tables of the Romans. Under the Roman republic vestal virgins violating their vows of chastity were buried alive, and in the time of Paul crucifixion, burning, and decapitation were the chief modes of execution. Crucifixion (see CROSS) was in use likewise among the Assyrians, Persians, Egyptians, Carthaginians, and Greeks. Constantine, on his adoption of Christianity, abolished crucifixion in the Roman empire. The Italians of the middle ages, however, crucified some of their prisoners of war. Another revolting form of execution among the Romans was that of condemning the criminal to fight with wild beasts. Impalement, by thrusting a sharp stake through the body lengthwise, was one of Nero's cruelties, and is referred to by Juvenal. It is said to have been practised in the Balkan Peninsula so recently as 1876. Under Charles V. impalement was effected by driving a pointed stake through the heart while the criminal in open grave was being covered with earth. Other barbarous modes of execution were pouring melted lead on the criminal; sawing him asunder, a mode practised by the Jews against the conquered in Palestine; starvation in dungeons; pressing to death; breaking on the wheel; tearing to death with red-hot pincers. Boiling alive was occasionally practised on the Continent; and in England in Henry VIII.'s time poisoning was punishable by boiling to death, and 'it seems,' says Sir James Stephen, 'that three or four persons

were so boiled.' In 1532 sentence of boiling alive was put in execution against a miscreant who attempted to poison Fisher, Bishop of Rochester, and actually poisoned some of his household. The act under which that sentence was carried out was repealed by 1 Edward VI. Drowning a parricide in a sack, in which were also a dog, cock, viper, and ape, was a Roman punishment, imitated in the middle ages, when quartering alive, tearing to pieces by horses, and disembowelling were likewise punishments known on the Continent. Among the severer forms of military execution were hunting and spearing the condemned to death by his fellow-soldiers, practised in Germany in the time of the Lanzknechts of the end of the 15th and during the 16th century; making him run the gantlet of rods till dead; flogging him to death with the knout. These last two modes of execution were practised in Russia till into the 19th century.

English law has in practice, according to Sir J. Stephen, been in a marked manner distinguished from the practice of the Continent by its aversion to execution by torture. The usual mode of execution in England has been for many centuries, and still is, hanging, though in early times decapitation was also known. Treason, however, was punished in the case of men by hanging, drawing (anciently dragging at the tail of a horse), and quartering; of women by burning. A woman was burned alive for petty treason (killing her husband) at Tyburn in 1726. Heresy was also punished by burning. In 1283 David, the last native Prince of Wales, was for treason sentenced to be hanged, drawn, and quartered, and to have his bowels burned. Pressing to death, or the *peine forte et dure*, is said to have been practised as late as 1741 at the Cambridge assizes. Burning continued till 1790 to be the punishment inflicted on women for treason, high or petty; at Ipswich a woman was burned in 1783 for murdering her husband. In practice, however, women were strangled before being burned. A woman was burned for witchcraft at Dornoch in Sutherland in 1722. By 25 Geo. II. any person convicted of murder was to be executed on the next day but one after sentence, but if sentenced on a Friday he was to be hanged the following Monday. In the interval he was to be fed on bread and water, and his body after death was to be either dissected or hung in chains. By laws passed in 1832–34 the bodies of murderers were no longer to be anatomised or hung in chains, but to be buried in the precincts of the prison in which they were last confined before execution. This regulation, repeated in 24 and 25 Vict., is now in force. On 21st February 1803 Edward M. Despard (q.v.) was drawn on a hurdle, hanged, and decapitated; and on 1st May 1820 Thistlewood and four of his fellow-conspirators were likewise hanged and decapitated. In this case—the last decapitation for treason in England—the head was cut off with an amputating knife by a masked executioner, who then thrice held it up by the hair to three different points of the compass, with the words, 'This is the head of Arthur Thistlewood, a traitor.' The mode of execution now obtaining in Britain and British colonies is hanging; in Austria, strangling; in Spain, Garrotting (q.v.); in France, decapitation by the guillotine; in Germany, decapitation. In New York state it was enacted that after 1st January 1889 executions should be by electricity, a mode calculated to effect instantaneous death; some other states of the union have followed. Lynching (see LYNCH LAW) sometimes takes the place of judicial execution in America. The Bowstring (q.v.) was an old Turkish institution; and the Hara-Kiri (q.v.) was peculiar to old Japan. Shooting is the military form of execution. In India, during and after the mutiny of 1857–58, some of the rebels were blown from the mouths of cannon. Till 1868 executions in the United Kingdom were performed publicly, in London for the most part at Tyburn till 1783. At Edinburgh the place of execution was chiefly in the Grassmarket till 1784, when it was transferred to a platform at the west end of the Tolbooth, a building removed in 1817. The gallows at Tyburn was a permanent erection on three posts, 'Tyburn's triple tree,' and wooden galleries near it accommodated the crowds of spectators. The scandalous scenes, however, attending the procession of the criminal from Newgate to Tyburn caused the place of execution to be changed in 1783 to the area in front of Newgate prison, where on the 3d December 1783 ten were executed.

In 1868 an act was passed prohibiting public execution, and directing that all executions proceed inside the walls of the prison in presence of the sheriff, gaoler, chaplain, and surgeon of the prison, and such other officers of the prison as the sheriff requires or allows. The Act of 1868 further orders that execution take place at 8 A.M. on the first Monday after the intervention of three Sundays from the day on which sentence is passed. A black flag has to be hoisted at the moment of execution conspicuously above the prison, and remain displayed for an hour, while the bell of the prison or parish church tolls for fifteen minutes before and fifteen minutes after the execution. Till 1783 the mode of execution was by drawing away the cart from under the prisoner after the rope had been fastened round his neck. From 1783 the prisoner was placed not on a cart but on a platform, which on the withdrawal of a bolt suddenly fell from under him. In 1874 this method was improved upon by a plan whereby the length of the rope is proportioned to the weight of the body, so that the momentum of the fall suffices to rupture the ligatures of the spine, and thus cause instant death. Execution in England must in all cases be performed by the sheriff, or, as is invariably the practice, by his deputy called the executioner. In royal burghs in Scotland, the office is imposed on the civic magistracy, one of whom attends the execution, similarly as does the sheriff in England.

In several German states the office of headsman is said to have been hereditary, and in *Coriolanus* (act ii. scene 1) Menenius speaks of 'hereditary hangmen.' The last headsman of the Tower of London died in 1861. The office had grown to be a mere sinecure. In some parts of England the office was annexed to other posts; for instance, in the time of Henry II. and Henry III. the porter of the city of Canterbury was executioner for the county of Kent, and in receipt on account of that office of an allowance of 20 shillings per annum from the sheriff. Derrick was public executioner in the first part of the 17th century, and gave his name to a kind of crane; after him came Gregory Brandon, whose son, Richard Brandon, executed Strafford, Laud, and Charles I. John Ketch, public hangman from 1663 till 1686, executed William Lord Russell and the Duke of Monmouth, and bequeathed his name ('Jack Ketch') as a nickname to his successors in office for nearly two centuries. The family of Sanson for many generations gave Paris her executioners, the name 'M. de Paris' being first playfully given to the elegant and handsome Charles Henri Sanson, who in his old age executed Louis XVI. In recent times, Calcraft, employed as executioner down till 1874, was paid by the corporation of London £1, 1s. per week as a retaining fee, and an extra £1, 1s. for each execution. He had, besides, from the county of Surrey £5, 5s. annual retaining fee, and £1, 1s.

for each execution, and £10 for an execution in the country. Calcraft was succeeded in 1874 by Marwood, who, in turn, in 1883, was succeeded by Berry; and he, before his resignation in 1892, had been engaged for over 200 executions, and carried 134 sentences into effect.

Besides the references in the body of the article, and at the end of CAPITAL PUNISHMENT, see *Hanging and Scenes witnessed before the Gallows*, by R.L.A.T. (1868); *Hanging not Punishment enough for Murtherers, &c.* (1701); a collection of broadsides, containing an account of murders and executions (1794–1860; and another collection, 1830–55?); *Memoirs of the Sansons*, edited by Henri Sanson, late executioner of the Court of Justice of Paris (Eng. trans. 2 vols. 1875); *The Punishment and Prevention of Crime*, by Sir E. F. Ducane, in 'English Citizen' series (1885). See also the articles DROWNING, ELECTROCUTION, GUILLOTINE, MAIDEN, NEWGATE, PARRICIDE, PEINE FORTE ET DURE, LONDON (for Tyburn), and WHEEL (BREAKING ON THE).

Execution of Deed. See DEED.

Executive. See GOVERNMENT.

Executor, in England, the person to whom the execution of a last will and testament of personal estate is by testamentary appointment confided. The appointing by will of an executor, without giving any legacy or appointing anything to be done by him, is sufficient to make a will. The appointment of an executor can only be by a will, the person who takes charge of the estate of an intestate being called an Administrator (q.v.). The appointment may be either express or constructive—i.e. gathered from the general terms of the will. An early duty of an executor is to take Probate (q.v.) of the will. He derives his title solely from the will; the estate vests in him from the death of the testator, at which time his responsibility begins, and from which time he may enter upon all the duties of managing the estate. But his position will not be recognised as suitor in any court until he has taken probate. The whole personal estate vests in the executor, and, if the testator has made no disposition of the residue, it devolves, as trustee for the next of kin, upon the executor, unless it appears from the will or any codicil thereto that the executor was intended to take the residue beneficially. By 21 Henry VIII. chap. 5, an executor is bound to prepare an inventory of the personal estate. This, if required, must be produced. An executor may raise actions in respect to the estate in his charge; and generally it may be said that his powers, duties, and liabilities are commensurate with those of the deceased, except in regard to contracts and wrongs of a merely personal nature. He may enter the house of the deceased to remove the personal property. The first claims to be discharged are those of the funeral and the expenses of probate. He must then pay the debts; and he is responsible for paying them in due order, so that those having a legal preference shall first be discharged. An executor is not bound to accept the office; but, if he administer, he cannot then renounce the executorship without cause. On the death of an executor, the office passes, as a general rule, to his executor. See Sir E. V. Williams's *Law of Executors and Administrators* (10th ed. 2 vols. 1905), or the shorter treatise of Walker and Elgood (4th ed. 1905).

In Scotland the term executor is given to all who manage the estate of a deceased, whether appointed by will, and administering the estate on behalf of the creditors and beneficiaries, or appointed to an intestate by authority of the court, and administering for the next of kin. The former are called executors nominate; the latter, executors dative. All executors must, before they can ingather the estate, obtain *confirmation* from the Commissary Court. This is analogous to probate in England. But in Scotland no right vests in the executor until after confirmation, except a title to sue, being exactly the reverse of the English rule. An executor acting without confirmation is called a *Vitious Intromitter* (see INTROMISSION). Executors must, on applying for confirmation, exhibit a full inventory of the whole movable estate of the deceased. An executor is only liable to the extent of the inventory. He is not bound to pay interest on the funds in his hands unless they bore interest before confirmation, or unless he is guilty of undue delay in administering the estate. He is not bound to pay the debts for six months after the death of the deceased. But, as in England, the expenses of the funeral and confirmation are entitled to immediate payment. Servants' wages and a year's house-rent have also a preferable claim. By the Intestate Moveable Succession Act, 1855, an executor's claim to one-third of the *Dead's Part* (q.v.), after deducting debts, was abolished, and he now receives no benefit *qua* executor from the estate.

In the United States, the rights and duties of an executor are analogous to those defined by English law; in this, as in other matters relating to property, each State has its own laws. See Stimson, *American Statute Law;* Schouler, *Treatise on Law of Executors and Administrators* (Boston); *Cyclopedia of Law*, vol. xviii. (New York, 1905).

Executory, in English law, is opposed to 'executed,' and implies that something remains to be done. In an executory contract each party has some obligation to fulfil. An executory limitation of property is one which gives an interest to come into existence at a future time or on the happening of an event. An executory trust directs trustees to make a future conveyance in favour of the person beneficially entitled. Executory devises and other limitations form an important branch of the law of real property. In American law, the term executory is used as in England; executory gifts of property are subject to rules against Perpetuities (q.v.), similar to the rules which prevail in England.

Exegesis. The word comes from the Greek, and signifies 'interpretation' or 'explanation.' It may be applied to the interpretation of any book. Technically we may speak of any annotated edition of Sophocles, or Shakespeare, or Dante as exegesis, but, as a matter of fact, in common usage the word is generally restricted to the interpretation of the Bible. In former times scholars used to distinguish exegesis from hermeneutics. Hermeneutics was the science which investigated the principles of interpretation, exegesis the art which applied those principles to the explanation of any particular book or passage of Scripture. This distinction, however, has fallen into disuse, and the word 'exegesis' is now applied to both the science and the art of interpreting Scripture.

The principles of exegesis have varied, as the view with regard to the nature and character of Scripture has changed and developed. Three notable types of exegesis have come into prominence at different times: (*a*) the Allegorical, (*b*) the Dogmatic, (*c*) the Historical.

In the early centuries the allegorical method generally prevailed. It is a mistake, however, to suppose that the allegorical method was confined to the interpretation of Scripture. Hatch has shown in his Hibbert Lecture that this method was applied to the interpretation of Homer in the schools of Alexandria. A distinguished teacher found in Homer's phrase about 'the ceaseless flow of the ocean' an allusion to a prophecy of the Heraclitean principle, 'All things are in a state of flux' (*πάντα ῥεῖ*). The current doctrine of inspira-

tion which we find developed in Plato's *Ion* and the writings of Philo lent itself to the allegorical method. The words of Plato are most significant, 'The poet is a light and winged and airy thing, and there is no invention in him until he has been inspired and is out of his senses, and the mind is no longer in him. . . . God takes away the minds of the poets and uses them as his instruments, just as he uses divine and holy prophets, in order that we who hear them may know that they speak not of themselves when they utter these priceless words in a state of unconsciousness, but that God is the speaker, and through them he is conversing with us.' This theory of inspiration implied that all writings composed under its influence contained a full and complete divine revelation; if, therefore, the statements of these inspired works of antiquity seemed to exhibit inadequate knowledge, or to be in conflict with later discoveries, the defect could not be inherent in the book itself (seeing that it was inspired), but must be due to faulty interpretation. What was not on the surface must be looked for under the surface, and if it was not obvious even then, the plain meaning of the text must be twisted and distorted until it yielded the desired result. The category of historical evolution was almost entirely absent from the ancient mind, especially when a divine revelation was in question. Just as the Alexandrians could not conceive of the possibility that Homer was less learned than Heraclitus, so the primitive Christian Church found it impossible to regard the Old Testament as representing a lower level of revelation than the New Testament. The fundamental position from which the Church started was that the Old Testament, being an inspired book, must contain the complete sum of divine truth. The aim of exegesis, therefore, was to discover the whole of the New Testament in the Old, and the most successful exegetes were those who could make the statements of the prophets and the psalmists yield the theology of St Paul. Two extreme illustrations may be given of the application of the allegorical method. Clement of Rome, for instance, makes the scarlet thread, which Rahab hung out of the window to direct the spies, 'show that a redemption must be made by the blood of the Lord for all who believe and hope upon God.' The epistle of Barnabas regards the 318 servants of Abraham as symbolic of the death of Christ upon the Cross, because the number is represented in Greek letters by I H T. I H stands for Jesus, T represents the Cross. It was the Alexandrian Church Fathers who carried the allegorical method to its highest point, and attempted to put it on a scientific basis. Origen laid down the principle that each separate text possesses three meanings—one for the body (the literal meaning), one for the soul (the ethical meaning), and one for the spirit (the spiritual meaning)—and of these three the literal sense of the passage was always the least important. The method of Origen was developed by later writers. In mediæval times it became a recognised principle of exegesis that each statement in Scripture had four senses: (*a*) the literal or historical; (*b*) the spiritual or mystic, teaching what ought to be believed; (*c*) the moral or tropological, teaching what the course of conduct ought to be; (*d*) the anagogical, expressing the Christian hope. These four meanings were expressed in the well-known lines:

> Littera gesta docet;
> Quid credas, allegòria;
> Moralis, quid agas;
> Quo tendas, anagogia.

The Reformation changed the spirit of exegesis and substituted the *dogmatic* method for the allegorical. Luther was most vigorous in his protests against the vice of allegorism. 'When I was a monk,' he writes, 'I allegorised everything; but now I have given up allegorising, and my first and best art is to explain the Scriptures according to the simple sense: for it is in the literal sense that power, doctrine, and art reside.' The principle of the dogmatic method is this: The interpreter approaches the Bible with a rule of faith which is the norm or standard of his exegesis. The assumption is that this standard faith will be found everywhere in the pages of Scripture, and each particular passage must be interpreted in the light of the tenor of the general teaching of the whole. Roman Catholic theologians applied the principle of the dogmatic method in one way, Protestants in another, but it was essentially the same method in both cases. The fundamental position of Roman Catholicism was that the Bible must be interpreted in relation to the authoritative decisions of the Church and the traditional exegesis of the Fathers. In other words, the text of Scripture is subordinated to the dogmatic decrees of the Vatican, and the private judgment of the modern interpreter must be in subjection to the patristic and scholastic interpretation of the Bible. The authority of the Church comes first, and Scripture, by an unscientific method of exegesis, is forced to support that authority. Undoubtedly Protestantism made a remarkable advance in some directions. Theoretically, at any rate, it subordinated the authority of the Church to the authority of Scripture. It boldly asserted the right of the modern interpreter of the Bible to depart from traditional patristic exegesis. It insisted upon the use of the original Hebrew and Greek documents, which had for centuries been superseded by the Vulgate. But in spite of the enlightened principles which it laid down as the basis of exegesis, it was still, almost as much as Roman Catholicism, the victim of the dogmatic method. It started from the assumption that the Bible is primarily a text-book of theology, and since it was verbally or at any rate plenarily inspired, there must be a uniform system of theology in all the parts of Scripture. Luther was much more advanced in his treatment of Scripture than most of his followers. When a book of Scripture did not yield the results he wished to find, he boldly questioned its authority. He regarded the Epistle of James, for instance, as an 'epistle of straw,' because it did not seem to support his fundamental doctrine of 'justification by faith.' The later reformers, however, refused to follow him in this free treatment of the Word. By exegetical devices and tortuous methods of interpretation, by the exploitation of the principle of symbolism in the Old Testament, for instance, they managed to discover the evangelical doctrines in every book of the Bible. They laid down the principle that every verse of Scripture must be interpreted in relation to the general teaching of the whole, and if the surface meaning of a text seemed to be in opposition to some cherished doctrine, it was obvious that the surface meaning was wrong, and it was then the business of exegesis to discover another meaning for the words which would bring them into harmony with the general evangelical position.

The transition from the dogmatic to the historical method of exegesis was slow and gradual, and it cannot be said that the dogmatic method is altogether destroyed to-day. We are under a great debt to Schleiermacher, who in the initial stages gave a great impulse to the historical method. Schleiermacher challenged the position that the Bible is merely a compendium of proof-texts, and urged that each particularly should be studied by itself, without any preconceived ideas as to what its teaching ought to be. 'No biblical book,' he says, 'can be perfectly understood except as it is studied with

reference to the whole environment out of which it grew, and in connection with the circumstances of its author and readers.' The old assumption that a uniform body of doctrine is to be found in each document of the Bible is now completely abandoned. Modern criticism has achieved great results by reconstructing the circumstances under which each book was written, and relating it to the general situation which prevailed at the time of its production. The application of the category of evolution to the Old Testament has made it a new book. We no longer look for the Sermon on the Mount in Amos, or the theology of St Paul in the Psalms. The question we ask is, How did the religious development of Israel produce the 'fullness of the times' which made the Sermon on the Mount and the theology of St Paul possible?

The principles upon which scientific exegesis works to-day may be summarised as follows:

(1) First of all, it is necessary to settle, as far as possible, the true text of the Bible. There are many variant readings in the Old Testament and vastly more in the New, and it is necessary, by the application of the principles of the science of textual criticism, to determine which reading represents what was originally written by the author of the document.

(2) Having determined the text, it is necessary, by the application of the latest grammatical principles and lexicographical discoveries, to find out the plain sense of the passage—i.e. the meaning which it possessed for writer and reader when it was first composed. The advance which has been made in Semitic studies and the epoch-making 'finds' of Greek papyri have introduced revolutionary results in this particular branch of exegesis. As a result, we shall be able to obtain a true translation of the book—i.e. a translation which is a real equivalent in English (as far as that is possible) of the original document.

(3) Having obtained our translation, the next task of the exegete is to relate the document to the environment in which it was produced. The one fact which must never be lost sight of is that each book was written to meet the specific needs of its own age. The apostle Paul, for instance, in each of his epistles deals with the problems, both intellectual and practical, which confronted the Church in the 1st century. The prophet Isaiah faced a situation which was created by the special circumstances of the time in which he lived. Neither Paul nor Isaiah nor any other biblical writer ever imagined that he was writing a document which would be treated as inspired literature and used as source of Christian theology throughout the centuries. It is absolutely necessary to find out what the message of a book was for its own age, before we can discover the elements in its teaching that are of eternal value.

(4) It is necessary to ask a further question, How far was the writer influenced in his conception or interpretation of religion by the current thought and language of his times? The revelation of God never fell upon a *tabula rasa*—it was refracted in a mirror that was always more or less imperfect, and generally warped by influences and conditions of the age. Allowance must be made for the personal equation of the prophet and apostle. In the spiritual region as well as in the physical, the mind sees what it brings with it the power of seeing; and in the interpretation of what has been seen, the writer is restricted by the categories and thought-forms of his time. No writer can therefore be fully understood unless his statements are interpreted in the light of the larger context of the intellectual and moral outlook of his time. The Epistles of St Paul would have assumed a very different form if they had been written for the first time in the 20th century, and his ideas would inevitably have taken very different shape. It is not enough, therefore, for the exegete to translate the epistles out of one language into another; he is bound to attempt to translate the ideas as well out of one universe of thought and experience into another. This is the modern ideal that exegesis sets before itself—and though the task involves the utmost knowledge, sympathy, and insight, the results are worth the labour. The gain in our understanding of the Bible is already very great, and modern scholarship is as yet only at the beginning of its work.

See articles on BIBLE, BIBLICAL CRITICISM, INSPIRATION, REVELATION.

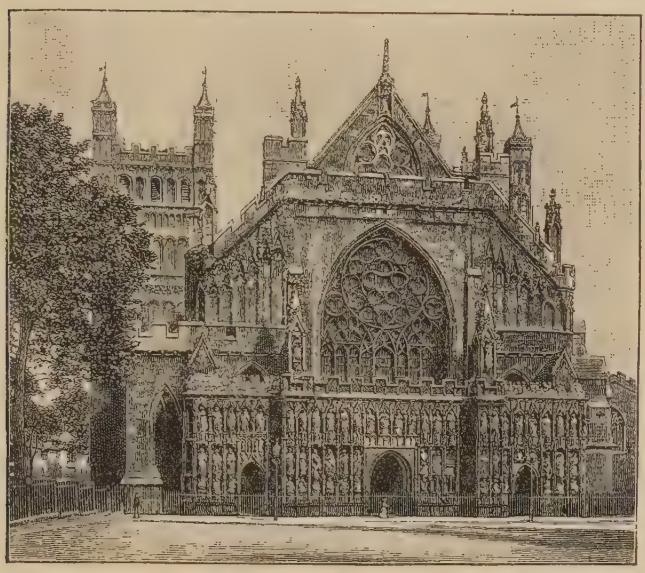
Exelmans, REMY JOSEPH ISIDORE, COMTE, a distinguished French general, was born at Bar-le-duc, 13th November 1775. Entering the army in 1791, he served with distinction in the campaign of Naples under Championnet, was made general of brigade after Eylau, and followed Murat to Spain, where he was taken prisoner and sent to England. For his conduct in the disastrous Russian campaign Napoleon created him a general of division. Exelmans seems to have been equally esteemed under every successive government. On the fall of Napoleon, he was for some time banished from France, but was permitted to return in 1823. In 1831 Louis-Philippe restored his titles and rank. Louis Napoleon named him Grand Chancellor of the Legion of Honour, and in 1851 raised him to the dignity of Marshal. On the 21st July 1852 Exelmans had a bad fall from his horse, from the effects of which he expired on the following night.

Exempla. See FABLE.

Exequatur. See CONSUL, PLACITUM REGIUM.

Exeter, the capital of Devonshire, 171 miles by rail WSW. of London, and 75 SW. of Bristol. Dominated by higher hills, it is built on the summit and slopes of a flat ridge, rising 150 feet from the left bank of the Exe; and, having been modernised chiefly in its suburbs, it is a pleasant antique city —'as good a specimen of an English county town, at once prosperous in business, and with a quiet air of aristocratic distinction, as can be found within the four seas' (Escott's *England*). The quaint old High and Fore Streets, crossed by North and South Streets, still follow the line of the Icknield Way; and the walls in great part remain, though their four gateways were demolished between 1769 and 1819, and though Rougemont Castle (1068) was almost all swept away in 1774, to make room for an ugly assize-hall. In 932 Athelstan founded here a Benedictine monastery, and hither in 1050 Edward the Confessor translated the western bishopric from Crediton; but St Peter's Cathedral was not begun till sixty-two years afterwards. Measuring 408 feet by 76 (or 140 across the transepts), and 66 feet high, it is a long, low edifice, with massive transeptal towers—a feature imitated at Ottery St Mary, but otherwise unique. These towers, 140 feet high, are the original Norman ones, but the rest of the pile, rebuilt between 1280 and 1369, is mainly in the purest Geometrical Decorated. The most striking characteristics of the whole are its perfect bilateral symmetry and the grand unbroken line of vaulting. Special features are the exterior western screen (*circa* 1388), adorned with sixty-seven statues of saints and princes; the beautiful choir-screen (1324), surmounted by the fine organ (1665); the minstrels' gallery (1353); the misereres, sedilia, and bishop's throne; the modern reredos, stall-work, and pulpit; a clock, dating from 1317 or earlier; the Great Peter bell, brought from Llandaff in 1482, recast in 1616, and weighing 12,500 lb.; and the chapter-house (1420–78), containing 8000 MSS. and early books. In

1870–77 the cathedral was restored by Sir G. G. Scott; in 1889 the cloisters and library. The picturesque guild-hall (1464) has a cinque-cento façade (1593); noteworthy modern buildings are the Devon and Exeter Hospital (1743), the Lunatic Asylum (1865), and the Albert Memorial Museum (1868). The chief public walk is Northernhay. A ship-canal (1563–1827) extends 5 miles to the tideway at Topsham. Exeter has a University College (new buildings, 1911; others proposed on Streatham Hall estate). It manufactures gloves, agricultural implements, &c., besides being the chief mart of 'Honiton' lace. Its woollen trade, once second only to that of



Exeter Cathedral: West Front.

Leeds, is a thing of the past; and as a seat of commerce and industry it has been outstripped by many a younger competitor. The 'ever loyal city' got its earliest charter from Henry II. some time prior to 1162; in 1537 was made a county of itself; and it returned two members from about 1300 till 1885, when their number was cut down to one. Pop. (1891) 37,404; (1911, as extended in 1900) 48,664; (1921) 59,608.

The Celtic *Caerwise*, the Roman *Isca Damnoniorum*, and in 876 the *Exanceaster* of the West Saxons, who till 926 shared it with the Britons, Exeter, in Freeman's words, 'is the one great city of the Roman and the Briton which did not pass into English hands till the strife of races had ceased to be a strife of creeds, till English conquest had come to mean simply conquest, and no longer meant havoc and extermination.' To Freeman's pages reference must be made for its capture by the Danes (876 and 1003), by William the Conqueror (1068), and by Stephen (1136); for its siege by the Yorkists (1470), by Perkin Warbeck (1497), and by the Catholic rebels (1549); for its surrender to Prince Maurice (1642) and to Fairfax (1646); and for the entry of William of Orange (1688). Whereto must be added the tragic burning of the new theatre (5th September 1887), with a loss of 188 lives. Among bishops of Exeter have been Leofric (1050–72), Bartholomew (1161–84), Stapledon (1308–26), Grandison (1327–69), Miles Coverdale (1551–53), Joseph Hall (1627–41), Seth Ward (1662–67), Trelawny (1689–1707), Phillpotts (1831–68), Temple (1869–85), Lord Hugh Cecil. Natives were Archbishop Baldwin, Cardinal Langton (doubtfully), John Vowel or Hoker, the historian of Exeter (1525–1601), the Judicious Hooker, Sir Thomas Bodley, and Henrietta, Duchess of Orleans.

Exeter, Peerage of. See Burghley.

Exeter Book, or Codex Exoniensis, an Old English folio manuscript, dating probably from the first half of the 11th century, presented between 1050 and 1072 to Exeter Cathedral by its first bishop, Leofric. It consists of some legal documents, from eighty to ninety riddles, and an anthology of poetry, containing, as in *Christ*, some of the finest extant specimens of Old English verse. Dates of composition vary, but the poem *Widsith* is certainly older than *Beowulf*. See works by B. Thorpe (1842), and Sir I. Gollancz (1895).

Exeter College. See Oxford.

Exeter Hall, a large proprietary building, on the north side of the Strand, London, was completed in 1831, and could contain upwards of 5000 persons. It was let chiefly for religious assemblies, and was in great request during the 'May Meetings' of the several religious societies. It was also the scene of many great musical fêtes. In 1880 it was purchased for the Young Men's Christian Association, and in 1908 it was demolished.

Exhibitions. The earlier beginnings of Industrial Exhibitions, like all great movements, are not particularly easy to define. The first exhibition of anything like national importance, however, seems to have been the one originated by the Marquis d'Avèze at Paris, 1798, though previous to this a show of agricultural and other machinery had been held by the Society of Arts in London (1756), and another exhibition had been given at Prague in 1791. A second exhibition of greatly improved kind was opened at Paris in 1802; a third in 1805; and hence arose the custom of holding such displays triennially, continued with slight interruption for half a century. It should be mentioned that the specimens exhibited on these occasions were essentially of French production, and care was taken to exclude any article of foreign character. The impetus given to the movement by the Paris displays was felt over Europe, and reached the United States. Between the years 1820 and 1850 exhibitions were held at Vienna, Berlin, Brussels, St Petersburg, Stockholm, Moscow, Lisbon, Madrid, New York, Philadelphia, and numerous other towns. Nor did the United Kingdom escape the infection, though here the promoters of such undertakings had to struggle against much apathy and even opposition. To Ireland belongs the credit of the first display of noticeable merit. This was the Exhibition of Irish Industries, held by the Royal Dublin Society at their rooms in 1829, and the association continued the practice triennially for several years. The Society of Arts in London also held a number of exhibitions illustrative of the manufactures, commerce, and agriculture of the country, and the Cornwall Polytechnic Society energetically laboured in a similar direction by holding periodical exhibitions to illustrate the mineral wealth of that county, and the mechanical appliances necessary for mining. From this may be said to have originated the happy idea of holding in various large towns exhibitions descriptive of the industrial work carried on in the locality. Manchester led the way with a display of everything concerned in the manufacture of

cotton; Liverpool followed with an exhibition of the raw produce brought to that seaport, and the shipbuilding that rendered such trade possible; Leeds held an exhibition of the material and processes involved in the flax and woollen trades; and Birmingham (1849) fairly surpassed them all with an excellently arranged show of the numerous useful and ornamental forms into which metals can be wrought. The Birmingham Exhibition may be said to have had an important influence in bringing about the first great exhibition of 1851.

For some time past the English government had been urged without success to organise an exhibition in London of a really national character, illustrating the arts of Great Britain and Ireland. In the spring months of 1849 the Society of Arts, being greatly influenced in the matter by Prince Albert, sketched the outline of a great exhibition of the industries of all nations, and proposed that such exhibition should be held at London in 1851. It was held in Hyde Park in a vast structure of iron and glass, called the Crystal Palace (q.v.; now located at Sydenham), and planned by Sir Joseph Paxton (q.v.). The exhibitors numbered nearly 15,000, about equally divided between British and foreign contributors. The entire number of visitors was over 6,000,000, or about 42,000 per day. The total receipts amounted to £505,107, leaving a surplus of £200,000.

The second great international exhibition of 1862 was held in a building at South Kensington, occupying together with its annexes, and two cupolas of great magnitude, an area of about 24 acres. The total number of exhibitors was 28,653, of whom 26,348 were in one or other of thirty-six industrial classes, the remainder in one or other of four fine art classes. The visitors numbered rather more than in 1851, but the daily average was less. There was a deficit of about £10,000.

In 1867 came the Paris Exhibition, which in its general arrangement and magnitude of conception surpassed anything that had yet taken place. The building was a vast oval, 1550 feet by 1250, with a series of twelve concentric galleries running round it, and a small garden in the centre. In each gallery a separate branch of science and art was illustrated, and the entire oval was divided into sections, one of which was devoted to each country. The complete exhibition covered close on 100 acres. The number of exhibitors was 50,226, and the total expense £800,000, half of which was defrayed by the public attendance, half by the imperial government and the Paris municipality; visitors were 10,200,000. Britain did not figure very favourably in this exhibition—probably by reason of the want of technical education—whereas Germany, France, and Belgium showed a marked advance. The Vienna exhibition in 1873 was a huge financial failure.

In 1871 the first of a series of annual London International Exhibitions was opened. The movement, however, never became popular, and was relinquished in 1874. The next most important display after Vienna was the Philadelphia Centennial Exhibition of 1876, held in commemoration of the hundredth anniversary of American Independence. The main building, in the form of a parallelogram, covered a floor-space of about 20 acres. One centre and two side avenues ran along the inside of the edifice, the former being 1832 feet long by 120 feet wide—the longest avenue of that width ever known in an exhibition structure. The number of exhibitors fell below those of the preceding exhibitions at Paris and Vienna—in all about 40,000. The building was open to the public on 159 days, and the total attendance of visitors was 9,910,966; receipts, $4,300,000—a sum much below the expenditure. The Paris International Exhibition of 1878 again made an advance in magnificence and size upon all previous displays. The total area covered by the various buildings was about 80 acres, the exhibitors numbered 80,000, and the visitors 16,032,725. The Universal Exhibition of Paris in 1889 excelled all its predecessors in point of magnitude and comprehensiveness; with the included grounds it occupied an area of 173 acres. The Eiffel Tower (q.v.) was one of the principal attractions of the exhibition. Still grander in conception and scope was the World's Columbian Exposition held at Chicago in 1893, on the fourth centenary of the discovery of America by Columbus; it was attended by some 25,000,000 visitors. The Paris Exhibition of 1900 was based on a scale sufficiently vast to mark worthily the completion of the century; in the 20th were those of Glasgow, St Louis, London (Franco-British), San Francisco (Panamá-Pacific), Wembley, &c. Many exhibitions have been devoted to special activities—the book-trade, town-planning, fisheries, the empire, and the like; and local industries have had their frequently recurring exhibitions, called fairs.

Exile. See BANISHMENT.

Ex-Libris. See BOOKPLATES.

Exhumation. It is a misdemeanour to disinter a dead body without lawful authority, whether for sale, dissection, or reinterment. If only reinterment in other consecrated ground is contemplated, a faculty from the ordinary of the diocese may be obtained for that purpose. In cases of suspected foul play, the coroner (or corresponding legal authority in Scotland) may order disinterment for medical inspection, or for further examination in connection with possible criminal proceedings. Otherwise no body may be disinterred without the license of the Secretary of State, under a penalty not exceeding £10. See also POST-MORTEM EXAMINATION, RESURRECTIONISTS.

Exmoor Forest, in the west of Somersetshire and north-east of Devon, is a wild, mostly uncultivated waste, consisting of long ranges of steep hills and lonely valleys, and bordered by deep wooded glens. The hills rise in Dunkery Beacon to 1707 feet, in Chapman Barrow to 1540, and in Span Head to 1610. The 'forest' proper is about 25 miles in area, but with the adjacent commons Exmoor extends over 100. The rocks belong to the Devonian series, mainly slates and sandstones. Hence the outlines are less bold and rugged, and the general aspect far less stern and desolate than that of Dartmoor, ribbed and spread with granite. Though 'improvements' were attempted in 1818, and many trees planted by Mr J. Knight, who had purchased the forest from the crown, Exmoor is still in the main covered with grass (in some parts short and sweet, in others rank and sedgy), bracken, and heather, with dangerous bogs near the hill-tops. Where it ranges down to the coast near Lynton, the scenery is very bold and picturesque. The Exe, Barle, Mole, and the two Lyns are the chief streams rising here. Gold has been found in Northmolton parish, and copper-mines have been worked there from time to time. There is a native breed of very small ponies, known as Exmoor ponies, stout and hardy, as well as a local breed of horned sheep of high quality. The most notable feature of the fauna of Exmoor is, however, that it is the only place in England where red deer still run wild. They are now becoming numerous. Staghounds have been kept here and stag-hunting followed since at least 1598. Sir Thomas Acland in 1917 gifted to the nation a 500 years' lease of Exmoor. Exmoor is the chief scene in Blackmore's *Lorna Doone*, which abounds in admirable descriptions. See also Hall's *Exmoor* (1849), Collyns's *Chase of the Wild Red*

Deer (1862), Rawle's *Annals of Exmoor* (1894), Snell's *Book of Exmoor* (1903), MacDermot's *Forest of Exmoor* (1911), and DEER FORESTS.

Exmouth, a Devonshire watering-place, at the east side of the mouth of the Exe, 11 miles by rail SSE. of Exeter. A sheltered spot, with fine climate, good beach, and beautiful views, it had dwindled from a considerable seaport to a poor fishing-village, when, about the beginning of the 18th century, it rose into repute as a seaside resort; and now it has terraces, hotels, baths, promenades, and pleasure-grounds along the seashore, and docks, constructed in 1869. Lace-making and fishery are the main pursuits. Pop. (1851) 5123; (1921) 13,614.

Exmouth, EDWARD PELLEW, VISCOUNT (1757–1833), an English admiral, was born at Dover. He entered the navy at the age of thirteen, and first attracted notice by his gallant conduct in the battle on Lake Champlain in 1776. In 1782 he attained the rank of post-captain. In 1793, having been appointed to the command of the *Nymphe*, a frigate of thirty-six guns, he encountered, and, after a hard-fought battle, captured *La Cléopâtre*, a superior French frigate. For this victory he was knighted; and in 1796, for acts of personal bravery, he was created a baronet. In 1798 he received the command of the *Impétueux*, and was sent to the French coast, where many of his most brilliant actions took place. In 1804 he was appointed rear-admiral of the Blue, and commander-in-chief in India, from whose seas he drove the French cruisers; he was afterwards made commander-in-chief in the North Sea and in the Mediterranean. In 1814 Pellew was created Baron Exmouth of Canonteign, in Devonshire, with a pension of £2000 a year. In 1816 he was sent to Algiers, to enforce the terms of a treaty regarding the abolition of Christian slavery, which the Dey had violated. With a combined fleet of twenty-five English and Dutch vessels, he bombarded the city for nine hours, and inflicted such immense damage, destroying all the Algerine fleet and many of the public buildings, that the Dey consented to every demand. For this service he was raised to the rank of viscount. See his Life by Osler (1835), and Mahan's *Types of Naval Officers* (1902).

Exocetus. See FLYING-FISH.

Exodus, the second book of the Pentateuch. It describes the oppression of the Hebrews in Egypt, the birth and early life of Moses, the ten plagues, the exodus or departure from Egypt, the crossing of the Red Sea and the destruction of Pharaoh's army, the march to Sinai, the giving of the law, the episode of the golden calf, the construction of the Tabernacle. Like the other books of the Pentateuch, Exodus is made up of three documents, known as (*a*) the Jahvist, (*b*) the Elohist, (*c*) the Priestly Code (see PENTATEUCH, BIBLICAL CRITICISM). To what extent the narrative is historically accurate is a matter of dispute among modern scholars. There are considerable difficulties in fixing the date at which the exodus from Egypt took place. The traditional view places it in the reign of Merenptah (1234–1214 B.C.), the main basis on which this theory rests being the statement in Exod. i. 11, about the building of the 'store-cities,' since we know from the inscriptions that building operations were carried out at Pithom by Rameses II. (1300–1234 B.C.), the predecessor of Merenptah. Other data (e.g. the statement in 1 Kings, vi. 1) assume an earlier date for the event. See EGYPT, p. 242; JEWS, p. 330. The best popular commentaries are Bennett's (*Century Bible*) and Driver's (*Cambridge Bible*).

Exogamy, the usage by which among many primitive peoples a man may not marry a woman of his own stock or tribe or section thereof. See FAMILY, MARRIAGE.

Exogenous Plants, or EXOGENS, a term applied by Lindley to Dicotyledons (q.v.). See also BARK, CAMBIUM, MONOCOTYLEDONS.

Exophagy. See CANNIBALISM.

Exorcism, the term used by the Fathers of the Church to denote the act of conjuring evil spirits, in the name of God or Christ, to depart out of the person possessed. The first Christians adjured evil spirits in the name of Jesus Christ, who had conquered the devil; but as the opinion was at the same time entertained that all idolaters belonged to the kingdom of Satan—who suffered himself to be worshipped under the form of idols—it was customary to exorcise heathens previous to their receiving Christian baptism. After Augustine's theory of original sin had found acceptance in the 5th century, and all infants were regarded as belonging to Satan's kingdom, exorcism became general at the baptism even of Christian children. Following the practice of the Roman Catholic Church, Luther retained it, and the baptismal office in the first prayer-book of Edward VI. (1549) contained a short form, omitted at Bucer's intervention in the 1552 revision. The seventy-second canon (1603) of the Church of England forbids any minister attempting to expel a devil or devils, without first obtaining the license of his bishop. Although abandoned by illustrious and orthodox Protestant theologians, such as Chemnitz and Gerhard, or deemed unessential, and in modern times done away with by the 'Protestant' Church, since 1822 baptismal exorcism has been revived by the Old Lutheran or High Church party.

In the Catholic Church the function of exorcism belongs peculiarly to the third of the so-called 'minor orders' (see ORDERS). Our Lord having not only himself in person (Matt. ix. 32; Mark, i. 25; Luke, iv. 35, viii. 29) cast out devils, but having also given the same power to his disciples, it is believed to be permanent in the church. Of its exercise in the early church, both in relation to 'energumens,' or persons possessed, and in the administration of baptism, there are numerous examples. Tertullian and Origen speak of it as of ordinary occurrence, and the Council of Carthage, in 255, alludes to its use in baptism. The rite of exorcism is used by the modern church in three different cases: in the case of actual or supposed demoniacal possession, in the administration of baptism, and in the blessing of the chrism or holy oil, and of holy water. This last practice is alluded to by Cyprian (Ep. 70). The use of exorcism in cases of possession is now extremely rare, and in many diseases is prohibited, unless with the special permission of the bishop. In baptism it precedes the ceremony of applying the water and the baptismal form. It is used equally in infant and in adult baptism, and Catholic writers appeal to the earliest examples of the administration of the sacrament as evidence of the use of exorcism in both alike. The rite of baptismal exorcism in the Roman Catholic Church follows closely the Scriptural model in Mark, viii. 33. The exorcisms in the blessing of the oil and water resemble very closely the baptismal form, but are more diffuse. See WITCHCRAFT.

Exosmose. See OSMOSE.

Exostemma, a West Indian genus nearly allied to Cinchona, for which its bark was formerly introduced as a substitute; it does not, however, contain the Cinchona alkaloids.

Exostosis, a term for a protuberance or morbid enlargement of a bone.

Exoteric. See ESOTERIC.

Exotic Plants, or EXOTICS (Gr., 'coming from

abroad'), cultivated plants originally derived from foreign countries. The term is most frequently applied to those whose native country differs so much in soil or climate from that into which they have been conveyed that their cultivation is attended with difficulty, requiring artificial heat or other special means. See GARDENING.

Expansion. See HEAT, BRIDGE.

Expectation of Life. See PROBABILITY, ANNUITY, INSURANCE.

Expectorants (Lat. *ex*, 'out of,' and *pectus*, 'the breast'), medicines given to carry off the expectorations—the mucus and other secretions of the air-tubes. The principal expectorants are antimony, ammonia, squill, ipecacuanha, senega, balsam of tolu, lobelia, gum ammoniac, asafœtida, galbanum, &c. The examination of the expectoration is of great value in the diagnosis of diseases of the chest (see BRONCHITIS, PNEUMONIA, CONSUMPTION). The word 'expectoration' has come by an abuse to be regarded as a mere elegant synonym for spitting. See SALIVA.

Expenses or **Costs of a Lawsuit.** In Scotland, the charges payable by the parties to a lawsuit are technically called expenses. The rules according to which they are awarded, apportioned between the parties, and taxed, do not differ materially from those applied in England to Costs, and explained under that head, *supra*. The Scottish official who discharges the functions of taxing master is the Auditor of Court. If the agent who has conducted the cause wish it, the decree for expenses will be pronounced in his favour; and the party found liable will not be allowed to plead a counter-claim against the client, as by that means he might prevent the agent from recovering what he very probably has disbursed.

Experiment. See SCIENCE.

Expert, a man of special practical experience or education in regard to a particular subject—a word commonly applied (after the French) to medical or scientific witnesses in a court of justice, when selected on account of special qualifications, as in the case of an analysis of the contents of the stomach in suspected poisoning. The term is similarly applied to a person professionally skilled in handwriting, for detection of forgery of deeds and signatures (see WRITING).

Exploration. See GEOGRAPHY, POLAR EXPLORATION; also AFRICA, &c.

Explosion. See GUNPOWDER, MINING.

Explosives, a term used of gunpowder, gun-cotton, dynamite, nitro-glycerine, cordite, melinite, &c., treated under their several heads. Other high explosives are dealt with along with dynamite. See also BLASTING, BOMBS, FIRE-ARMS, MINING, BULLET, GENEVA, MINES, TORPEDO, &c.

Whoever unauthorisedly introduces explosives into a building is responsible for damage caused. The tenant of a house is answerable for the damage caused by an explosion of gas on the premises, if gas escapes through the negligence of himself or his servants in attending to the stopcocks by which the supply of gas is regulated. Under the Explosives Act, 1875, any person throwing, casting, or firing any fireworks in or into any highway, street, thoroughfare, or public place, is liable to a penalty of £5. Any person unlawfully and maliciously causing, or attempting or conspiring to cause, an explosion likely to endanger life or seriously to injure property, is guilty of felony. It is also felony to make, keep, or have in one's possession any such explosive under circumstances indicating unlawful intent, unless the defence dispels the suspicion. The chief enactments are the Explosives Act (which regulates the manufacture, storage, keeping, selling, and conveyance of nitro-glycerine, dynamite, gun-cotton, and other explosives), the Petroleum Acts, 1871 and 1879, and the Petroleum (Hawkers) Act, 1881. All factories and stores of gunpowder and other explosives must be licensed, and all places where explosives are kept must be registered. The sale of gunpowder to any child apparently under thirteen is prohibited. Government inspectors, officers of local authorities, and constables may search for and seize explosives unlawfully kept, in ordinary cases with a warrant, and in cases of emergency with a written order from a superintendent of police. The master of every ship which enters a British harbour must, if the ship carry petroleum, give notice of the fact to the harbour authority, which, under confirmation of the Board of Trade, makes bylaws regulating the landing of petroleum. Petroleum to the amount only of three gallons may be kept for private use or sale without a license, if it is kept in separate glass, metal, or earthen vessels, securely stopped, and each containing not more than a pint.

Exponents, or INDICES. The product $5 \times 5 \times 5 \times 5$ is expressed thus, 5^4, and the eighth power of a thus, a^8. The numbers 4 and 8 are the exponents of these respective powers. In general, a^n (where a is any number or expression) stands for the nth power of a—i.e. the product of n factors each $= a$, and there the value of this contracted notation is obvious. Introduced by Descartes, the theory of indices was speedily extended, and may now be said to affect algebraic operations of every conceivable kind. The two fundamental laws of indices are $a^m \times a^n = a^{m+n}$, and $(a^m)^n = a^{mn}$. These, with certain necessary conventions, apply to all possible values of the exponents m and n—integral or fractional, positive or negative, simple or complex, rational or surd, real or impossible, trigonometrical or logarithmic, &c. Minor results of the theory are such as these:

$a^0 = 1$, whatever a may be; $a^{-3} = \frac{1}{a^3}$, or a^{-n} is the reciprocal of a^n; $a^{\frac{1}{2}} = \sqrt{a}$, $a^{\frac{1}{3}} = \sqrt[3]{a}$, $a^{\frac{4}{5}} = \sqrt[5]{a^4} = (a^{\frac{1}{5}})^4$. An exponential equation is one in which the x or y occurs in the exponent of one or more terms, as $5^x = 800$. Its solution generally requires the use of logarithms. The exponential theorem gives a value of any number in terms of its natural logarithm, and from it can at once be derived a series determining the logarithm.

Expositions. See EXHIBITIONS.

Exposure. See INFANTICIDE.

Express, a system organised for the speedy transmission of parcels or merchandise of any kind, and their safe delivery in good condition, originated in the trip made from Boston to New York by William Frederick Harnden (1813–45), the first 'express-package carrier,' on 4th March 1839. The project recommending itself to business men, competing companies sprang up rapidly, and express lines were established in all directions. Adams & Co.'s was started in 1849; Wells, Fargo, & Co.'s California express in 1852; the American-European company was created in 1855. As railways extended, the early 'pony express' disappeared, and individual companies now have contracts with the several railway companies, their business over these routes being held to be entitled to the protection of the courts against any efforts to dispossess them. Many of the rival companies were amalgamated, and most of the successful concerns are now joint-stock institutions, the industry employing capital aggregating many millions of pounds. Goods can be sent to strange firms at a distance marked C.O.D., with the amount to be collected on the outside of the package, and the

payment is collected by the express company, which receives a slight compensation for this extra trouble. Much use is made of money-orders sold by express companies.

Expressionism, in literature and painting, is a revolt against the passive receptivity of Impressionism. The rising generation, says Hermann Bahr, 'turns away from the outer life to the inner; listens to the voices of its own hidden nature; and believes that man is not a mere echo of his world, but its creator, or, at all events, is as strong as it is.' The expressionist despises the copying of actuality, and uses it only as a means of expressing his own emotion. Many of the best writers of 20th-century Germany are or have been expressionists.

Extension, a term in Logic, opposed to *intension*, referring to the extent of the application of a term, or the number of objects included under it. The greater the extension of a term, the less is the intension; and the greater the intension or comprehension (the common characters included in a term), the less is the extension.

Extent. To extend is, in English law, to make a valuation of property by the oath of a jury. A writ of extent directs the sheriff to 'extend' and seize the property of a debtor. Such writs are now issued only for the recovery of debts of record due to the crown. In Scotland 'extent' (often shortened to 'stent') was used to denote the general valuation of lands for taxation, &c. For the old and new extent, see VALUATION. Writs of extent were formerly issued for the recovery of crown debts; and the English form of process was introduced, in revenue cases, by the Act of Union. In America extent is a process whereby the lands of a debtor are delivered to his creditor until the debt is paid out of the profits.

Extenuating Circumstances. When a crime is committed, those circumstances, in connection either with the position of the prisoner or with the act alone, which are taken into consideration by the court in mitigation of the punishment are popularly called extenuating circumstances. The previous good character of the person convicted may always be proved as a circumstance giving him some claim to leniency of punishment. Besides character, there are other circumstances, the presence of which in a case sometimes serves to mitigate the sentence, sometimes to take the act done out of the category of crime altogether. One is youth. Thus, no act done by any person under seven years of age is a crime. Defective mental power in the person convicted will always be considered in determining the severity of his sentence. Such disease of mind as prevents a man from knowing that the act he does is wrong will excuse him from the consequences of an act otherwise criminal. Thus, if one man kill another under the insane delusion that he is breaking a jar, the act is not a crime. Drunkenness, when voluntary, is not held an extenuating circumstance, but if a man is made drunk by the fraudulent administration of drugs, and while under their influence kills another, not knowing what he does, the act is not a crime. It is a good excuse for persons charged with crime that they have been compelled by others by threats of death or great violence to do the criminal act. Ignorance of the law is no excuse for an offence. Thus, a foreigner, not knowing the law of England, might kill a man in a duel, and suppose that he had done nothing unlawful. But he would be guilty of murder. Nor, in general, will ignorance of facts be a good excuse, although in particular circumstances it might form a valid defence. Thus, if a man pretended in a joke to be a robber, presented a pistol at the head of a traveller, and demanded his money, and the traveller, believing himself to be attacked by a real robber, shot and killed the pretended robber, his act would be held as justified. Sir James Fitzjames Stephen (*Digest of the Criminal Law*) states, in language purposely vague, to represent the vagueness of the law, a principle under which the stress of necessity is held to excuse acts otherwise criminal. He says: 'An act which would otherwise be a crime may in some cases be excused if the person accused can show that it was done only in order to avoid consequences which could not otherwise be avoided, and which, if they had followed, would have inflicted upon him or upon others whom he was bound to protect inevitable and irreparable evil, that no more was done than was reasonably necessary for that purpose, and that the evil inflicted by it was not disproportionate to the evil avoided.' He gives as an illustration of the principle the case of a governor of Madras who acted towards his council in an arbitrary and illegal manner. The council deposed him and put him under arrest, and assumed the powers of government themselves. That was not an offence if the acts done by the council were the only means by which irreparable mischief to the establishment at Madras could be avoided. He also gives as a further illustration the often figured case of the plank. 'A and B, swimming in the sea after a shipwreck, get hold of a plank not large enough to support both; A pushes off B, who is drowned. This is not a crime.' The principle, however, was not held to cover the case of sailors who probably saved their lives by killing and eating a boy.

Exterritoriality. See EXTRATERRITORIALITY.

Extortion, in Law, is the offence or illegal act committed by a public officer who, under colour of his office, takes from any person any money or valuable thing which is not due from him at the time when it is taken. The act is a misdemeanour, and punishable as such. For example, if the governor-general of India wrongfully compel a native prince to pay sums of money to the Indian government (as was the charge against Warren Hastings), he commits extortion. The term has a special meaning in the criminal law of Scotland, in which it is also applied to the offence of compelling any one by force or fear to do any act which he would not have done of his own consent and inclination. For extortion in the sense of blackmailing, see THREAT.

Extractive Matter is the term applied to the soluble portions of any drug. The substances extracted from the same drug may vary according as the solvent is water, alcohol, ether, &c.; but, so long as the originally insoluble portions are not rendered soluble by the chemical action of the solvent, the term extractive matter is applicable to them.

Extracts, in a technical sense, are medicinal preparations of vegetable principles, got either by extracting these from the plants by means of a solvent or menstruum, and then evaporating the liquid down to about the consistency of honey, or by expressing the juice of the plants and evaporating; this last is properly *inspissated juice* Extracts, therefore, contain only those vegetable principles that are either held in solution in the juices of the plants themselves, or are soluble in the liquid employed in extracting them, and at the same time are not so volatile as to be lost during evaporation. Now, as many extractive matters are more or less volatile, it makes a great difference whether the operation is conducted at a low or at a high temperature. Besides the loss of volatile constituents by prolonged or excessive heating, extracts become more or less changed and inert owing to the readiness with which vegetable principles are

destroyed when exposed to heat and air. On this account it is usual to avoid evaporation as much as possible, and, where this is impracticable, evaporation *in vacuo* is resorted to. Extracts are called *watery* or *alcoholic* according as the menstruum employed is water or alcohol. Ether is also used in extracting. Different plants, of course, afford different extracts, some being of the nature of bitters, others being used as pigments, tannin, &c.

Liquid extracts are those which are not evaporated so far as to form a paste, and it is usual to make them of such a strength that one fluid ounce contains the active ingredients of one ounce by weight of the drug.

Extract of Meat is obtained by acting upon chopped meat by cold water, and gradually heating, when about one-eighth of the weight of the meat dissolves out, leaving an almost tasteless insoluble fibrin. The extract of meat contains the salts and savoury constituents of the meat, and is a light and stimulating article of food (see Beef-tea, and Broth). It may be concentrated into small bulk, and, when desired, may be afterwards treated with water; being heated, it forms an agreeable light soup, though rather stimulating than nutritious. Of this nature is the well-known Liebig's Extract. In order to impart to extract of meat a nutritive as well as stimulant value, the fibrin is sometimes dried and powdered, and, when then incorporated with the extract itself, a product is obtained which represents the original meat in a readily digested form.

Extradition is the surrender of a person accused of crime to the government of a foreign country, within which the crime is alleged to have been committed. The duty of making such surrender has long been acknowledged by civilised nations; but some governments refuse to surrender their own subjects when accused of offences against a foreign law. In England it has been held that no executive officer has authority to surrender any person found within His Majesty's dominions unless empowered to do so by act of parliament. Modern facilities for travelling have made extradition a subject of great importance. In 1843 the British government concluded an extradition treaty with France, and parliament passed an act giving the executive the necessary powers. Since that time treaties have been made by all, or almost all, civilised governments for the surrender of criminals; and even before the extradition treaty with Spain (1878), for example, offenders were given up by the Spanish government—thus in 1872 Bidwell, the bank forger, was extradited by Spain. The British practice is regulated by the Extradition Acts of 1870 and 1873, slightly modified by an Act of 1895. Any police-magistrate may order the detention of a person accused of crime committed abroad on the same evidence as would justify committal of a person accused of crime committed in England. But the person detained is not surrendered until a demand has been addressed to a secretary of state by a diplomatic representative of the government making the demand. The secretary of state may direct a magistrate to inquire into the case; and on such inquiry the prisoner may show that the evidence against him is not sufficient to justify his committal and surrender for trial, or that the crime of which he is accused is not an 'extradition crime'—i.e. not within the treaties and acts which apply to the case. The list of extradition crimes, as fixed by the Act of 1870, includes murder, manslaughter, forgery, larceny, frauds by bankers, extortion by threats, and many other offences. If the magistrate certifies that he has committed the accused, the secretary of state gives a warrant for his surrender, but not until fifteen days have elapsed; during this interval the prisoner may, if so advised, apply to a superior court for a *habeas corpus*. Political offences are expressly excluded from the category of 'extradition crimes;' but it is to be observed that a political offence does not mean an offence committed from political motives, but an offence committed during a time of civil war or open insurrection (see Political Offences). A person surrendered on a specific charge may not be tried on any other charge. In 1877 a Royal Commission recommended that treaties should not be considered indispensable, and that British subjects should be surrendered as well as foreigners. It happens sometimes that the person whose surrender is demanded is not a subject of either government—a Spanish subject, for example, may commit crimes in Russia and take refuge in England. In this case the British government would probably not surrender the accused to Russia without obtaining the consent of Spain. In the United States offenders from one State taking refuge in another are usually surrendered by the governor thereof without question; but even in such cases constitutional points of considerable difficulty have sometimes arisen.

Extraordinary Professor (Lat. *professor extraordinarius*) in German universities is of lower status than an ordinary professor.

Extraterritoriality, or Exterritoriality, is the privilege of being considered outside the territority, and exempt from the laws of the country in which one is for the time being resident. It is accorded to foreign sovereigns and ambassadors with their households, to public ships of a foreign power within territorial waters, to foreign troops allowed to pass through the country, in certain cases more generally. For particulars, see Ambassador, Capitulation, Consul.

Extravasation is the escape of any of the fluids of the living body from their proper vessels (*vas*) through a rupture or injury in their walls. Excrementitious matter thus sometimes escapes into the abdomen through a wound or ulceration of the bowels. But the term is oftenest used in speaking of the escape of blood from injured blood-vessels. Extravasation is distinguished from exudation by this, that in the last the vessels remain entire, and the effusion takes place by filtration through their walls; nor does more than a part of the blood so escape, the coloured blood-corpuscles being retained, while in extravasation perfect blood is effused. Many kinds of extravasation are rapidly fatal, such as that of urine or of the contents of the intestines into the abdomen, or of blood from the vessels of the brain in cases of apoplexy. The dark colour resulting from a bruise is owing to extravasated blood from ruptured capillary or larger vessels.

Extreme Unction, a sacrament of the Roman Catholic Church, which, as the other sacraments supply spiritual aid in the various circumstances of life, is believed to impart to the Christian in death grace and strength to encounter the struggle, as well spiritual as bodily, of the dying hour. The rite of unction in different forms is common to several of the sacraments; the name 'extreme' is given to that of the present sacrament, because it is reserved for the last act of the Christian career. The Council of Trent declares this sacrament, although 'promulgated' in the well-known passage of James, v. 14, 15 (which Protestants regard as having more to do with the general belief in the sanative properties of oil), to have been 'instituted' by Christ. The Fathers frequently allude to the rite of unction, and although many of these allusions certainly refer to the unctions of baptism and confirmation, yet Catholics rely on several passages of Origen, Chrysostom, Cæsarius of Arles, and Pope

Innocent I. as decisive regarding the unction of the dying, as also upon the fact that in the various separated churches of oriental Christians—Greek, Coptic, Armenian, and Nestorian—the rite is found, although with many ceremonial variations. In the Roman Catholic Church the sacrament is administered by the priest, who, 'dipping his thumb in the holy oil, anoints the sick person, in the form of the cross, upon the eyes, ears, nose, mouth, hands, and feet; at each anointing making use of this form of prayer: "Through this holy unction, and His most tender mercy, may the Lord pardon thee whatever sins thou hast committed by seeing. Amen." And so of hearing, smelling, taste and speech, touch, and walking, adapting the form to the several senses.' Extreme unction is reputed by Catholics one of the sacraments 'of the living;' —i.e. it ordinarily requires that the recipient should have previously obtained remission of his sins by absolution or by perfect contrition; but it is held to remit, *indirectly*, actual sins not previously remitted, and also (although not infallibly, but according to the merciful designs of Providence) to alleviate, and even to dispel, the pains of bodily disease. The holy oil which forms the 'matter' of this sacrament must be blessed by the bishop—a ceremony which is performed with great solemnity once each year by the bishop, attended by a number of priests, on Maundy-Thursday. The oil so blessed is reserved for use during the year. In the Greek Church the sacrament is administered by several priests conjointly. The Greeks call this sacrament 'The Holy Oil,' and sometimes 'The Oil of Prayer.'

Extrovert, and INTROVERT, in the view of Jung and his followers, the two basal types in human psychology. The fundamental function of the extrovert is feeling, that of the introvert is thought. This distinction, in no sense new or original, has, according to Jung, important bearings on the interpretation of 'repression' in psycho-analysis. The origin of repression Freud finds in sexuality *per se*, but Jung places it on a much wider basis, by tracing it to a natural tendency to adapt to the demands of life one-sidedly; the extrovert adapts by means of feeling, the introvert by means of thought, thought in the first instance and feeling in the second being repressed and necessarily weak; in both cases inequality in development of function results, and this inequality operating in the unconscious brings about a conflict, amounting in certain subjects to a neurosis.

Exumas, comprise Great Exuma, Little Exuma, and the Exuma Keys. See BAHAMAS.

Exuviæ, a term applied to organic remains, frequently used by the older geologists.

Eyam (pronounced as if *Eem*), a lead-mining village in North Derbyshire, 5 miles N. of Bakewell. Here broke out in September 1665, in its most virulent form, the plague which was then raging in London, and which had been carried hither in a box of clothes and tailor's patterns. William Mompesson, the rector of the parish, aided by Thomas Stanley, who had been ejected in 1662, devoted himself to the care of the dying with the most heroic courage. The plague lingered till the middle of October 1666, and as many as 260 out of a population of 350 perished. Another rector of Eyam achieved a less honourable eminence by living in his vestry for years (till his death in 1705) to evade the consequences of a breach of promise case.

Eyck, HUYBRECHT or HUBERT, and JAN VAN, two illustrious painters of the early Flemish school. They were probably born at Alden Eyck or Maas Eyck on the Maas. Even W. H. J. Weale, in his great work on the brother-painters (1908), has not made the dates and localities of their birth perfectly certain; but Hubert seems to have been born about 1370, and Jan about 1390. The distinction of being the inventors of oil-painting was wont to be claimed for them, though sufficient evidence has been adduced to show that the method was practised previously. Before their time, however, the custom, particularly in Italy, was to paint with gums or other substances of an adhesive nature dissolved in water, and they were the first who brought into notice and perfected the mode of mixing colours with oil or some medium in which oil was the chief ingredient; while for transparent and brilliant colouring and minute finish their works have never been surpassed. Jan appears to have been instructed in art by his elder brother, and to have painted in conjunction with him as court-painter to Philip of Charolais till 1422, when he entered the service of John of Bavaria, Count of Holland, at The Hague; and in 1425 he was appointed painter and varlet-de-chambre to Philip the Good, Duke of Burgundy, and practised his art chiefly at Bruges. Hubert continued to reside at Ghent, and at the time of his death, on 18th September 1426, was engaged upon a very important altar-piece, with folding-doors, the only work which we can certainly assign to him. It was completed by his brother. Its subject was 'The Adoration of the Lamb,' and it was painted for Jodocus Vydts, who presented it to the cathedral of St Bavon in Ghent. The two central panels, carried off by the French in 1794, were returned in 1815. Of the side panels, two representing Adam and Eve found their way to the Brussels Museum; the rest were sold in 1816, were bought later by the king of Prussia, and were restored to Ghent by the Treaty of Versailles. The masterpieces of the brothers are for the most part in the cities of Ghent, Bruges, Antwerp, Berlin, Munich, and Paris. In the National Gallery, London, are Jan van Eyck's portraits of Jean Arnolfini and Jeanne de Chenany, his wife, standing in the middle of an apartment, with their hands joined—signed and dated 1434; a portrait of a man in a cloak and fur collar, with a red handkerchief twisted round the head as a turban—painted, according to an inscription on the lower part of the frame, 21st October 1433; and a portrait of a man with a dark-red dress and a green head-covering—signed and dated 10th October 1432. In the Louvre is his exquisitely finished 'Chancellor Rollin kneeling before the Virgin.' Jan died at Bruges, 9th July 1440.

MARGARET VAN EYCK, a sister of the two above painters, is mentioned as an excellent artist by Lucas de Heere and Van Manden. A 'Virgin and Child,' in the National Gallery, London, was formerly assigned to her, but is now attributed to an unknown painter of the Early Flemish school. She is believed to have executed the miniatures in the missal of the Duke of Bedford. She died before 1431. See Mrs De Witt's *German and Flemish Masters in the National Gallery* (1904); Sir M. Conway, *The Van Eycks* (1921).

Eye (A.S. *ig*, 'an island'), a market-town and municipal borough in Suffolk, 20 miles N. of Ipswich. It has a fine Perpendicular flint-work church (restored 1869), with a tower 101 feet high, a corn exchange and town-hall (1857), and a grammar-school (restored and enlarged, 1876–82). Till 1885 it returned one member. Pop. 1800.

Eye. In this article we shall consider: (1) The structure of the human eyeball, and of certain accessory parts or appendages which serve to protect that organ, and are essential to the due performance of its functions. (2) The most striking modifications which this organ presents in some of the lower animals. (3) The eye considered as an optical instrument. (4) The action of the retina. (5)

The movements of the eyeballs, and binocular vision.

(1) The *globe of the eye* is placed in the anterior part of the cavity of the orbit, in which it is held in position by its connection with the optic nerve posteriorly, by the muscles which surround it, and by the eyelids in front. It is further supported behind and on the sides by a quantity of loose fat, which fills up all the interstices of the orbit, and facilitates the various movements of which the eye is capable.

The form of the eyeball is nearly spherical; but on viewing the organ in profile we see that it is composed of segments of two spheres of different diameters. Of these, the anterior, formed by the transparent cornea, is more curved, and therefore more prominent. The horizontal transverse diameter

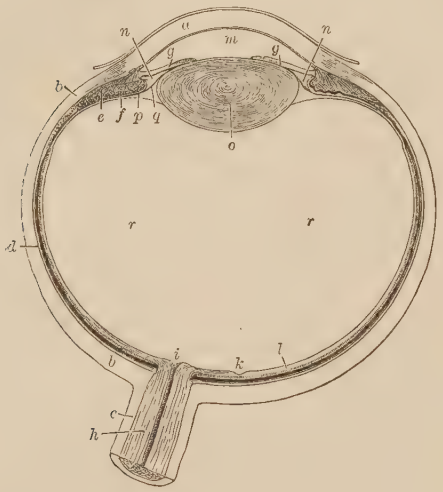


Fig. 1.—View of lower half of right Human Eye, divided horizontally:

a, cornea; *b*, sclerotic; *c*, sheath of optic nerve passing into sclerotic; *d*, choroid; *e*, ciliary muscle; *f*, ciliary process; *g*, *g*, iris; *h*, optic nerve with artery in centre; *i*, passage of nerve into retina, called optic disc or papilla; *k*, fovea centralis; *l*, retina; *m*, anterior chamber of aqueous humour; *n*, posterior chamber of aqueous humour; *o*, crystalline lens; *p*, zonule of Zinn; *q*, suspensory ligament of lens; *r*, vitreous humour.

is almost exactly an inch; the antero-posterior and vertical each about $\frac{1}{20}$ less. The radius of the posterior or sclerotic segment is about half, and that of the anterior segment about three-tenths of an inch.

When the eyes are in a state of repose, their antero-posterior axes are parallel; the optic nerves, on the other hand, diverge considerably from their commissure within the cavity of the skull to the point where they enter the globe; consequently their direction does not coincide with that of the eye. Each nerve enters the back of the globe at a distance of about one-eighth of an inch on the inner side of the antero-posterior axis of the eye.

The eyeball is composed of three concentric membranes, and of certain transparent structures, which are inclosed within them, and which, together with the cornea, transmit and refract the rays of light which enter the eye.

The outer (fibrous or protective) membrane consists of the sclerotic and cornea; the middle (vascular or nutrient) of the choroid and iris; the inner (nervous or percipient) of the retina. The transparent contents are (from before backwards) aqueous humour, crystalline lens, and vitreous humour. We shall consider these structures in order.

The *sclerotic* (from *sklēros*, 'hard'), or 'white of the eye,' is a strong, dense, fibrous structure, covering about five-sixths of the eyeball, and continuous, anteriorly, with the cornea. Posteriorly, it is perforated by the optic nerve, and it is there continuous with the sheath which that nerve derives from the dura mater, the fibrous investment of the brain and spinal cord. Near the entrance of the nerve, its thickness is about $\frac{1}{20}$th of an inch; from this it diminishes to about $\frac{1}{40}$th; but in front it again becomes thicker, from the tendinous insertions of the straight muscles which blend with it.

The *cornea* (so called from its horny appearance) is a transparent structure, continuous with the sclerotic, from which it differs more in appearance than in texture, and completing the fibrous tunic of the eye anteriorly. Its circumference is overlaid by the free edge of the sclerotic, as 'a watch-glass by the edge of the groove into which it is received.' Its thickness is from $\frac{1}{20}$th to $\frac{1}{30}$th of an inch. It is covered in front by a layer of conjunctival epithelium, which is exquisitely sensitive.

The cornea, in consequence of its greater convexity, projects beyond the line of the sclerotic; the degree of convexity, however, varies slightly in different persons, and at different periods of life. It is so strong as to be able to resist a force capable of rupturing the sclerotic. The fibrous coat, by its great strength and comparatively unyielding structure, maintains the inclosed parts in their proper form, and serves to protect them from external injuries.

The *choroid coat* is a dark-coloured vascular membrane, which is brought into view on the removal of the sclerotic. Its outer surface, which is nearly black, is loosely connected with the sclerotic by connective tissue, in which are contained certain nerves and vessels—termed the ciliary nerves and vessels—some of which go forward to the iris. Its inner surface is smooth and dark-coloured. In front, it terminates in the *ciliary processes* (figs. 1 and 3), which consist of about sixty or seventy radiating folds or thickenings of the membrane, each of them terminated by a small free interior extremity, and lodged in a corresponding fold in the suspensory ligament of the lens. In other parts, it is covered by the

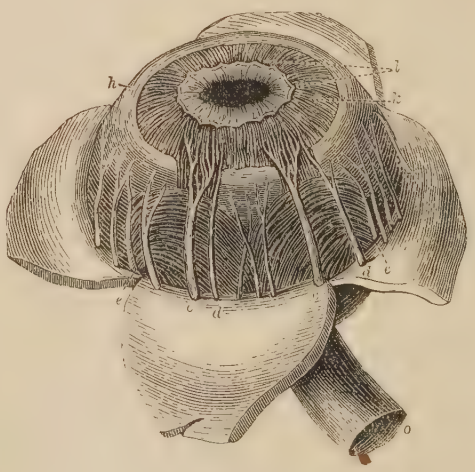


Fig. 2.—Choroid and Iris, exposed by turning aside the sclerotic:

c, *c*, ciliary nerves going to be distributed in iris; *d*, *d*, smaller ciliary nerves; *e*, *e*, veins known as vasa vorticosa; *h*, ciliary muscle; *k*, *l*, converging fibres of iris; *o*, optic nerve.

hexagonal pigment-cells of the retina. The choroid is composed of minute ramifications of vessels—

especially of veins, which, from their whorl-like arrangement, are termed *vasa vorticosa*—of connective tissue, and of large branching pigment-cells. Between the sclerotic and choroid at its anterior part lies a small but important structure, the *ciliary muscle*, which arises from the inner surface of the sclerotic near the cornea, and passes backwards to be inserted into the choroid opposite the ciliary processes.

The *iris* may be regarded as a process of the choroid, with which it is continuous, although there are differences of structure in the two membranes. It is a thin flat membranous curtain, hanging nearly vertically in the aqueous humour in front of the lens, and perforated by the pupil for the transmission of light. Its anterior surface is variously coloured, and covered by fine irregularly-radiating projections; its posterior surface is smooth, and covered by a uniform layer of dark pigment, continuous with the pigment-cells of the retina. The posterior surface near the pupil is in contact with the anterior capsule of the lens. It divides the space between the cornea and the lens into an anterior (the larger) and a posterior (the smaller) chamber, these two chambers freely communicating through the pupil (see fig. 1). The outer and larger border is attached all round near the line of junction of the sclerotic and cornea, to the cornea, choroid, and ciliary muscle, while the inner edge forms the boundary of the pupil, which is nearly circular, lies a little to the side of the centre of the iris, and varies in size according to the action of the muscular fibres of the iris, so as to admit more or less light into the interior of the eyeball; its diameter varying, under these circumstances, from about $\frac{1}{3}$d to $\frac{1}{20}$th of an inch. It is muscular in its structure, one set of fibres being arranged circularly round the pupil, and, when necessary, effecting its contraction, while another set lie in a radiating direction from within outwards, and by their action dilate the pupil. These fibres are of the unstriped or involuntary variety. The nerves which are concerned in these movements will be presently noticed. The iris is richly supplied with blood-vessels; and pigment-cells like those of the choroid are scattered through its substance.

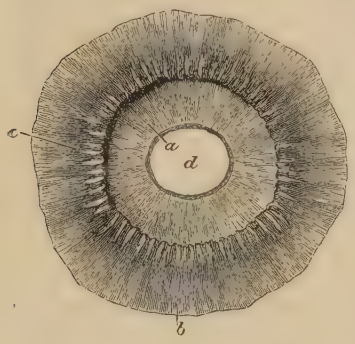


Fig. 3.—Iris and Ciliary Processes from behind:

a, posterior surface of the iris, with the sphincter muscle of the pupil; *b*, anterior part of the choroid coat; *c*, one of the ciliary processes, of which about seventy are represented; *d*, the pupil.

The varieties of colour in the eyes of different individuals, and of different kinds of animals, mainly depend upon the colour and amount of the pigment in these cells. In blue eyes, this pigment is scanty or absent, and the colour is due to the dark pigment of the posterior surface partly seen through the vascular membrane; in brown and black eyes, it is abundant, and is the cause of the colour. In albinos, this pigment is absent from iris, retina, and choroid, and hence their eyes have a pink appearance, which is due to the unconcealed blood in the capillaries of the choroid and iris.

Within the choroid is the *retina*, which, although continuous with the optic nerve—of which it is usually regarded as a cuplike expansion—differs very materially from it in structure. Before noticing the elaborate composition of this part of the eye, which has only been revealed by microscopical investigation, we shall briefly mention those points regarding it which can be established by ordinary examination. It is a delicate semi-transparent sheet of nervous matter, lying immediately behind the vitreous humour, and extending from the optic nerve nearly as far as the lens. On examining the concave inner surface of the retina at the back of the eye (see fig. 4), we observe, directly in a line with the axis of the globe, a circular yellow spot (*macula lutea*), of about $\frac{1}{20}$th of an inch in diameter, called, after its discoverer, the *yellow spot of Sömmering*, with a depression in its centre, the *fovea centralis*. About $\frac{1}{8}$th of an inch internal to this is the entrance of the optic nerve, called the *optic disc* or *papilla*, from which the central artery and vein of the retina may be seen branching as they pass to their distribution.

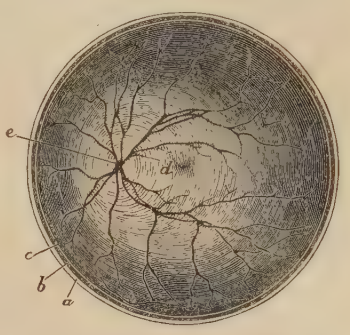


Fig. 4.—Posterior half of left Eye from the front:

a, cut edge of sclerotic; *b*, of choroid; *c*, of retina; *d*, macula lutea; *e*, optic disc or papilla.

The structure of the retina, as revealed by the microscope, is in the highest degree remarkable (see fig. 5). Although its greatest thickness (at the entrance of the optic nerve) is only about $\frac{1}{50}$th of an inch, and as it extends anteriorly, it soon diminishes to $\frac{1}{250}$th of an inch, the following layers from without inwards can be distinguished in most parts of it: (*a*) The pigmentary layer, consisting of a single layer of flat hexagonal cells, regularly arranged; its outer surface closely connected with the choroid, its inner in contact with the extremities of the rods and cones. Though its development shows that it really belongs to the retina, its mechanical connection with the choroid is firmer; and to this it adheres when the retina is stripped off. (*b*) The layer of rods and cones, frequently termed, from its discoverer, the *membrane of Jacob*; (*c*) outer granular layer; (*d*) outer molecular; (*e*) inner granular; (*f*) inner molecular; (*g*) layer of nerve-cells; (*h*) layer of nerve-fibres, in which the blood-vessels lie.

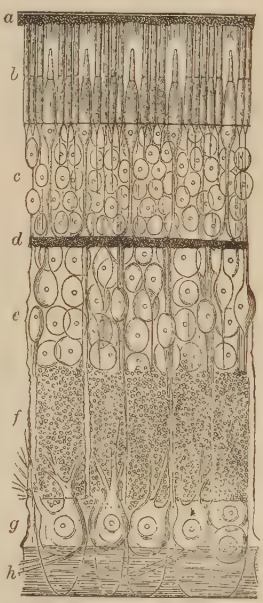


Fig. 5.—Diagrammatic Section of Human Retina.

The layer of rods and cones, the portion of the eye which receives the impressions of light, deserves special attention. The rods are thinner but longer than the cones, and in most parts of the retina far more numerous. At the yellow spot, however, only cones are found. Each rod or cone consists of a thicker inner portion, connected with the outer granular layer, and ultimately with the optic nerve by a fine fibril; and an outer thinner part, directed towards and connected with the pigmentary layer. The percipient elements are thus directed away from, not towards the light. 'In fact, we do not look outwards at the actual object, but we see the object as reflected from the base of our own eye.' Of the cones there are several, of the rods many millions in each human eye, and they are closely packed together over the whole extent of the retina.

It now remains for us to describe the *transparent media* which occupy the interior of the globe, and through which the rays of light must pass before they can reach the retina, and form on it the images of external objects. We shall consider them in the order in which the rays of light strike them.

Immediately behind the transparent cornea is the *aqueous humour*, which fills up the anterior and posterior chambers which lie between the cornea and the lens. As its name implies, it is very nearly pure water, with a mere trace of albumen and chloride of sodium. It is believed to be secreted by the choroid and to pass forward from it through minute lymphatic channels.

The *crystalline lens* lies opposite to and behind the pupil, in contact with the inner part of the iris, and its posterior surface is received into a corresponding depression on the forepart of the vitreous humour (see fig. 1). In form, it is a double-convex lens, with surfaces of unequal curvature, the posterior being the most convex. It is inclosed in a transparent capsule, of which the part covering the anterior surface is nearly four times thicker than that at the posterior aspect. The microscopic examination of the substance or body of the lens reveals a structure of wonderful beauty. Its whole mass is composed of extremely minute elongated ribbon-like structures, commonly called the *fibres of the lens*. These fibres are arranged side by side in lamellæ, of which many hundred exist in every lens, and which are so placed as to give to the anterior and posterior surfaces the appearance of a central star, with meridian lines. The lens gradually increases in density, and at the same time in refracting power, towards the centre; by this means, the refracting power is made greater than it would be even if the lens had throughout the same index of refraction as the nucleus. (According to the latest measurements, the index of refraction of the outer layer is 1·393; of the nucleus, 1·431; the total refractive power corresponds to that of a homogeneous body of the same size and shape with index 1·448.) This arrangement besides corrects to a certain extent the spherical aberration of the eye. According to Berzelius, the lens contains 58 per cent. of water, 36 of albumen, with minute quantities of salts, membrane, &c. In consequence of the albumen, it becomes hard and opaque on boiling, as we familiarly see in the case of the eyes of boiled fish. In the adult, its diameter transversely is about $\frac{1}{3}$d, and its thickness antero-posteriorly about $\frac{1}{3}$th of an inch; and it weighs three or four grains. The lens is held in position by the *suspensory ligament* of the lens and *zonule of Zinn*, a fine transparent fibrous structure, attached outwardly to the choroid between the ciliary processes, and passing inwards to blend with the anterior and posterior capsule of the lens near its margin (see fig. 1).

The *vitreous humour* lies in the concavity of the retina, and occupies about four-fifths of the eye posteriorly. Its form is shown in fig. 1. It is inclosed, except in front, in the hyaloid membrane, which blends anteriorly with the zonule of Zinn; and its anterior surface is in contact with the posterior capsule of the lens. It is quite transparent, and of a soft gelatinous consistence. Its outer part at least is laminated, like the coats of an onion. But the exact arrangement of the framework which gives it its consistence has not been determined. Between the anterior border of the retina and the border of the lens, we have a series of radiating folds or plaitings termed the *ciliary processes of the vitreous body*, into which the *ciliary processes of the choroid* dovetail. The vitreous humour contains, according to Berzelius, 98·4 per cent. of water with a trace of albumen and salts, and hence, as might be expected, its refractive index is almost identical with that of water.

The appendages of the eye now claim our notice. The most important of these appendages are the *muscles within the orbit*, the *eyelids*, the *lachrymal apparatus*, and the *conjunctiva*, to which (although less important) we may add the *eyebrows*.

The *muscles* by which the eye is moved are four straight (or *recti*) muscles, and two oblique (the superior and inferior). The former arise from the margin of the optic foramen at the apex of the orbit, and are inserted into the sclerotic near the cornea, above, below, and on either side. The superior oblique arises with the straight muscles; but after running to the upper edge of the orbit, has its

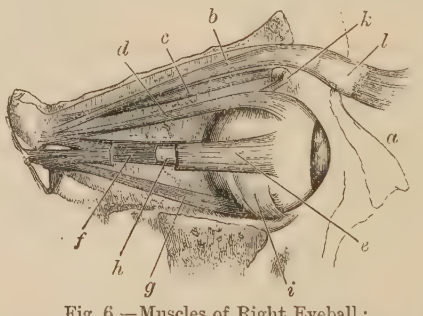


Fig. 6.—Muscles of Right Eyeball:

The external rectus muscle divided to show the optic nerve, which has also been cut to show the internal rectus muscle.

a, nasal bone; *b*, levator palpebræ superioris; *c*, superior oblique; *d*, superior rectus; *e*, external rectus; *f*, internal rectus; *g*, inferior rectus; *h*, optic nerve; *i*, inferior oblique; *k*, pulley; *l*, tarsal cartilage.

direction changed by a pulley, and proceeds backwards, outwards, and downwards (see fig. 6). The inferior oblique arises from the lower part of the orbit, and passes backwards, outwards, and upwards. The action of the straight muscles is sufficiently obvious from their direction: when acting collectively, they fix and retract the eye; and when acting singly, they turn it towards their respective sides. The oblique muscles antagonise the recti, and draw the eye forwards; the superior, acting above, directs the front of the eye downwards and outwards, and the inferior upwards and inwards. By the duly associated action of these muscles, the eye is enabled to move (within definite limits) in every direction.

The *eyelids* are two thin movable folds placed in front of the eye, to shield it from too strong light, and to protect its anterior surface. They are composed of (1) skin, with a layer of muscle (part of the *orbicularis*, see below) closely adherent to it; (2) of a thin plate of fibro-cartilage, termed

the *tarsal cartilage*, the inner surface of which is grooved by thirty or forty parallel vertical lines, in which the Meibomian glands are imbedded; and (3) of a layer of mucous membrane (*conjunctiva*), continuous, as we shall presently see, with that which lines the nostrils, and joining the skin at the margin of the lids, in which the eyelashes (*cilia*) are arranged in two or more rows. The upper lid is much the larger; and to the posterior border of its cartilage a special muscle is attached, termed the *levator palpebræ superioris*, whose object is to elevate the lid, and thus open the eye; while there is another muscle, the *orbicularis palpebrarum*, which surrounds the orbit and eyelids, and by its contraction closes the eye. The Meibomian glands secrete a sebaceous matter, which facilitates the free motion of the lids, and prevents their adhesion. The eyelashes intercept the entrance of foreign particles directed against the eye, and assist in shading that organ from an excess of light.

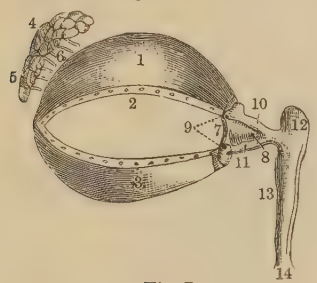


Fig. 7.
The Appendages of the Eye:
1, the cartilage of the upper eyelid; 2, its lower border, showing the openings of the Meibomian glands; 3, the cartilage of the lower eyelid, also showing on its border the openings of the Meibomian glands; 4, 5, the lachrymal gland; 6, its ducts; 7, the plica semilunaris; 8, the caruncula lachrymalis; 9, the puncta lachrymalia, opening into the lachrymal canals; 10, 11, the superior and inferior lachrymal canals; 12, the lachrymal sac; 13, the nasal duct, terminating at 14 in the lower meatus of the nose.

The *lachrymal apparatus* consists of the lachrymal gland, by which the tears are secreted; two canals, into which the tears are received near the inner angle of the eye; the sac, into which these canals open; and the duct, through which the tears pass from the sac into the nose. The gland is an oblong body, about the size of a small almond, lying in a depression in the upper and outer part of the orbit. The fluid secreted by it reaches the surface of the eye by twelve or fourteen ducts, which open on the conjunctiva at its upper and outer part. The constant motion of the upper eyelid induces a continuous gentle current of tears over the surface, which carry away any foreign particle that may have been deposited on it. The fluid then passes through two small openings, termed the *puncta lachrymalia* (see 9 in fig. 7), into the canals; whence its further course into the lower portion of the nose is sufficiently obvious from the figure. The conjunctiva (or mucous coat) which covers the front of the eyeball, and lines the inner surface of the lids, passes down and lines the canals, sac, and duct; and is thus seen to be continuous with the nasal mucous membrane, of which it may be regarded as an offshoot or digital prolongation.

We shall conclude this sketch of the anatomy of the human eye by a brief notice of the *nerves* going to this organ and its appendages. Into each orbit there enters a nerve of *special sense*—viz. the optic nerve; a nerve of *ordinary sensation*—viz. the ophthalmic branch of the fifth nerve; and certain nerves of *motion* going to the muscular tissues, and regulating the movements of the various parts—viz. the third, fourth, and sixth nerves.

As the optic tracts from which the *optic nerves* originate are noticed in the article BRAIN, we shall merely trace these nerves from their *chiasma* or commissure forwards. This commissure results from the junction of the optic tracts of the two sides; and it is especially remarkable for the fact that it presents a partial decussation of the nervous fibres; the central fibres of each tract passing into the nerve of the *opposite* side, and crossing the corresponding fibres of the other tract, while the outermost fibres, which are much fewer in number than the central ones, pass to the optic nerve of the *same* side. In front of the commissure, the nerves enter the optic foramen at the apex of the orbit, receive a sheath or investment from the *dura mater*, acquire increased firmness, and finally terminate in the retina. The peculiar mode of termination of the optic nerves in the cuplike expansion of the retina, the impairment or loss of vision which follows any morbid affection of them, and the constant relation in size which is observed in comparative anatomy between them and the organs of vision, afford sufficient evidence that they are the proper conductors of visual impressions to the sensorium.

The first or ophthalmic division of the fifth or trifacial nerve sends branches to the eyeball (ciliary nerves), to the skin of the eyelids, and to the conjunctiva. That it is the nerve of ordinary sensation of the eye is sufficiently obvious from the following facts: (1) That in disease of this nerve in the human subject, it is not uncommon to find the surface of the eyeball totally insensible to every kind of stimulus (particles of dust, pungent vapours, &c.); and (2) that if the nerve be divided in the cranium (in one of the lower animals), similar insensibility results.

The most important of the nerves of motion of the eye is the third nerve, or *motor oculi*. It supplies with motor power the elevator of the upper eyelid, and all the muscles of the globe, except the superior oblique and the external straight muscle, and, in addition to this, it sends filaments to the iris and ciliary muscle within the eye. The application of an irritant (in vivisection experiments) to its trunk induces convulsive contraction of the principal muscles of the ball and of the iris; while paralysis or division of the trunk occasions an external squint, with palsy of the upper eyelid and fixed dilatation of the pupil. The squint is caused by the action of the external straight and the superior oblique muscles, while the other muscles are paralysed by the operation. The normal motor action of the nerve upon the iris, in causing contraction of the pupil, is excited through the optic nerve, and affords a good illustration of *Reflex Action* (q.v.); the stimulus of light falling upon the retina, and, through it, exciting that portion of the brain from which the third nerve takes its origin. This nerve clearly exerts a double influence in relation to vision: (1) it mainly controls the movements of the eyeball and the upper eyelid; and (2) from its connection with the muscular structures in the interior, it regulates the amount of light that can enter the pupil, and the adjustment of the eye to various distances. The fourth nerve supplies the superior oblique muscle with motor power, while the sixth nerve similarly regulates the movements of the external straight muscle—the only two muscles in the orbit which are not supplied by the third pair. Although not entitled to be termed a nerve of the orbit, the facial nerve deserves mention as sending a motor branch to the *orbicularis* muscle, by which the eyelids are closed.

(2) *Comparative Anatomy of the Eye.*—In *mammals*, the structure of the eye is usually almost identical with that of man. The organ is, however, occasionally modified, so as to meet the peculiar wants of the animal. Thus, in the Cetacea, and in some amphibious Carnivora that catch their prey in the water, the shape of the lens

is nearly spherical, as in fishes, and there is a similar thickening of the posterior part of the sclerotic, so as to thrust the retina sufficiently forward to receive the image formed by such a lens. (See the subsequent remarks on the eyes of fishes.) Again, instead of the dark-brown or black pigment which lines the human choroid, a pigment of a brilliant metallic lustre is secreted in many of the mammalia, forming the so-called *tapetum lucidum* at the bottom of the eyeball, which seems (according to Bowman) to act as a concave reflector, causing the rays of light to traverse the retina a second time, and thus probably increasing the visual power, particularly where only a feeble light is admitted to the eye. The pupil, moreover, varies in form, being transversely oblong in the Ruminants and many other Herbivora, and vertically oblong in the smaller genera of Cats. These shapes are apparently connected with the positions in which the different animals look for their food. Lastly, in some mammals (e.g. the horse) there is a rudimentary third eyelid corresponding to the *membrana nictitans* of birds.

In *birds*, the eye, though presenting the same general composition as in man, differs from the mammalian eye in several important points. From our knowledge of the habits of birds (especially birds of prey), we should naturally expect that in their rapid movements they would be able readily to alter the focus between the extremes of long and short sighted vision, and the modifications we shall now proceed to notice clearly have this object in view.

In reference to fig. 8, which represents a section of the eye of the owl, we see (1) that the shape of the organ is not spherical, as in mammals, nor flattened anteriorly, as in fishes and aquatic reptiles, but that the cornea is very prominent, and the antero-posterior diameter lengthened; the consequence of this arrangement being to allow room for a large quantity of aqueous humour, and to increase the distance between the lens and the posterior part of the retina, and thus to produce a greater convergence of the rays of light, by which the animal is enabled to discern near objects. In order to retain this elongated form, we find a series of bony plates, forming a broad zone, extending backwards from the margin of the cornea, and lying imbedded in the sclerotic. The edges of the pieces forming this bony zone overlap each other, and are slightly movable, and hence, when they are compressed by the action of the muscles of the ball, there is protrusion of the aqueous humour and of the cornea, adapting the eye for near vision; while relaxation of the muscles induces a corresponding recession of the humour and flattening of the cornea, and fits the eye for distant vision. The focal distance is further regulated by a highly vascular organ called the *marsupium*, or *pecten*, which is lodged in the posterior part of the vitreous humour (fig. 8, *a*). It is attached to the optic nerve at the point where it expands into the retina, and seems to be endowed with a power of dilatation and contraction; as it enlarges, from distension of its blood-vessels, it causes the vitreous humour to push the lens forwards, while, as it collapses, the lens falls backwards again towards the retina.

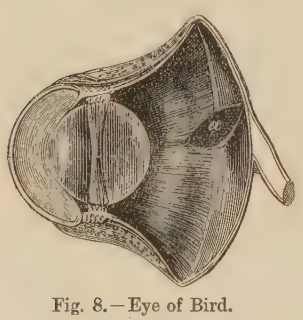


Fig. 8.—Eye of Bird.

In addition to an upper and lower eyelid, birds have an elastic fold of conjunctiva, which, in a state of repose, lies in the inner angle of the eye, but is movable by two distinct muscles, which draw it over the cornea. It is termed the *membrana nictitans;* it is to a certain degree transparent, for (according to Cuvier) birds sometimes look through it, as, for example, the eagle when looking at the sun. The lachrymal gland is situated as in mammals, but there is here a second gland, the *glandula Harderi*, which yields a lubricating secretion.

There are no very special peculiarities in the eyes of *reptiles*, and we therefore proceed to notice the most remarkable points presented by the eye in *fishes*. From the comparatively great density of the medium (water) through which the rays of light pass before they impinge upon the transparent structure of the eye of the fish, it is obvious that this organ must act as a very powerful refractive apparatus. The main peculiarity in the eye of the fish is the size, extreme density, and spherical shape of the lens, which give it such an extraordinary magnifying power that it has been employed as a simple microscope. See Brewster's *Treatise on the Microscope*, p. 31. But its focus being shortened in proportion as its power is increased, it is necessary that the retina should be brought near its posterior surface. For this purpose the eyeball is flattened by diminishing the quantity of vitreous humour; and this flattened form is maintained by the existence of two cartilaginous plates in the tissue of the sclerotic, which in some of the larger fishes is actually converted into a bony cup. The aqueous humour, as the cornea has here hardly any refractive power and is also flattened, is barely sufficient to allow the free suspension of the iris. The pupil is very large, so as to take in as much light as possible, but is generally motionless. Their eyes being constantly washed by the water in which they live, no lachrymal apparatus is necessary, nor does any exist; and the same remark applies to the *cetacea* amongst the mammals. We thus see that throughout the sub-kingdom of the *vertebrata* the eye is constructed according to one general scheme, with modifications to suit the mode of life of individual classes.

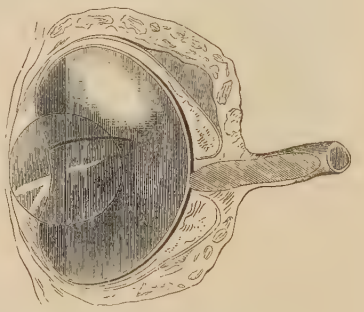


Fig. 9.—Eye of Fish.

There is another organ present in most vertebrate animals which seems, from recent investigations, to represent an eye, though it is very doubtful whether it has the power of sight in any living animal. This is represented in mammals and birds by the pineal gland (see BRAIN); but in some lizards is placed upon the top of the head, and has the appearance of a rudimentary eye, similar in structure to that of some of the Invertebrata.

In the Invertebrata there is an immense variety in the structure of the eye where such an organ is present. There are two main types, *simple* and *compound* eyes. In *simple* eyes (of which the human eye itself is the most highly organised form), every degree of complexity is present, from a mere pigmented spot, with or without a rudimentary lens, to an organ nearly as complicated as that of the Vertebrata (e.g. in some of the Cuttle-fishes), with a cornea, iris, lens, and retina all well

developed. In these eyes, however, almost without exception, the nerve expands behind the retina, and the percipient elements are directed towards the light; while in the vertebrate eye the opposite arrangement obtains.

Some of these organs are so rudimentary that they can have no function beyond mere perception of light; but in cases where they are sufficiently developed to admit of the perception of objects, they see, roughly speaking, as our eyes do—that is to say, a more or less accurate picture of external objects is thrown on the expansion of nerve-endings corresponding to the retina, and its direction is reversed (see below).

In the *compound* eyes the whole principle of the structure and perception is different. They are best developed in Insects (q.v.), and in the higher Crustaceans; but occur in a rudimentary condition in some molluscs. The surface of such an eye is divided into a number of hexagonal facets, the cuticle of each generally forming a minute lens. Beneath each facet is a transparent rod, surrounded and separated from those adjacent to it by pigment, and leading inwards to the retinula, a group of cells in connection with the terminal fibrils of the optic nerve. In most familiar insects they form two hemispherical masses on the sides of the head. In some ants there are only fifty facets in each eye; in the house-fly about 4000; in some beetles as many as 25,000. It is probable that in these eyes only the rays of light which fall upon a particular facet exactly, or very nearly, in the direction of the transparent rod beneath it can reach the corresponding nerve-fibre, and that other rays are absorbed by the pigment around the rod. Each percipient element therefore receives light only from a very small portion of the field of vision, and the picture is a mosaic, each element of which is furnished by a different facet of the eye. The picture has obviously the same position as the objects it represents, instead of being inverted as in a simple eye. Most insects have simple as well as compound eyes; but the latter have by far the most perfect vision.

(3) We may now proceed to the consideration of the uses of the various parts of the eye. Assuming a general knowledge of the ordinary laws of geometrical optics (see Optics, Lenses, &c.), we shall trace the course of the rays of light proceeding from any luminous body through the different media on which they impinge. If a luminous object, as, for example, a lighted candle, be placed in front of the eye, some of its rays fall upon the cornea, and are in part reflected, giving to the surface of the eye its beautiful glistening appearance; in part refracted or converged by it, to enter the aqueous humour, which exerts no perceptible effect on their direction. Those which fall on and pass through the outer or circumferential part of the cornea are stopped by the iris, and are either scattered or absorbed by it; while those which fall upon its more central part pass through the pupil, and are concerned in vision. In consequence of its refractive power, the rays passing through a somewhat larger surface of the cornea than the pupil are converged so as to pass through it and impinge upon the lens, which, as its refractive index is much greater than that of the aqueous and vitreous humours, by the convexity of both its surfaces very much increases the convergence of the rays passing through it. They then traverse the vitreous humour, whose principal use appears to be to afford support to the expanded retina, and are brought to a focus upon that tunic, forming there, if the eye be adjusted for the distance from which the rays proceed, an exact but inverted image of the object.

This inversion of the image may be easily exhibited in the eye of a white rabbit or other albino animal, after removing the muscles, &c. from the back part of the globe. The flame of a candle (A, B, C, fig. 10) held before the cornea may be seen inverted at the back of the eye (*a*, *b*, *c*), increasing in size as the candle is brought near, diminishing as it retires, and always moving in a direction opposite to that of the flame.

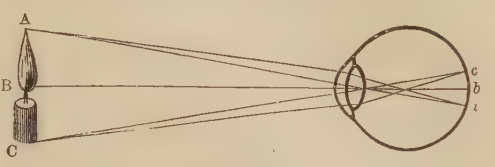


Fig. 10.

The adjustment of the eye for distinct vision at different distances, or *accommodation*, must next be considered. The normal eye in the position of rest is adjusted to see objects at a distance (practically all objects at 20 feet or more are seen with equal clearness): to see a near object (at 10 inches, say) a distinct effort is required, and when the effort ceases the object at once appears blurred. Careful observations and measurements by means of a suitable instrument (Ophthalmometer) of images reflected from the three principal refracting surfaces of the eye (cornea, anterior and posterior surfaces of crystalline lens) have shown that during

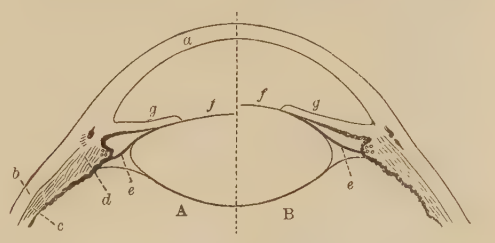


Fig. 11.—Action of Ciliary Muscle and Iris in accommodation:

A, (right or left) half; eye at rest, or focused for a distant object. B, (left or right) half; eye focused for a near object. *a*, cornea; *b*, sclerotic; *c*, anterior part of choroid; *d*, ciliary muscle; *e*, suspensory ligament of lens; *f*, anterior capsule of lens; *g*, iris.

accommodation for a near object (1) the position and curvature of the cornea remains unchanged; (2) the anterior surface of the crystalline lens approaches the cornea and becomes much more convex; (3) the posterior surface does not change its position, but becomes very slightly more convex. Accommodation, then, depends upon change of shape of the crystalline lens. The common explanation of the mechanism by which this is effected was first given by Helmholtz. The ciliary muscle, as already stated, has its fixed attachment all round within the sclerotic close to the margin of the cornea; and passes outwards and backwards to the anterior part of the choroid, close to the ciliary processes. When it contracts, therefore, it draws these structures inward; and with them the outer attachment of the suspensory ligament of the lens. The tension of this membrane is thus relaxed, and the elastic lens, whose form as well as position is controlled by it, is allowed to assume a more spherical shape. When the ciliary muscle ceases to contract, the converse takes place, and the lens is again flattened as the suspensory ligament and lens capsule become more tense. With the contraction of the ciliary muscle is always associated a contraction of the circular fibres of the iris, diminishing the size of the pupil; and when the ciliary muscle relaxes, the pupil enlarges again. This

change, though of much less importance than the change in shape of the lens, is much more easy to observe.

Change of adjustment requires a short but measurable time; that from distant to near vision requires a little longer time than the converse; the former from a little over one to two seconds, the latter about one second.

As age advances, the power of accommodation steadily and quickly diminishes, not because the ciliary muscle gets weaker, but because the lens becomes less elastic. This change begins during youth, but is not commonly noticed before middle life. At ten years of age an object can be seen distinctly at less than 3 inches; at twenty, not nearer than 4 inches; at about forty-five, not nearer than 10 inches; at sixty, not nearer than 3 feet. After seventy-five, the lens is so unyielding that accommodation is altogether lost. When the shortest distance at which distinct vision is possible approaches that at which reading or work is usually attempted, the failure of accommodation begins to attract attention, and spectacles have to be resorted to to compensate for it. This condition has received the name of *presbyopia* or old sight, but must be clearly understood to be perfectly natural after the age of forty-five, and in no way to imply defect or weakness of the eyes.

The eye, regarded as an optical instrument, has numerous imperfections: the more important of these must be mentioned.

Spherical aberration (see LENSES) is in part avoided by the iris, which, acting as a diaphragm, cuts off all but the central pencil of rays; in part by the forms of the refracting surfaces, which are not truly spherical, but ellipsoidal or hyperbolical —i.e. more curved at the centre than elsewhere; in part by the constitution of the lens (see above). What remains is, like *chromatic aberration*, for which no correction seems to exist, too slight to be perceptible.

Regular *Astigmatism* (q.v.) is present in almost all eyes, but is generally so small in amount as to be of no importance.

Imperfect Transparency of Media.—The stellate arrangement of the lamellæ of the lens is the cause of the rayed (or, as we say, star-shaped) appearance of a point of light. *Muscæ volitantes*, the clear threads or strings of beads often seen in looking at a bright surface flitting about when the eye is moved, are due to the shadows of the minute fibres and corpuscles naturally present in the vitreous humour.

(4) We must now consider how the image formed in the back of the eye by the dioptric media gives rise to vision. It is the retina, and only that part of it known as the layer of rods and cones (see fig. 5), which is directly affected by light.

Let two marks be made on a sheet of paper about 3 inches apart horizontally (a cross and a round mark to the right of it). Close the left eye, and holding the paper about a foot from the face, look steadily at the cross; the circle is also visible. Now bring the paper gradually nearer, keeping the right eye fixed upon the cross. The circle soon disappears; but becomes visible again when the paper is brought still nearer the eye. The *blind spot* in which the circle becomes invisible is the entrance of the optic nerve; hence we know that the nerve-fibres themselves are not sensitive to light. Further proof of this is given by *Purkinje's figure*, which is easily perceived as follows: Take a candle in a room otherwise dark, and holding it a short distance in front and to the outer side of one eye, move it from side to side, looking straight forward. A set of branching dark lines, the shadows of the retinal blood-vessels, will be seen (see fig. 4). These could not be perceived unless the sensitive portion of the retina lay behind the blood-vessels, which the nerve-fibre layer of the retina does not.

Stimulation of the retina, however it may be caused, gives rise to the sensation of light. Thus, slight pressure on one side of the eyeball causes an appearance of flashes of light towards the opposite side. A sudden blow on the eye, or the indirect shock to it of a fall on the head, makes one 'see stars.' Electric currents passed through the eye similarly cause a sensation of bright light. But true vision is only caused by rays of light falling upon the retina.

In what way light affects the layer of rods and cones we do not know. Probably it produces some chemical change, which leads to stimulation of the nervous elements. A substance called *visual purple* or *rhodopsin* has been found in the outer segments of the rods of some animals, which is bleached on exposure to light, and regenerated. Photographic pictures of bright objects have been obtained in eyes of rabbits, &c. by means of it. Rods are absent in the most sensitive portion of the human retina, but the visual purple diffuses into the surrounding liquid.

The *fovea centralis* is the part of the retina where vision is most acute: as cones only are present here, it is probable that from them alone the impulse passes along the nerve, and not from the rods, which greatly preponderate at other parts of the retina. When the eye looks straight at an object (or in technical language *fixes* it), its image falls upon this part of the retina. In *direct* vision, as this is called, two black marks on a white ground are distinguished as separate when the interval between them subtends an angle of about one minute at the eye. It is found by calculation that this angle, prolonged to the back of the eye, pretty nearly corresponds to the distance between two adjacent cones at the fovea centralis. The vision at other parts of the retina (*indirect* vision) is very much less acute, and less capable of accurate measurement. We have only to fix steadily one letter in a page of ordinary print to satisfy ourselves in how small an area we can see sufficiently distinctly to make out words without moving the eyes. The *field of vision*, or whole space within which objects are perceived by an eye while it is fixed upon one point, is very much wider, extending in each eye to more than 90 degrees from the fixation point or centre to the outer side, and rather less in other directions. Colour-vision is also most distinct at the centre of the field; and it diminishes more rapidly towards the outer portions than light-vision, so that near the limits of the field colours cannot always be recognised. See COLOUR-PERCEPTION, COLOUR-BLINDNESS.

There must be a certain amount of light for the purpose of vision. Every one knows that it is difficult and painful to discern objects in a very faint light; and, on the other hand, that on suddenly entering a brilliantly lighted room from the dark, everything appears confused for one or two seconds. There is, however, a gradual adaptation of the retina to different amounts of light. Persons long immured in dark dungeons acquire the power of distinctly seeing surrounding objects; while those who suddenly encounter a strong light are unable to see distinctly until the shock which the retina has experienced has subsided, and the iris has duly contracted. In protecting the retina from the sudden effects of too strong a light, the iris is assisted by the eyelids, the orbicular muscle, and to a certain extent by the eyebrows. Moreover, the dark pigment of the choroid coat acts as a permanent guard to the retina, and where it is deficient, as in albinos, an ordinary light becomes painful, and the protective appendages, especially the eyelids, are in constant use.

The persistence during a certain time of impressions made on the retina facilitates the exercise of sight. Such persistent impressions are called *after-images.* A momentary impression of moderate intensity continues for a fraction of a second; but if the impression be made for a considerable time, or be very intense, it endures for a longer period after the removal of the object. Thus, a burning stick, moved rapidly in a circle before the eyes, gives the appearance of a continuous ribbon of light, because the impression made by it at any one point of its course remains on the retina until it again reaches that point. It is owing to this property that the rapid and involuntary act of winking does not interfere with the continuous vision of surrounding objects; and, to give another illustration of its use, if we did not possess it, the act of reading would be a far more difficult performance than it now is, for we should require to keep the eye fixed on each word for a longer period, otherwise the mind would fail fully to perceive it. However great may be the velocity of a luminous body, it can always be seen; but if an opaque body move with such rapidity as to pass through a space equal to its own diameter in a less time than that of the duration of the retinal impression, it is altogether invisible; and hence it is, for example, that we cannot see bullets, &c. in the rapid part of their flight. In these cases the after-image is of similar brightness and colour to the original impression, and is known as a *positive* after-image. When the stimulation of the retina is very strong, or the retina itself in a very sensitive condition—e.g. in certain morbid states of the system and in twilight, a *negative* after-image appears, in which the bright parts of the original impression appear dark and *vice versâ.* An image of this kind may persist for some seconds or minutes or even longer. This physiological phenomenon has probably given origin to many stories of ghosts and visions. Thus, if a person has unconsciously fixed his eyes, especially in the dusk, on a dark post or stump of a tree, he may, on looking towards the gray sky, see projected there a gigantic white image of the object, which may readily be mistaken for a supernatural appearance. The phenomenon is easily seen on looking away from a bright window after directing the eyes to it for some time, when the bars appear as bright lines on a dark ground. Negative after-images are always of the complementary colour to that of the object. Thus, the image left by a red spot is green; by a violet spot, yellow; and by a blue spot, orange.

(5) Each eye can be moved from its ordinary position, looking straight forward, through an angle of nearly 60 degrees downwards, and of 35 to 45 degrees in other directions. But one eye never moves without the other. Two series of associated movements have to be distinguished: movements of both eyes in the same direction, and movements which *converge* the eyes, or bring the corneæ of both eyes towards each other. When a near object is looked at, the movement of accommodation is associated with a proportionate contraction of the internal recti of both eyes, so as to direct the visual axis, or in other words the fovea centralis, of each towards the object.

If we suppose the retinæ of the two eyes to be placed in contact, so that the foveæ centrales and the vertical meridians correspond, then all points which lie together in the two retinæ are called *corresponding points,* and have the property that simultaneous stimulation of both gives rise only to a single impression. An object whose image falls upon corresponding points thus appears single; otherwise it appears double. Hold up two fingers in line in front of the face. When the nearer one is looked at, it is seen single, but the farther appears double and somewhat out of focus; when the farther is looked at, it appears single, and the nearer is similarly doubled and blurred. Generally speaking, images of the great majority of the objects in the field of vision of both eyes must fall on non-corresponding points of the two retinæ; but as the attention is generally directed to the images of the object for which the eyes are accommodated, and as these, falling upon the foveæ centrales, are much the most distinct, the double vision of other objects is seldom noticed.

In the case of near objects, however, something more is needed to explain single vision. For example, take the case of a solid object. The two eyes, looking from different points of view, receive quite different images; the right eye sees more of the right side, the left eye more of the left. It is impossible that the images of each point of the object can fall upon accurately corresponding points of the two retinæ. Yet the appearance presented is that of a single object clearly defined. In this case then there must be in the brain-centres a power of combining in a single picture images which do not accurately correspond.

Various topics which the reader might perhaps have expected to find noticed, such, for instance, as 'the appreciation of solid forms by the sense of vision,' 'correct vision with an inverted image on the retina,' &c., which belong fully as much to metaphysics as to physiology, are discussed in the article on VISION. We may also refer those who desire information on these points to Professor Bain's treatise on *The Senses and the Intellect.*

For the anatomy of the eye, see Quain or other standard work. Avebury in *The Senses of Animals* gives a concise account of the chief types of eyes in the Invertebrata. Helmholtz's *Physiological Optics* is the classical work on the optical aspects of the eye. The larger works on human physiology—e.g. Foster, Landois and Stirling—may also be consulted.

DISEASES AND INJURIES OF THE EYE, as might be expected from the delicate and complicated structure of the organ, are very numerous. But as the position of the eye and the transparency of its dioptric media give exceptional facilities for their detection and study, they are more thoroughly understood than those of any other organ. Only the most common and important can be referred to here.

Diseases of Conjunctiva are mainly different forms of inflammation, or *conjunctivitis.*

(*a*) *Simple* or *Catarrhal Conjunctivitis* may be acute or chronic. In the former case, it is commonly called 'cold in the eye.' The white of the eye is more or less reddened, and there is an increased discharge of gummy substance, causing the lids to cohere during sleep; a sensation is experienced as of sand or dust in the eyes, and there is a little increased sensitiveness to light. The acute form generally subsides in a few days without leaving any ill effects, unless improperly treated; the chronic form is often obstinate. The common popular treatment—viz. tying wet cloths or poultices over the eye, cannot be too strongly condemned; it may produce temporary relief of irritation, but aggravates the inflammation, and is very apt to lead to ulceration of the cornea. A mild astringent lotion should be used thrice or oftener in the day (boracic acid 10 grains, alum 3 grains, to the ounce of water); and a little simple ointment, e.g. boracic ointment, applied to the lids at bedtime to prevent their becoming glued together. The chronic form often requires stronger remedies, but they should not be used except under medical advice.

(*b*) *Purulent Conjunctivitis* resembles the last, but is very much more severe, and highly dangerous. In its most characteristic forms it is known as *gonorrheal ophthalmia*, and *ophthalmia neonatorum* (eye inflammation of new-born children). To the latter variety about one-third of the blind persons in Europe owe their loss of sight. It is caused by infection of the infant's eye with gonorrhœal discharge at birth; and the discharge from an affected eye will infect any other eye with which it comes in contact. The conjunctiva becomes intensely red and swollen, and the lids partake in the swelling so that they cannot be opened; there is severe burning pain, and after two days or more a profuse discharge of matter. The danger to sight is due to the fact that the cornea is extremely apt to be destroyed, wholly or in part, before the inflammation subsides. In infants the disease usually begins on the third day after birth, and is, as a rule, less severe than in the adult, but unfortunately is often overlooked, or regarded as of no importance till irreparable mischief has been done. Scrupulous cleansing of the eyes immediately after birth, and dropping in of a 2 per cent. nitrate of silver or of corrosive sublimate lotion (1 grain to 8 ounces) is the best preventive. When the disease has commenced, very frequent removal of discharge and washing with a similar lotion is necessary. But all such cases should at once be put under the charge of a medical man.

(*c*) *Pustular* or *Phlyctenular Conjunctivitis* is a form of inflammation very frequent in children, much less so in adults. It is an indication of a lowered state of the general health, and its treatment must include fresh air and light, good food, and cod-liver oil or some other strengthening medicine. The inflammation does not extend all over the white of the eye, but is localised in one or more sections of it, and is most intense near the margin of the cornea, where one or more small rounded blebs or pimples may be seen. It is often accompanied in children by extreme tenderness to light; but the tendency to this is aggravated by a bandage or darkness. The local treatment should be bathing with boracic acid or some other mild astringent lotion; but, unless the case be very mild, a medical man should be consulted.

(*d*) *Granular Conjunctivitis*, or *trachoma*, is an exceedingly chronic and intractable disease. It is sometimes called Egyptian ophthalmia, having been extremely prevalent in the French army in Egypt in 1798. In Europe it is most common among the Jews and the Irish, but is often troublesome in industrial schools and similar institutions. It is encouraged by overcrowding, bad ventilation, and other unfavourable hygienic conditions, and is undoubtedly somewhat contagious. It is characterised by numerous distinct semi-transparent elevations on the conjunctiva of the lids, chiefly the upper. It often lasts for months or years, and is chiefly dangerous on account of the shrinking of the conjunctiva produced by it, which leads to trichiasis, Ectropion (q.v.), and opacity of the cornea. It should always be treated by a skilled medical man.

(*e*) In *Diphtheritic Conjunctivitis* there is a 'false membrane' formed on the conjunctiva, as in Diphtheria (q.v.) in other situations. It is happily rare in Britain.

Diseases of the Cornea.—The most common and important are inflammations associated with ulceration—i.e. destruction of some of the corneal substance. This is replaced when healing takes place by imperfectly transparent tissue, and results very frequently in great impairment of vision (irregular Astigmatism, q.v.), even where no obvious mark remains. The appearances, symptoms, and appropriate treatment of different forms and stages of corneal ulceration are extremely various, and cannot profitably be discussed here. Skilled medical advice should always be obtained. It must suffice to say that the eyes should be rested, shaded from light, and bathed, generally with boracic or corrosive sublimate lotion. Poulticing or tying up the eyes should never be resorted to unless under a doctor's orders, as it is usually still more mischievous than in conjunctivitis.

In one form of inflammation of the cornea, called *interstitial*, there is an appearance all over it of great haziness or even complete opacity, but without breach of surface. It occurs usually in boyhood or girlhood, and though alarming in appearance and tedious, generally results in complete recovery. Mr Jonathan Hutchison first pointed out that it is usually a manifestation of congenital syphilis.

The *sclerotic* is comparatively seldom affected by disease, probably on account of its slight vascularity and comparatively low vitality.

The *iris* is liable to inflammation (*iritis*), characterised by severe deep-seated pain, redness of the white of the eye, contracted pupil, and much dimness of sight. The inflammation, if unchecked, produces adhesion between the posterior surface of the iris and the anterior capsule of the lens, which may permanently interfere with vision, or even lead ultimately to complete loss of sight. Local treatment at the early stage by Atropia (q.v.) dilates the pupil and prevents the formation of adhesions. Unless the result of injury, iritis usually depends on constitutional causes, especially syphilis and rheumatism, and treatment of these is of prime importance for its cure. Medical aid should be sought at once; for atropia, which is most beneficial in iritis, is disastrous in glaucoma, a disease which sometimes resembles it in many of its symptoms.

The chief disease of the *lens* is opacity, or Cataract (q.v.); it may also be displaced or dislocated, either from an anomaly in its development, or as the result of injury.

Diseases of the deeper structures of the eye (choroid, vitreous humour, retina and optic nerve) usually require for their recognition the use of the Ophthalmoscope (q.v.). Generally speaking, they are associated with little or no pain, and attract the patient's attention in consequence of the dimness of vision they produce. They are much less amenable to treatment in most cases than affections of the more superficial parts.

Inflammation and atrophy of the *choroid* occur in several forms; the most distinct are those occurring in syphilis, in old age, and in connection with high degrees of short-sightedness (progressive myopia, see below).

The *vitreous humour* rarely if ever becomes diseased, except in consequence of changes in the ciliary body or choroid. The abnormal condition generally manifests itself in more or less opaque threads or films, which move with the movements of the eye, and appear to the patient as clouds or dark lines interfering with vision, much more large and distinct than the 'muscæ volitantes' present in the normal eye.

The *retina* may be the seat of hemorrhage or of inflammation in many forms of disease. The most common and characteristic retinitis is that associated with Bright's disease (q.v.), which is almost always of very serious import. Its main artery may become blocked by a plug carried into it from the heart or elsewhere (*Embolism;* see ARTERIES, DISEASES OF), an accident which causes sudden and usually almost complete loss of sight. Not unfrequently, too, the retina becomes detached from the choroid, either as the result of disease or injury, and floats in the

vitreous chamber in front of its normal position, a condition greatly interfering with sight, and most difficult to improve.

The *optic nerve* may become inflamed (*optic neuritis*), most commonly in consequence of an inflammation or tumour of the brain or its membranes. It may degenerate (*optic atrophy*) either after inflammation or independently of it. In the latter case, however, as well as the former, there is in the great majority of instances some disease of other parts of the nervous system (brain or spinal cord).

There are two diseases chiefly affecting the deeper parts of the eye which it is desirable to describe at some length, as their course is often insidious, and their results when not recognised early, most disastrous, while timely interference is often signally successful in preserving the sight. These are *glaucoma* and *sympathetic ophthalmia*.

Glaucoma occurs most commonly during or after middle life, frequently in persons whose eyes are hypermetropic (see below). It may come on with such suddenness and intensity that vision is lost in a few hours, or its course may extend over years. Always, however, if unchecked, it tends to progress till sight is destroyed. Both eyes are usually affected, but often one long before the other. In many cases there are *premonitory* symptoms, consisting in temporary attacks of cloudiness of vision, during which the patient, when looking at a light (e.g. a gas or candle flame), sees it surrounded by coloured rings or halos. During this 'premonitory stage,' the vision is perfectly normal between the attacks; but they become more frequent and prolonged, till it is permanently impaired. Variability of the symptoms is usually a characteristic feature in all stages of the disease. Often in the later phases, and always in acute and severe cases, much pain is experienced in and around the eye affected. The pupil is large and immobile; the iris and lens farther forward than normal; the cornea more or less hazy; and some of the blood-vessels of the white of the eye larger and more visible than they should be. The most important sign of the disease, and the feature on which many of its characteristics depend, is increased hardness of the eyeball, owing to increase of its contents. The exact cause of this increased hardness is not fully understood, nor the way in which some of the symptoms observed depend upon it; but it varies with the symptoms, being always more marked when the pain and dimness are at their worst. Chronic insidious cases are often mistaken for cataract, though the use of the ophthalmoscope readily distinguishes between the two conditions; in the most acute cases, the headache, sickness, and general disturbance of the system is sometimes so severe that the condition of the eyes is overlooked, and the disease is looked upon as a 'bilious attack' till the vision is hopelessly destroyed.

The disease was regarded as absolutely hopeless till Von Graefe, in 1857, proved that the removal by operation of a portion of the iris of a glaucomatous eye might arrest the process. This proceeding (*iridectomy*), though by no means uniformly successful, does good in the majority of cases, and has been of enormous benefit. But if too long delayed, it is of no avail for the restoration of vision.

It is of great importance that atropin or belladonna should not be applied to an eye with any tendency to glaucoma, as they aggravate the disease, and sometimes even produce it. Eserin, the active principle of the Calabar bean, has an action on the eye antagonistic to atropin, and can often keep glaucoma in check, though it rarely cures it. Pilocarpin, the active principle of Jaborandi, has a similar action.

Sympathetic Ophthalmia is the name given to a form of inflammation, chiefly of the iris and ciliary body, occurring in an eye previously healthy in consequence of disease or injury of the other. Almost, if not quite, invariably the eye first affected has had its coats (cornea or sclerotic) perforated; and the process in the second eye may begin at any time, from a fortnight to many years after this occurrence. It is an extremely insidious disease, sometimes quite painless; but also extremely dangerous, for it often leads to total loss of sight. The early symptoms are watering, tenderness to light, and dimness of sight, especially of near objects. When it begins, there is almost invariably irritability and tenderness to touch in the eye which is the origin of the disease. It can be absolutely prevented by early removal of the eye first affected; but if this be delayed till the inflammation has begun in the second eye, it may be useless. An eye which has received a perforating wound, particularly in the 'ciliary region'—i.e. just outside the cornea—may therefore at any subsequent period become a source of danger to the other eye; and if its vision is destroyed there can be no doubt that it should be removed. Even if some useful sight is retained, this may sometimes be desirable; but at all events, every one who has suffered from such an injury to one eye should know that the slightest symptoms of irritation or failure of sight in the other should at once lead him to seek skilled advice. Recent researches have rendered it probable that this form of inflammation is caused by micro-organisms, though this is not quite definitely established.

Errors of refraction are those defects in the dioptric media of the eye which, without diminishing their transparency, interfere with the formation of a retinal image in the normal way. Astigmatism (q.v.) has already been noticed; presbyopia is the failure of accommodation natural to age (see above). It remains to describe *myopia*, or short-sightedness, and *hypermetropia*, or long-sightedness. In most cases the condition of both eyes is alike, or nearly so; but exceptionally there is a considerable difference between them (*anisometropia*).

The knowledge of this branch of the subject was first systematised and placed on a satisfactory basis by Donders (1818–89), a distinguished Dutch physician and physiologist, professor of Physiology at Utrecht, in his work on *Anomalies of Accommodation and Refraction of the Eye* (Eng. trans. pub. by Sydenham Society, 1866).

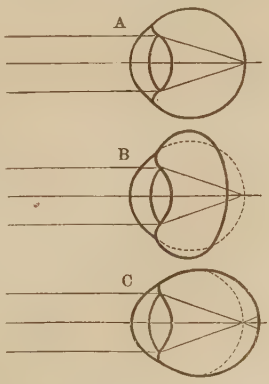


Fig. 12.

A, Normal eye: parallel rays brought to a focus at retina. B, Hypermetropic eye: globe shortened; parallel rays not yet brought to a focus when they reach retina. C, Myopic eye: globe lengthened; parallel rays brought to a focus in front of retina.

The normal eye in the position of rest is adjusted for parallel rays—i.e. for a distant object, and by means of the accommodation can be focused for a near object. The short-sighted eye at rest is adjusted for divergent rays—i.e. for a near object; accommodation enables it to focus for a still nearer object, but it can make no change enabling it to see clearly beyond its 'far point'—i.e. that for which it is adjusted at rest. The long-sighted eye at

rest is adjusted for convergent rays, which do not occur in nature; accommodation enables it to focus parallel rays (from distant objects), or divergent rays (from near objects), but not to see so near as a normal eye of the same age.

These defects generally depend on an abnormality in the length of the antero-posterior diameter of the eyeball; in short-sighted eyes it is greater, in long-sighted less than the normal (see fig. 12). They can be corrected by the use of suitable glasses; in short-sighted eyes concave lenses are used, which render the rays of light falling upon them more divergent; in long-sighted eyes convex lenses, which render the rays less divergent or convergent.

Loss of accommodation occurs with the progress of years in such eyes, just as in normal ones, though the effects are somewhat different. The short-sighted eye continues to be able to see near at hand without spectacles; but, contrary to the popular belief, has no other advantage over the normal eye as age advances, for vision of distant objects does not improve. The long-sighted eye in time loses the power of seeing even distant objects without spectacles; and the higher the degree of long-sightedness the earlier the age at which this occurs.

An abnormal shape of the eye, on which these 'errors of refraction' usually depend, is frequently hereditary, and is incurable; it usually remains stationary after early adult life, but in some cases of myopia, where it is associated with disease of the choroid, tends to become worse (*progressive* or *malignant* myopia). The object of treatment must be to counteract, so far as possible, the inconvenience resulting; and this can generally be done by the use of spectacles or eyeglasses. No general rules can be laid down as to their use, as much depends not only on the degree of the abnormality, but on the age and occupation of the individual. If glasses conduce to comfort and to the preservation of the sight, no mere regard for appearance should prevent their being worn.

Diseases of the Eyelids.—A *stye* is practically a minute Boil (q.v.) formed in the eyelid, and discharging at its margin. It should be fomented frequently with hot water till it bursts. Constitutional treatment is often desirable, as styes often occur, like boils, in groups or series.

Small rounded swellings (*tarsal cysts*) often form under the skin of the lids, owing to obstruction of the duct of a Meibomian gland. They are usually painless, but require for their cure the evacuation of their contents through a puncture on the inner surface of the lid.

A form of Eczema (q.v.) often occurs at the margin of the lids, called *blepharitis*, most commonly in delicate children. It can usually be readily cured if attended to in time; but if neglected, as it too often is, leads to destruction (blear eyes) or misdirection (trichiasis) of the eyelashes, and much subsequent trouble. It is characterised by redness and ulceration of the edges of the lids, usually masked by crusts adhering to the lashes. Frequent removal of these, with the daily application of a stimulant ointment (e.g. yellow oxide of mercury, 8 grains to the ounce of simple ointment), and the use of tonics generally effect a cure. Inversion (Entropion, q.v.) and eversion (Ectropion, q.v.) of the margins of the lids, and misdirection of the eyelashes (trichiasis), so that they rub against and irritate the cornea, are troublesome affections, usually requiring operation for their removal.

Diseases of the Lachrymal Apparatus.—A 'watery eye' (*epiphora*), when no irritating affection of the eye itself is present, usually proceeds from stricture of the nasal duct, or some other cause, which prevents the tears from discharging by their natural channel into the nose. The condition can be remedied in most cases by slitting up the canaliculus (see fig. 7), and passing graduated probes through the duct to restore its patency. If unattended to, it generally leads sooner or later to abscess of the lachrymal sac, with much swelling and pain.

Injuries.—In no part of the body is there so often great disproportion between the severity of an injury and the amount of pain and irritation it occasions. A penetrating wound sometimes causes less discomfort than a mere particle of sand beneath the eyelid. Any wound or blow affecting the eye, therefore, particularly if it interfere at all with the sight, should be seen by a doctor as speedily as possible. Substances thrown against the eye may injure it. Quicklime is rapidly destructive to the eye, slaked lime and mortar less so. When one of these, or any other alkaline caustic, has got into the eye, diluted vinegar should at once be used to neutralise it. If it is oil of vitriol (sulphuric acid) or another acid that has been the cause of the injury, a weak solution of soda may be used in the first place to neutralise the acid. After this, sweet oil is the best thing to introduce, until the surgeon arrives. In gunpowder explosions near the eye, besides the burn, the particles are driven into the surface of it, and will cause permanent bluish stains over the white of the eye, unless they are carefully removed at the time. When chips of glass, stone, &c. are driven into the interior of the eye, there is little hope of its being saved from destructive inflammation, though fragments of iron and steel are sometimes removed by means of a strong electro-magnet, with a successful result. In these and all other *penetrating* wounds—i.e. those where the cornea or sclerotic is broken through, the possibility of subsequent sympathetic ophthalmia in the other eye must be borne in mind. When only partially sunk into the cornea, as is often the case with sparks of cinder or iron, &c., or 'fires,' as they are called, the rubbing of the projecting part on the eyelid causes great pain, and the surgeon has not much difficulty in removing them. Most commonly these, or other 'foreign bodies,' as particles of dust, sand, seeds, flies, &c., when not speedily washed away by the tears, merely get into the space between the eyeball and the lids, almost always concealed under the upper, as it is the larger, and sweeps the eye. They cause great pain, from the sensitiveness of the papillary surface of the lid, and of the cornea over which they are rubbed by its movements, soon excite inflammation, and their presence, as the cause, is apt to be overlooked. The lid must be turned round to find them. To do this, pull the front or edge of the lid forward by the eyelashes, held with the finger and thumb, and at the same time press down the back part of the lid with a small pencil or key, directing the patient to look downwards. The lid will readily turn round, when the body may be seen about its middle, and may be removed with the corner of a handkerchief. Another plan, which the person himself may try, is to pull forward the upper lid by the eyelashes, and push the lashes of the lower lid up behind it, when the foreign body may be brushed out. After the bodies are removed, a feeling as if they were still there may remain for some time. See BLIND, COLOUR-BLINDNESS.

ARTIFICIAL EYES are worn for the sake of appearance in cases where, as the result of disease or injury, an eye has either been totally lost, or rendered unsightly. They are, moreover, distinctly advantageous in cases where a gaping socket is liable to irritation by dust, cold winds, &c. They cannot be used unless the size and prominence of the eyeball is at least somewhat diminished. Few surgeons in Britain recommend them to be worn unless the eyeball is either entirely removed (enucleation), or has the front part removed

(abscission), or all the contents extracted (evisceration); for the artificial eye is apt to cause irritation of the sensitive anterior portion of the globe, and may lead to the development of sympathetic ophthalmia (see above). Enucleation is the most certain means of preventing this; but the other operations named above allow of better movement, and give a more natural appearance to the eye.

An artificial eye consists of a thin shell, usually of enamelled glass, coloured to present as nearly as possible the same appearance as the visible part of the normal eye. Celluloid (q.v.) has been used instead of glass, and is said to last better, as its surface is not affected by the secretions; while it has the advantage that it is not brittle, and can easily be pared to fit the socket accurately. Rubber eyes, enamelled in front, were introduced in 1916. To obtain a satisfactory result, it is necessary either to have an artificial eye specially made, or to be able to select from a very large stock; as colour of iris, size of pupil, tinge of sclerotic, as well as curvature of surface and form of margin, must be adapted to the particular case. They are therefore to be got to most advantage in large cities, such as London or Paris.

The eye must not be worn continuously, but removed each night and replaced in the morning. It is slipped in under the lids, which hold it in position. Even when the globe has been entirely removed, the muscles, by their attachment to the tissues remaining in the orbit, usually effect movements in the same direction, though not of the same extent, as those of the normal eye; and it is often difficult for any but a practised observer to detect to what the difference between the two is due. A single glass eye can rarely be worn more than a year without being polished, for the surface becomes roughened by the action of the tears, &c., and irritates the lids as they rub over it.

Common Eyebright (*Euphrasia officinalis*).

Eyebright (*Euphrasia*), a genus of Scrophulariaceæ. The British species (*E. officinalis*), a plant of extraordinary variability, is a root-parasite common in pastures and grassy uplands, which at the end of summer are gemmed abundantly with its bright little flowers. From this general aspect and spotted corolla the popular name is derived; hence, too, the doctrine of signatures ascribed it an efficacy in the treatment of eye-diseases, which a mild astringency long aided it to maintain. It is the *Euphrasy* of Milton.

Eylau, a town of 3500 inhabitants, in East Prussia, 23 miles S. of Königsberg by rail. Here Napoleon encountered the allies—Russians and Prussians—under Bennigsen, 8th February 1807. Darkness came on while the contest was still undecided; but as Napoleon had a considerable force of fresh troops close at hand, the allies retired during the night upon Königsberg. Their loss is estimated at about 20,000; that of the French is set down at 10,000, but must have been considerably greater. The place is called Preussisch-Eylau, to distinguish it from Deutsch-Eylau (Polish, *Ilawa*), also in East Prussia, a town of 10,000 inhabitants, 75 miles ENE. of Bromberg.

Eyot, or Ait (O.E. *iggath*), a little island in a river, especially one overgrown with willows, as in the Thames.

Eyre, Edward John, an Australian explorer and colonial governor, the son of a Yorkshire clergyman, was born in August 1815. Emigrating to Australia at the age of seventeen, he prospered as a squatter on the Lower Murray, and was appointed a resident magistrate and protector of the aborigines. In 1840 he failed in an attempt to reach the centre of the continent; he discovered and passed Lake Torrens, but was blocked by the great salt swamp afterwards called Lake Eyre (q.v.). On his way back he made for the coast at Port Lincoln, and followed it westwards, in spite of enormous difficulties, to Albany in Western Australia (*Discoveries in Central Australia*, 1845). In 1847–53 he was lieutenant-governor of New Zealand, and in 1854–60 of St Vincent in the West Indies. In 1862 he was appointed governor of Jamaica, where in 1865 negro disturbances broke out. The outbreak was suppressed with sharp, stern severity, martial law being proclaimed in the disaffected district; a wealthy mulatto named Gordon, a Baptist and member of the Jamaica House of Assembly, who had taken a leading part in instigating the rising, was hurriedly tried by court-martial, and hanged two days after, the sentence having been confirmed by Eyre. A commission sent to inquire into this case found that Gordon had been condemned on insufficient evidence, and Eyre was recalled. On his return he was prosecuted by a committee of whom John Stuart Mill was the most prominent; Thomas Carlyle, Charles Kingsley, and Sir R. Murchison promoted the Eyre defence fund. The prosecutions could not be sustained; and eventually in 1872 the government refunded to Eyre the costs of his defence. After 1874 he lived in retirement, and he died 30th November 1901.

Eyre, Lake, a salt lake of South Australia, lying due N. of Spencer Gulf, at an altitude of 79 feet. Except in the season of rains, this lake is generally a mere salt marsh. It was discovered in 1840 by Eyre, who thought it part of Lake Torrens.

Eyre, Justices in. See Assize.

Eyria Peninsula, on the south coast of South Australia, is triangular in shape, its base being formed by the Gawler Range, whilst its sides are washed on the SE. by Spencer Gulf, and on the SW. by the Great Australian Bight. It constitutes a rich pastoral country.

Ezekiel, one of the most important of the Hebrew prophets. Our knowledge of his career is scanty, and is derived entirely from his own statements in his prophecies. He was the son of Buzi, and together with Jehoiachin, king of Judah, was carried away captive by Nebuchadnezzar in 597 B.C. Little can be surmised about his earlier life, except that he must have been closely associated with Jeremiah: nor do we know his age at the time when the catastrophe befell him. In Babylonia he settled in a colony of exiles at Tel Abib on the banks of the river Chebar. His public ministry began in 592 B.C., and lasted for twenty-two years. He became the religious leader of the exiles, who formed an independent community and enjoyed the privilege of self-government. Ezekiel seems to have attained a commanding position, and his preaching became popular, though he failed to carry the people with him in his attempts to purify religion. The effect of his ministry is described in xxxiii. 30–33: 'Thou art unto them as a very lovely song of one that hath a pleasant voice and can play well on an instrument; for they hear thy words, but they do them not.' The Book of Ezekiel is comparatively free from any serious critical problems. The attempts of some scholars—e.g. Geiger,

Seinecke, and Zunz—to prove that it is the product of the Persian period, have entirely failed, and the book is now, by the general consent of modern scholars, regarded as authentic. The only point in dispute is as to whether the prophecies were collected together in their present form by Ezekiel himself or by a later editor. The book falls into four divisions: (1) The first part consists of chapters i.–xxiv., and contains the prophecies which were delivered before the final fall of Jerusalem in 586 B.C. In this section Ezekiel announces the complete overthrow of Judah, on account of its increasing unfaithfulness to God and its perjury in forming an alliance with Egypt when it had accepted the suzerainty of Babylon. (2) The second part (chaps. xxv.–xxxii.) contains a series of prophecies against the surrounding nations, Ammon, Moab, Edom, the Philistines, Tyre, and Egypt, and announces the final doom of Tyre and Egypt. (3) The third part (chaps. xxxiii.–xxxix.) contains the prophecy of the restoration of Israel. The revival of the people is depicted under the figure of the resurrection of an army of dry bones, and the promise is held out of the advent of an ideal shepherd who is to spring from the house of David. (4) The fourth part (chaps. xl.–xlviii.) gives us an ideal picture of the restored Israel and the reformed temple-worship. These chapters form a connecting link between Deuteronomy and the 'Priestly Code,' and pave the way for the introduction of the ritual of the Levitical system. As Dr Bennett says, 'Ezekiel represents a transition and a compromise: the transition from the ancient Israel of the monarchy to Judaism, and the compromise between the ethical teaching of the prophets and the popular need for ritual. He also marks the transition from the prophet to the scribe or theologian.' Among the other characteristics of Ezekiel we may note (1) the use of magnificent but artificial symbolism, which justifies Jerome's description of the book as a 'labyrinth of the mysteries of God.' (2) The stress laid throughout the book on the transcendence of God; (3) the constant emphasis on individual responsibility; (4) the introduction of apocalyptic elements into prophecy.

The most useful books are Skinner (*Expositor's Library*), Davidson (*Cambridge Bible*), Lofthouse (*Century Bible*). Among the more elaborate commentaries are those of Cornill, Bertholet, Smend, Keil.

Ezra, the leader of Israel's return from the captivity in Babylon. Our knowledge of his career is derived from Ezra, vii.–x.; Nehemiah, viii.–x.; and the apocryphal 1 Esdras. He is described as a 'priest' and 'a scribe,' and, according to the narrative, obtained great favour at the court of Artaxerxes Longimanus (464–425 B.C.). The *firman* in which Artaxerxes proclaimed the liberty of the Jews to return to Palestine (Ezra, vii, 11–26) is so favourable that considerable suspicion attaches to its genuineness. It seems hardly likely that Artaxerxes would have sent presents of gold and sacred vessels for Ezra to offer to God in the temple of Jerusalem. In 458 B.C. Ezra led a company of some 1500 men (the exact number differs in different documents) out of Babylonia, and after a journey of four months reached the holy city. Soon after his arrival Ezra applied himself to the task of reform. The most serious problem that confronted him was the question of intermarriage. The Jews who had remained in Palestine had, in defiance of the law of God, intermarried with foreigners. In order to grapple with the situation Ezra summoned an assembly of the people and urged upon them the necessity of repentance, and besought them to annul these unlawful marriages. The proposal was not received with enthusiasm, and the meeting was broken up by a great storm of wind and rain. A commission, however, was appointed to remedy the evil. Ezra soon realised the impossibility of bringing the people as a whole up to his own standard of religion, and so he formed a society of men like-minded with himself, who pledged themselves to live according to the law of God. In 444 B.C. Ezra issued a new law to the people. There can be little doubt that this new law is represented by 'the Priestly Code,' which is now embodied in the Pentateuch (see BIBLICAL CRITICISM). The establishment of this code marked an epoch in the history of Israel, since it initiated the era of legalism.

The Book of Ezra is intimately connected with the Book of Nehemiah. Originally they were one document and formed a continuation of the Book of Chronicles. In their present shape they can scarcely have come into existence before the period 300–250 B.C. The author's name is unknown, but the interest which he displays in the Levites and the temple music suggests that he belonged to one of the Levitical choirs. The writer, however, embodied in these books earlier documents of varying value. There is a whole section of Ezra (vii. 27–ix.) which is written in the first person, and which is probably, therefore, derived from memoirs composed by Ezra himself. Another section of the book (Ezra, iv. 8–vi. 18; vii. 12–26) is written in Aramaic, and is clearly taken from an earlier source which is usually dated about 450 B.C. These two sections constitute the most valuable part of the book from a historical point of view. The first three chapters of the book are the work of the compiler himself; some of the statements found in them have been challenged by modern criticism, notably the account of the return of the exiles in the reign of Cyrus (537 B.C.).

See commentaries by Ryle (*Cambridge Bible*), T. Wilton Davies (*Century Bible*), Bertheau-Ryssel, Keil, Schultz; Sayce, *Introduction to Ezra, Nehemiah, and Esther;* Hunter, *After the Exile;* Torrey, *The Composition and Historical Value of Ezra-Nehemiah;* Cheyne, *Jewish Religious Life after the Exile.*

Ezzelino da Romano, an Italian Ghibelline family, whose most famous and warlike representative, Ezzelino or Eccelino IV. (1194–1259), *podestà* of Vicenza, is known from Dante as notorious for cruelty. He won many victories for Frederick II., but was ultimately wounded in battle, defeated, and captured; he died in prison, and all his family were put to death.

F

the sixth letter of our alphabet, represents the sixth letter, *wāw*, of the ancient Semitic alphabet, which denoted primarily the consonant *w*, and secondarily the cognate vowel *ū*. The word *wāw* in Hebrew means a curtain-pin, but it has no affinities in Semitic, and probably the curtain-pin was so called because its shape resembled that of the letter, which in early inscriptions appears as Y. The name *wāw* was, on this view, an arbitrary invention intended to express the sound which it contains twice over; in Hebrew and Aramaic initial *w* is so rare that it was impossible to provide the letter with a name signifying a visible object. The shape of the letter underwent various modifications in the later Semitic scripts, becoming in Hebrew ו, in Syriac ܘ, ﻭ, and in Arabic و.

In early Greek use the letter assumed two forms, Y, which is very close to the original type, and F, which is a modification probably due to assimilation to the preceding letter E. In the oldest inscriptions these two forms are already differentiated in function, F being used for *w*, and Y for *u*. The consonant-sign F retained the sixth place in the alphabet, while Υ (the ancestor of our U, V, W, and Y) was placed after T, the last of the original 22 letters.

The sound *w* and its symbol eventually disappeared from the Greek language (see DIGAMMA), but were still in use when the alphabet was adopted by the Romans. The sixth letter in its original function was found by the Romans unnecessary, as their *w*-sound was merely a devocalisation of *u*, and could be represented by the same symbol as the vowel, namely V. Latin, however, had one consonant-sound (nearly or exactly that of our *f*) unknown to the Greek language, and it was necessary to provide a sign for this. The nearest Greek sound was *wh*, which was written FH. Hence in early Latin inscriptions the sound *f* was rendered by FH; but it was soon perceived that the H could be dispensed with. The modern forms of the letter are obviously derived from the Roman F; our script *f* has lost all resemblance to the original, but it is easily seen to result from the attempt to join *f* to the preceding and following letter without taking off the pen. In mediæval MS. the minuscule *f* was often doubled to serve as a capital; a survival of this practice is seen in the spelling of certain surnames, as ffoulkes, ffarington.

In nearly all languages written in the Roman alphabet, F retains its Latin sound—the voiceless labial spirant. In early Latin it was perhaps bilabial, but afterwards became dentilabial (formed between the upper lip and lower teeth) like the *f* of most modern languages. In Old English *f* was in the middle of words pronounced like our *v*; in Welsh a single *f* has always this value, the sound of our *f* being expressed by *ff*.

In Irish written in the native character, an etymological *f* which has become silent is written ḟ; in transliterated Irish and in Scottish Gaelic *fh* is substituted for this. In modern English the only exception to the normal pronunciation of the letter is the word *of*, where the *f* has been pronounced as *v* from Old English times.

The Latin name of the letter, *ef*, is, like those of L, M, N, R, S, formed differently from those of the stopped consonants, *be*, *ce*, *de*, &c. The reason probably is that as the spirants, liquids, and nasals are capable of prolongation at the end of a syllable, their sound was more distinct in a final than in an initial position. The name is preserved in the modern European languages, but has become disyllabic in Italian (*effe*) and Spanish (*efe*).

F, in Music, is the fourth note of the natural diatonic scale of C. See MUSIC, SCALE, KEY.

Faam, or FAHAM (*Angræcum fragrans*), an orchid, native of Madagascar, &c., prized for the fragrance of its leaves, which is owing to the presence of *Coumarin* (q.v.), and resembles that of the Tonka Bean and of Vernal Grass. In Mauritius an infusion of faam leaves is in great repute as a cure for pulmonary consumption and as a stomachic. It has also been imported into France as Isle of Bourbon Tea (*folio faham*), and used in infusion and as a source of perfume.

Fabaceæ. See LEGUMINOSÆ.

Faber, CECILIA. See CABALLERO, FERNÁN.

Faber, FREDERICK WILLIAM, hymn-writer, was born at the Yorkshire vicarage of Calverley, 20th June 1814, passed from Shrewsbury School to Harrow, and thence to Balliol College, Oxford, and in 1834 was elected a scholar of University College, in 1837 a fellow. Already he had come under the spell of Newman, and in 1845, after three years' tenure of the rectory of Elton, in Hunts, he followed him into the fold of Rome. He founded a community of converts at Birmingham—then Wilfridians, he himself being Brother Wilfrid, from his *Life of St Wilfrid*, published in 1844. With his companions he joined in 1848 the Oratory of St Philip Neri; next year a branch under his care was established in London, finally located in 1854 at Brompton, where he died 26th September 1863. Faber wrote many theological works; but his fame will rest upon his hymns—'The Pilgrims of the Night,' 'The Land beyond the Sea,' &c. A collection of 150 hymns was published in 1862. See the Lives by J. E. Bowden (1869; new ed. 1892) and his brother, F. A. Faber (1869).

Faber, GEORGE STANLEY, Anglican divine, was the eldest son of the Rev. Thomas Faber, and was born at Calverley vicarage, near Bradford, 25th October 1773. He entered University College, Oxford, in 1789, and four years later was elected Fellow and Tutor of Lincoln College. As Bampton Lecturer for 1801, he delivered the lectures subsequently published under the title of *Horæ Mosaicæ* (1801). In 1805 he became vicar of Stockton-on-Tees, and, after several changes, received in 1832 the mastership of Sherburn Hospital, near Durham. He died at Sherburn on 27th January 1854. Of Faber's numerous theological works, those on prophecy were most popular.

Faber, JOHN (1684–1756). See ENGRAVING.

Fabianism. The Fabian Society is the name chosen by a body of English Socialists who, in the year 1884, came together at a series of private

meetings in London for the discussion of social problems in general, and in particular of the views of a Scottish-American thinker, Thomas Davidson, who was then visiting England and endeavouring to rouse interest in the philosophy of Rosmini. The group formed around Davidson divided, after his return to America, into two sections, one of which survived for some years as the Fellowship of the New Life, and was lost sight of. The other, more matter-of-fact, militant, and political, established itself as the Fabian Society. All trace of Davidson's influence soon vanished; but the character of the Society was determined by its origin in a group of educated persons of the professional and higher official classes, including civil servants of the upper division, stockbrokers, journalists, and the propertied bourgeoisie generally, all under the age of thirty, with their careers still before them.

At that date Socialism, after a period of disrepute and almost of oblivion following the sanguinary suppression of the Paris Commune of 1871, had revived with extraordinary force and rapidity. The keenest of the converts to land nationalisation made in 1882 by the lecturing campaign of Henry George, and by his book *Progress and Poverty*, were carried on by the impetus of their conversion to the study of Karl Marx and Proudhon, and the formation of Societies of Land Nationalisers, Social-Democrats, and Anarchists, all aiming at the redemption of the wage workers from poverty, and looking to that class for their recruits, who were enlisted by public harangues at subscriptions of a penny a week, the program being to continue the process until an overwhelming majority of the workers had joined, when the Society would reconstruct European society on Georgist, Marxist, or Proudhonic lines.

Such Societies, hopeless and useless except for agitating and demonstrating against the unemployment and misery of the period of bad trade then prevailing, had no attraction for critical students of the great evangelists of the movement, especially for the politically experienced ones, much less for upper division civil servants with a practical knowledge of government and administration. The Fabian Society gave these students just what they wanted: a nucleus for a Society of their own class, and a name which proclaimed a literate atmosphere and a sane and patient temperament. Also, as the name suggested nothing else, the Society offered them an unformed constitution out of which they could make what they pleased. For several years the Society had less than forty members, who met in one another's drawing-rooms and administered an income from subscriptions of less than £40 a year. There was no fixed subscription: members gave what they could afford. There was no recruiting; and excitable or eccentric applicants for membership were discouraged and, if necessary, excluded. Members had to sign a declaration that they were Socialists, and that they accepted the Basis, a document stating the aim of the Society as 'the re-organisation of society by the emancipation of land and industrial capital from individual ownership, and the vesting of them in the community for the general benefit.' To this was added 'the transfer to the community, by constitutional methods, of all such industries as can be conducted socially,' and 'the establishment, as the governing consideration in the regulation of production, distribution, and service, of the common good instead of private profit.'

The Society soon asserted its critical independence of Socialist dogma, and affirmed its constitutional and practical character. A nominally separate body, called the Hampstead Historic Society from its place of meeting, but really a committee of the leaders of the Fabian Society, conducted a critical examination of Marx, and rejected his theory of value. This was followed by a less thorough examination of Proudhon's famous thesis that property is theft, mainly because this work had been for some reason adopted as a sort of gospel of Anarchism in opposition to Marx's *Das Kapital*, 'the Bible of German Social-Democracy.' These critical exercises were then discarded; and a course of original and independent study entered upon, with the result that in 1889 the Society published *Fabian Essays*, which, first issued as a six shilling volume, was so successful that a cheaper edition was hastily prepared, and gained a large circulation which has continued steadily up to the present moment. In these distinctively English essays there is no trace of Marx or Proudhon or the earlier revolutionary veterans of 1848. The economics, consisting of Ricardo's law of rent, and Jevons's law of value, are quite orthodox. It is shewn that the entry of the State into productive industry, far from being an untried, dangerous, and economically unsound innovation, is a fact already accomplished and in successful operation to an extent hitherto unnoticed. The notion of a sudden change from Capitalism to Socialism by the physical force of an insurrection is ridiculed and dismissed as 'catastrophic Socialism'; and the transition from Capitalism to Socialism is dealt with as part of the course of ordinary constitutional evolution. Heterodoxy in religion is omitted as entirely irrelevant. Socialism, in short, is presented as the creed of a constitutional political party pursuing its aims precisely as any other constitutional political party does, and involving no sacrifice whatever of current respectability and morality on the part of its adherents. This, at a time when Socialists were still very generally regarded as outlaws, and when the majority of avowed Socialists were themselves so saturated with revolutionary romance that they protested vehemently against every attempt to open their ranks to the conventionally behaved bourgeoisie and the clergy, was a step in advance which soon became imperceptible through its general acceptance.

In the meantime the Fabians had been the first to grasp the opportunity offered to practical Socialism by the possibilities of municipal enterprise; and when the Local Government Act of 1888 was passed, and the London County Council established, they circulated leaflets suggesting questions to county councillors in which, without any mention of Socialism, candidates were invited to pledge themselves to reforms involving various forms of direct municipal enterprise without the intervention of private commercial contractors, and to clear themselves of all suspicion of being opposed to 'moral minimum' wages or the abolition of sweating. The candidates for the new bodies, having no platform and no traditional policy to fall back on, snatched at the program thus adroitly suggested; and the policy of the supply of public needs by municipal trading, and the safeguarding of the interests of the workman by fair wages clauses, suddenly took shape in London as Progressivism. It was vigorously denounced and ridiculed as 'gas and water Socialism' by the other Socialist bodies; but it was extraordinarily successful at the polls, and retained its hold on London until the turn of the century, when the reaction towards official Liberalism which followed the South African war, and the rally of the Free Churches against the subsidisation of the Church of England

elementary schools by the Education Act of 1902, enabled the old parliamentary Liberals to oust the Fabian Progressives and replace them by Liberal partisans, with the unexpected result that the Progressive party in the Council, in ceasing to be Fabian, also ceased to be popular.

The success with which the Fabians imposed a program on the London County Council encouraged them to try their hands on the House of Commons. The method they adopted was that of Permeation, a word which they made current in Socialist and Labour politics as indicating Fabian tactics. Unlike the older societies, which held aloof from and excluded from their ranks members of all ordinary political bodies, the Fabians not only placed no restriction on their members as to their activity in other quarters, but actually urged them to join every other body to which they could obtain admission, in order to permeate these bodies with Socialist ideas, and persuade them to advocate Socialist measures. They had observed that, no matter which political party was in power at the moment, the Opposition was sure to be critical, impatient, and clamorous for reform. On this ground the Liberals, then in opposition, were first selected for permeation. Their local associations suddenly received several active and intelligent recruits; and the National Liberal Federation presently found itself committed to a series of resolutions of an unprecedented character, which were adopted at the annual conference of that body at Newcastle in 1891, and were thenceforth known as the Newcastle Program.

The general election of 1892, which the Liberal leaders wished to fight on the issue of Home Rule for Ireland, justified the bold assertion of the Fabians that the English working-class, worse off in many respects than the Irish, 'did not care a dump' for Home Rule, and that the election must be fought on social reform. The Liberal candidates, after their first taste of the temper of the electorate, hastily distributed Fabian pamphlets, made Fabian speeches, and won by a hair's-breadth. But their leaders, to whom the Fabian Society was hardly known, and the new departure repugnant and indeed unintelligible, dropped the Newcastle Program when they took office. The result was that two years later the Fabian Society, in a manifesto entitled 'To your Tents, O Israel,' which appeared in the *Fortnightly Review*, delivered a slashing attack on the Liberal government, making effective use of its technical political knowledge to discount the Government's plea that the slaughtering of its measures by the House of Lords and the slenderness of its majority in the House of Commons made any progressive legislation impossible. The Fabians produced a long list of administrative reforms promised in the Newcastle Program, which needed only the stroke of a minister's pen. No effective reply was forthcoming The Liberal leaders sulked disdainfully; and Lord Rosebery only remarked that he had said all along that the Newcastle Program was a mistake, like all programs. The Government quite underestimated the force of the blow, and in 1895 went into opposition for eleven years.

This stroke made an end of the direct political influence of the Fabians. Thenceforth they were intensely disliked and distrusted by the official section of the Liberal party, all the more as the Fabians made no secret of the fact that they had foreseen what would happen, and that the attack on the Liberal party was part of their original plan, which was now developed by the republication of the manifesto by way of preamble to a pamphlet entitled *A Plan of Campaign for Labour*, which laid down the lines for the formation of an independent Labour party in parliament.

But the long habit of regarding the Liberal party as the party of progress and the necessary instrument of every political advance made the Fabian attack on it almost as bewildering and scandalous to the working-classes as to the official Liberals. The older Socialist Societies, still unreconciled to the new Fabian tactics, encouraged the inference that those who attacked the Liberals, except from the extreme revolutionary point of view, must do so in the interests of the Tories, probably under the influence of bribes. The plan of campaign for Labour was not taken up; and the Fabian Society could only mark time until their temporary disrepute was aggravated by the outbreak of the war in South Africa. It was assumed on all hands that the Liberal Opposition, the working-classes, and the Socialists must oppose the war as a war of Capitalism, and support the Boers as its victims. The Fabian Society, in a pamphlet entitled *Fabianism and the Empire*, unexpectedly took the opposite view, and, for reasons that were as little to the taste of the Government as of the 'pro-Boers,' gave up the theocracy of President Kruger as obsolete and impossible, and declared for a consolidated British South Africa on the lines on which the final settlement was actually achieved. The Society, already suspected of Toryism, now stood convicted of Jingoism; and the limit of suspicion and discredit with the Liberal-Labour section was reached when the war was followed by a Conservative Education Bill, which threw the support of the Church schools on the rates. This roused all the old Nonconformist hatred of the Church which had been sown by the intolerance and class bias of generations of country parsons and squires, and which found expression in the Passive Resistance movement. But the Fabians again took the unexpected line of demanding public money for the Church schools on the ground that half the children in the country had no other schools to go to, and that only by financing the schools could the State impose on them the inspection and regulation needed to put an end to their abuses.

The breach of the assumed but wholly imaginary alliance between Liberalism and Fabianism was now apparent to all parties; but in the meantime the proposal for an independent Labour party in parliament had been vigorously pushed by a new body, the Independent Labour party, led by Keir Hardie and Mr Ramsay MacDonald. As its propaganda spread, detachment from the Liberal party became a qualification for the confidence of the workers instead of a bar to it; and the co-operation of the Fabians was welcomed when the Labour Representation Committee was founded in 1900. The Fabian Society was granted representation on the committee; and when, after the sensational Liberal and Labour victory at the general election of 1906, the Labour party became an accomplished parliamentary fact, the Fabian Society was affiliated to it, and allowed to retain its representation on the committee.

By that time the relative situation of the Society had altered considerably. During the twenty-two years of its existence Socialism had become Fabianised throughout Europe. Edward Bernstein, exiled by Bismarck in the 'eighties for his Socialism, had taken refuge in London; and, at the strenuous early debates of the Fabians, had heard the old doctrinaire Marxism torn to pieces, and a constitutional parliamentary and municipal Socialist program elaborated. Returning to Germany, he had divided the Social-Democratic party by heading a Fabian revolt against the old leaders, which became known as Revisionism. Vandervelde in Belgium, Jaurès in France, and Turati in Italy had become leaders of parliamentary Socialist

parties which had everything in common with the once distinctive features of Fabianism, and nothing in common with the veterans of 1848–71 whom the Fabians had superseded. In Australasia Labour parties had actually achieved parliamentary majorities, forming governments, and carrying into law many projects suggested and inspired by Fabian Essays and the long series of Fabian tracts which had supplemented them. Constitutionally, the Fabians were no longer pioneers: the ground they had broken was now occupied by the whole European centre of the Socialist movement.

Also, the Fabian leaders were no longer young men. Their personal ability had brought them work which inevitably competed heavily with the Society for their time and energy, and along with it a personal celebrity which made Permeation no longer possible for them as an unnoticed process. Sir Sydney Olivier [Lord Olivier], secretary to the Society for some years in its early days, distinguished himself in the colonial service; and finally, as Governor of Jamaica, could no longer take a direct personal part in the councils of the Society. Mr Bernard Shaw, achieving success as a playwright, first in America and Germany, and later on in England, substituted the theatre for the platform of the Fabian Society, and the prefaces to his published plays for Fabian pamphlets, as his chief means of propaganda. Mr Sidney Webb, on his marriage with Miss Beatrice Potter, whose genius for economic and industrial investigation had already declared itself, devoted himself to the monumental series of investigations into the history and structure of industrial democracy which are associated with his name and that of his wife, and to the foundation and development of the London School of Economics. Mrs Annie Besant, whose extraordinary gift of oratory for some years placed any public meeting in London at the mercy of the Fabian Society, passed through Socialism to Theosophy, and from London to India. Mr Graham Wallas, another of the Fabian essayists, became absorbed in the administration of public education, in professorial lecturing, and in sociological authorship. The late Hubert Bland found a new platform as a popular journalist. William Clarke, another very able essayist and journalist, died at a comparatively early age. The late Frank Podmore, whose studies of Owenite Socialism and its American derivatives are well known, was detached from the Society by his interest in psychical research. Mr Edward R. Pease, who was a stockbroker when the society was formed, became a working cabinetmaker for some years before rejoining the executive of the Society as its secretary, thereby acquiring direct personal experience of artisan life, an adventure parallel to that of Mrs Sidney Webb, who worked in disguise in the sweaters' dens of East London to investigate the conditions of the tailoring trade there. Mr Pease subsequently wrote a history of the Society.

The names of these makers of the Fabian Society are important, because their subsequent careers explain how it produced an effect on the Socialist movement, and on political thought generally, out of all proportion to its numbers and apparent resources. Largely by choosing its name happily, it attracted a handful of persons of more than average ability, with exceptional gifts of literary and oratorical expression. This concentration of talent was effected at a time when its possessors, being young and unknown, could enter unnoticed into the bodies in which they carried on their missionary work, and send their communications to the press in the disguise of ordinary professional journalists. The work done by them during the first ten years of the Fabian Society's existence was prodigious in quantity, and has been far-reaching in its effect; but the Press of that period, preoccupied with the Home Rule controversy and the party routine of the House of Commons, contains no record of it. One of their number has said: 'In the strength of my youth I delivered harangues, lasting from an hour to four hours, with long discussions afterwards, during a period of twelve years, at the average rate of three every fortnight, to large audiences; and nobody took the smallest notice of them. Now I cannot make the most trivial remark without finding it misquoted in half-a-dozen papers.'

In 1903 the Society made a brilliant recruit in Mr H. G. Wells, who called attention to the impossibility of developing Municipal Socialism within the limits imposed by our obsolete municipal boundaries. Later on Mr Wells tried to use the Fabian Society as an instrument for the social reconstruction he had sketched in his *Anticipations*. His project was received with enthusiasm by the whole Society; but the internal reforms he proposed included the superannuation of the older leaders, whose practice in debate, and dexterity in the handling of meetings and committees, made the task of adapting his proposals to their practical criticisms too tedious and irksome for his patience. The members recoiled from so violent a break with the traditions of the Society; and Mr Wells withdrew quietly after their refusal.

In 1907 'the equal citizenship of men and women,' always advocated by the Society, was added explicitly to its written Basis.

In 1909 the effective permeation of the Royal Commission on the Poor Law by Mrs Sidney Webb resulted in the issue by that body of a notable Minority Report, which gained so much support outside the ranks of professed Socialists that Mrs Webb was obliged to form a nominally new Society to push its proposals. It contains the Fabian solution of the unemployed question, and the Fabian proposals for the abolition of the poor law, and the redistribution and reorganisation of its functions.

By this time parliament was attempting to solve in its own way the social problems which the earlier Fabian propaganda had forced into English public consciousness and into colonial legislation. The Society consequently found itself occupied in severe criticism of the Government's methods, notably in the case of the Insurance Act of 1912, in framing which the Chancellor of the Exchequer ignored the investigations and proposals of the Fabians and their school, and went to Germany for his model, reproducing all the inconveniences and mistakes of the German experiment, and provoking a vehement agitation which threatened to wreck his party at the next general election. The old Fabian plan of prompting the politicians was useless now that Ministers were taking up Socialism in a crude form, and going to work upon it with a determination to owe nothing to the Fabians, who had become impatient of the want of skill and knowledge shown by the party politicians, and somewhat dictatorial in their solutions of the problems affecting the standard of life of the working-classes. The old wire-pulling had therefore to be dropped and replaced by public prompting; and this involved control of a weekly review of high political and literary quality, capable of doing for Collectivism what *The Spectator* and *The Nation* were doing for Unionism and the higher Liberalism. The Fabian leaders accordingly founded *The New Statesman* in 1913. The supplements on social questions, which were the distinctive feature of this weekly review, were really a development of the Fabian tracts. There was no formal official connection between *The New Statesman* and the Fabian Society; but as the staff and directorate were predominantly Fabian, *The New Statesman* was really a creation of the Society, and

was its public mouthpiece until, in the course of time, it inevitably developed a journalistic individuality of its own. The Society's official organ, *Fabian News*, is a monthly sheet which has existed since 1891, and has no circulation outside the Society.

The war of 1914–18 affected the Society favourably by compelling the Government to supersede private commercial enterprise in several directions by direct State control, and to save the banks by guaranteeing the foreign exchanges: steps which could not have been proposed and accepted, virtually without protest, but for the extent to which the Fabian Society had educated the public and the official classes to resort confidently to State action in spite of the traditions of the Manchester school. The unprecedented taxation and super-taxation of property for the support of the war was also in line with the Society's propaganda. The war, however, revealed the political futility of international Socialism, and the helpless nullity and ignorance of British Socialism and Labour in the sphere of foreign policy. The Fabian Society, therefore, turned its attention for the first time to the subject of what it called supernational law and political organisation, and produced, through the International Agreements Committee of its Research Department, plans for a supernational legislature and tribunal which were published as supplements to *The New Statesman*. In the meantime it identified itself, by a series of six public meetings held in London, Mr Bernard Shaw being spokesman, with his propaganda of equality of income as the economic goal of Socialism, but without committing itself to this article of faith.

A general survey of the Society's activities after the detachment of Labour from capitalist Liberalism in parliament, and its establishment there as an independent party, with an independent national political organisation, shows the Fabians as gradually disentangling themselves from the wire-pulling and tactical intrigue forced upon them in the last decade of the 19th century by the necessity of working through hostile parties in parliament, and outwitting them, and by the fact that at that time they alone, among the organised Socialists, knew enough of the arts of government under our system to be qualified for the work. This disentanglement was motived by the desire to get back to the true function of the Society in the investigation of social conditions, and the study and practical solution of the problems raised by them. The Society's centre of gravity became its Research Department, in which some of the older leaders, who had withdrawn more or less from the general management of the Society, for a moment resumed their activity side by side with the younger generation. For a few years this body worked with feverish energy as the intelligence department of the Labour Party during the great railway and coal-mining strikes which followed the war; but the sympathy of some of its most energetic young members with the Russian Bolsheviks produced a split which ended in their defection, and in the formation of a new Research Department by the Labour Party, which virtually absorbed and superseded the Fabian Department. The general election of 1922, at which Mr Sidney Webb entered parliament as a member of a greatly reinforced Labour Opposition, marked the final transfer of the political activities of the Fabian Society to the front benches of Labour in parliament.

The Society, nevertheless, maintains its existence as a relatively small and select body of constitutional Socialists, informing and prompting other bodies and public opinion, and acting through them whenever possible. Many of its numerous tracts have become obsolete through the passing of their proposals into law; but some of the earliest are still in active circulation. Local Fabian societies have been formed in the provinces. Of these the oldest and most important is the Liverpool Fabian Society. Fabian Societies, with a continually changing membership, existed for many years at the universities; but most of these became University Labour Clubs after the war. The number of persons distinguished in the literary and political world who have at one time or another been members of the Fabian Society is considerable; and though some of them may now regard the experience as a sowing of their political wild oats, the share taken by the Fabians in the education of the generation which followed that to which their leaders belonged has left its mark on political history, and will probably continue to influence it more or less until the Collectivist reaction against the Manchester School is consummated or exhausted.

Fabius, the name of one of the most illustrious patrician families of Rome.—QUINTUS FABIUS RULLIANUS, a general in the second Samnite war, was dictator (315), censor (304), and six times consul.—QUINTUS FABIUS MAXIMUS VERRUCOSUS, five times consul and twice censor, was elected dictator (221) immediately after the defeat of the Romans at Trasimenus. The peculiar line of tactics which he observed in the second Punic war obtained for him the surname of Cunctator ('Delayer'). Hanging on the heights like a thunder-cloud, to which Hannibal himself compared him, and avoiding a direct engagement, he tantalised the enemy by the favourite devices of guerilla warfare; he harassed them by marches and countermarches, and cut off their stragglers and foragers; and at the same time his delay allowed Rome to assemble her forces in greater strength. But this 'Fabian policy' was neither appreciated in the camp nor at home; and shortly afterwards, Marcus Minucius Rufus, Master of the Horse, was raised to an equal share in the dictatorship. During his fifth consulship Fabius recovered Tarentum (209 B.C.), which had long been one of Hannibal's important strongholds. He died in 203 B.C.—CUNCTATOR FABIUS, surnamed Pictor, executed in 302 upon the walls of the temple of Salus the earliest Roman painting of which we have any record. His grandson, QUINTUS FABIUS PICTOR, was the first writer of a Roman history in prose.

Fable, as defined by Dr Johnson in his Life of Gay, is, 'in its genuine state, a narrative in which beings irrational, and sometimes inanimate—*arbores loquuntur, non tantum ferœ*—are, for the purpose of moral instruction, feigned to act and speak with human interests and passions.' It is thus almost synonymous with the apologue, and closely allied to the allegory and the parable, but it need not be at all probable in its incidents, its essential motive being merely a moral or didactic end effected by any means, while its composition is due to more or less conscious literary art. In earlier times the name was frequently used as synonymous with myth, but this sense was dropped when a deeper insight into the mental condition of primitive man had revealed how small a factor conscious fiction was in the making of so composite a product as the mythology of a people. It is usual again to differentiate the parable from the fable as especially conveying spiritual truths, and not transgressing possibility and the actual order of nature; but, leaving out of sight the special examples in the New Testament, it is impossible to make so sharp a distinction between moral and religious truths. In the earlier stages of the history of every people the human intellect has employed itself in rudimentary meta-

physical speculations, and hence a host of myths have arisen everywhere of themselves to account for natural phenomena, the origin of man, and the like, which in many cases have been preserved. These myths are of course quite innocent of moral, and, indeed, in the hopeless confusion of a composite mythology, are usually strangely inconsistent with considerations of morality, being survivals of an irrational state of mind to which they seemed natural enough. Side by side with this process in the mind of many peoples, a rudimentary literary faculty early began to exercise itself, giving rise to real fables. One large class, indeed the most important, whether from the point of view of quality or of quantity, takes the form of fables about beasts, with whom primitive man has no difficulty in feeling a sense of affinity. These again develop with progressive culture and a growing moral sense into the didactic apologue, and thus reach the class of fables proper, as being essentially due to conscious literary art. These, unlike the myths that have grown spontaneously as an attempt to find concrete expression for those ideas and impressions about the relations between man and the physical world that lie at the basis of religion, lend themselves early to transmission, and have actually, as we shall see, travelled round the world. The folklore of even the rudest people contains many complex elements, but it is only as culture begins to advance that we find the beginning of the literary fable proper, although it remains true that a large number of the folk-tales are more or less perfect fables. While this is true, it is no less so that it is merely in half-civilised communities that the fable attains its greatest perfection. We find the moral apologues so dear to the oriental mind ranging in a thousand forms, from the scriptural example of Jotham to the elaborate and involved examples in the *Arabian Nights*.

The old French Fabliaux have little in common with fables beyond a name of similar origin, being short tales in verse, essentially satirical, or rather representing human things under the light of a ludicrous or only half-serious mockery. Of the genuine fables of medieval times the greater number were associated with the name of Æsop, whom it is usual for classical scholars to place in the 6th century B.C. Certainly his name occurs frequently in classical literature as that of a fabulist, but the so-called Æsopic fables that have come down to us are far from being Greek in character, to any great extent at least. The collection formed by Planudes of Constantinople in the first half of the 14th century has much in common with the metrical Greek fables of Babrius, who lived most likely in the 1st century B.C., and again with the Latin fables of Phædrus, a freedman of Augustus, because the ultimate source of many fables of these and other fabulists was the same—the Buddhist birth-stories and other Indian tales, which had long before been gradually finding their way westwards through Arab or still more obscure channels. Many of our Greek fables are substantially identical with the Buddhist Jātakas, and can be explained on no theory but that of simple transmission, often within even historical times. This much at least is certain, that a considerable part of the Æsopic fable reached the Greeks from the East, however obscure our knowledge of the methods of transmission may yet be. The medieval examples of the fable follow closely the two Latin versions (1) of Avianus, comprising fables in distichs, rendered at a later period into prose, and almost all borrowed from the immediate Greek originals bearing the name of Æsop; and (2) to a still greater extent a prose version of the fables of Phædrus, represented in the prologue as a translation into Latin of the Greek fables of Æsop by a certain Emperor Romulus for his son Tiberinus. The Latin *Romulus* was enlarged about the 11th century by a number of fables of quite a different character, bearing in the highest degree the stamp of the middle ages, and often of Christianity (as in that of the wolf who learns to read), coming in great part from India, by way of Byzantium, most frequently badly told, usually very obscure, but often original, well invented, and of a very popular character, as in that of the cat that has put on a stole in order to baptise a rat which wishes to remain a Pagan. The collection as thus increased originated without doubt in England, and at an early date was rendered in English, and associated without reason with the name of Alfred. It was from this lost English version that it was translated, in the reign of Henry II., by Marie de France, into elegant but somewhat dry French verses. She gave her work the name of *Isopet*, the title of all medieval collections of fables, itself really a mere familiar diminutive of the name of Æsop, to whom all apologues were always attributed. About the same time Walter the Englishman, or Gualterus Anglicus (probably) rendered into Latin distichs the first three books of *Romulus*, comprising fifty-eight fables, to which he added two stories, one from an unknown source, the other borrowed from the *Disciplina Clericalis* of Petrus Alphonsus, a 12th-century converted Jew, whose work is a book of moral instruction, filled with stories of Arab (and ultimately Indian) origin. According to custom, Walter's collection of fables (Henryson's chief source) was connected with the name of Æsop; its pretentious style brought it great success, and we have extant two verse translations of the 13th and 14th centuries, the *Isopet de Lyons* and the *Isopet II. de Paris*—the last called also the *Isopet-Avionnet*, because the translation of Æsop therein follows that of Avianus. Another redaction, by Alexander Neckam (12th century), in Latin distichs, was twice translated into verse in the *Isopet de Chartres* and the *Isopet I. de Paris*. Of these translations the most interesting, because the freest, is the *Isopet de Lyons;* all alike abound in misconstructions, to which the obscure language of their models lent itself too easily, and from which the rhymers extricate themselves as best they can.

Besides these special collections of fables, the best and most original examples, whether in French or Latin, are often to be found in the works of the moralists, the preachers, and even the historians, as, for example, in the *Récits du Ménestrel de Reims* (1260), a collection of semi-popular and current hearsay traditions, having for its point of departure the first Crusade, and loosely connected with the Holy Land, France, England, and Flanders. From the 12th century there were often inserted in sermons *Exempla*, or short tales, sometimes edifying in themselves, sometimes having the character of parables or even merry stories, from which the preacher at the end extorted a moral. These were stories merely Christianised for the ends of edification, and were very frequently nothing more or less than time-honoured fables. The collection in French by the English Franciscan Nicole Bozon (13th century) is particularly rich in such fables told in a lively and popular manner. Side by side with these fables transmitted by the clergy there circulated among the people many beast-fables, which, like the primitive examples of African and other savage peoples, are destitute of any moral aim, but unlike these are due to conscious literary art in depending mainly upon a sympathetic and humorous observation of certain animals, whose adventures conform to their supposed character and their known habits. A great many of these stories have for their theme the struggles between the wolf, the stronger, and the fox, the more cunning, which ends always in the former being worsted. The great innovation

which developed out of these a kind of beast-epic was the individualising of the heroes and giving to them proper names; the figures with which we are concerned are no longer a wolf and a fox, but Isengrim and Raganhard, with their wives Richild and Hersind (later Isengrin, Renard, Richeut, Hersent). Around these principal personages the action centres, and beside them we find a crowd of secondary actors: Noble the lion, Grimbert the badger, Belin the ram, Chanteclair the cock, Couard the hare, Tibert the cat, and Bernard the ass, who throughout preserve their characters and play consistent parts. This ingenious and artistic transformation may have originated in the north of France about the 11th century, but quickly spread over western Europe in Latin, German, and Flemish versions, and, both from the intrinsic interest of the theme, and its adaptability to satirical purposes, as well as its admirable artistic treatment, exercised a powerful influence over the popular imagination from the dark ages to the age of Goethe.

The pure fable of medieval times followed closely its venerable originals, as we find them still in our *Panchatantra*, *Hitopadesa*, and *Kalilah wa Dimnah;* but our modern examples have little beyond what is external in common with these, for the fable has long ceased to be a natural form for literary expression in prose or verse. The fables of Prior, Moore, and Gay are lively and often graceful poems, but they have usurped a name to which they really possess no claim. Nor are Dryden's so-called *Fables* fables at all, however effective as poems they may be. Quite different is the case of the great master of fabulists, the inimitable La Fontaine, who possessed one merit rarer even than his exquisite blending of humour and pathos and his matchless perfection of form, in that 'infantine familiar clasp of things divine' in which lies hid the real essence of the fable. No successor has discovered the secret of that exquisite naïveté on which depends his charm, although the imitators of this new form in literature have been countless in number. Gellert's German fables (1746) were among the most popular of these, and first attracted the great Lessing into imitation. The latter published his famous *Fabeln* in 1759, together with a striking essay on the history and meaning of the fable in literature, the conclusions of which were mostly much more subtle than always sound. Of more recent fables the best are a few examples among the exquisite prose fairy-tales of Hans Christian Andersen and in the verse of Krilof: everywhere else the making of fables would appear to be an art that is lost without hope of recovery.

See the articles ÆSOP, BEAST-FABLES, BIDPAI, FABLIAUX, FOLKLORE, MYTHOLOGY, and REYNARD; also MAX MÜLLER's essay 'On the Migration of Fables,' in vol. iv. (1880) of *Chips from a German Workshop;* W. G. Rutherford's dissertation on 'The History of Greek Fable,' in his edition of *Babrius* (1883), which is good so far as it goes; but especially O. Keller's 'Untersuchungen über die Geschichte der Griechischen Fabel,' in the *Jahrbücher für classische Philologie* (1861–67); Hervieux, *Les Fabulistes Latins depuis le Siècle d'Auguste jusqu'à la fin du Moyen Âge* (1893 *et seq.*); the admirable chapter by Gaston Paris, in *La Littérature Française au Moyen Âge* (1888); and Plessow, *Fabeldichtung in England* ('Palaestra,' lii. 1906).

Fabliaux, a group of over a hundred compositions peculiar to the literature of France, consisting of metrical tales, usually satirical in quality, written in octosyllabic couplets, the epoch of the production of which covers about a century and a half. The oldest preserved appears to be *Richeut* (about 1156); the greater number belong to the end of the 12th and the commencement of the 13th century; the most modern are those of Jean de Condé and of Watriquet, at the beginning of the 14th century. Society and literature then underwent a considerable change, and henceforward fabliaux proper disappear, being represented during the 15th century on one side by the prose tale, on the other by the farce, whence sprung in the fullness of time the modern novel and the comedy. Many of the French rhymed stories of the 12th and 13th centuries reappear later in the literature of other peoples, chiefly in Italy and England. It is certain that Boccaccio and Chaucer, for example, have sometimes imitated the French fabliaux, but this need not have been necessarily the case, as these stories circulated freely orally over all Europe, not to speak of their admission into sermons and books of edification,

Undoubtedly most of the stories were of oriental and especially Indian origin, many bearing distinctly the imprint of Buddhism, which has ever favoured the method of teaching by parable. These stories reached Europe by two main channels: from Byzantium, which received them from Syria or from Persia, whence they had been carried direct from India; and secondly, from the Arabs. The Arab importation took place at two widely different points: in Spain, largely by the mediation of the Jews; and in Syria, at the time of the Crusades. In Spain the transmission was mainly literary (through such media as the *Disciplina Clericalis*); in the East, on the contrary, the Crusaders, who lived in intimate contact with the Mussulman population, received many stories orally. Some of these being of Buddhistic origin were already moral and ascetic in character, and therefore easily Christianised; others, under cover of the final moral, related adventures that were dubious enough, but which were remembered while the tedious and not always relevant moral was forgotten; while others again were retained and transmitted simply for their wit. The fabliaux were, however, without exception, strangers to those great collections transmitted entire from one language to another; they spring from oral transmission and not from books. A few even are due to the native invention of their authors.

Their most general characteristic is their humorous and comic quality, too often involved in obscenity, and not infrequently falling into the most vapid platitude. Many of them are satirical, girding especially at certain classes, as villeins and clerics, who are made the heroes of amorous adventures, now happy, now unhappy. A few are concerned with religion, and these are incongruous and irreverent enough. The fabliaux were not written for women, no doubt being usually recited by the *jongleurs* when the women had left the room; hence women are usually presented in the most unfavourable colours, whether as abandoned in character, or merely as peevish and jealous. They abound in gross sallies, the aim of which was but a moment's laugh; yet many are sweet little stories, very well told, and usually very moral or very sentimental. All have the great merit of painting the real life of their time; not at all of set purpose, but without effort they enable us to penetrate into the hearths of nobles, clergy, citizens, or peasants, and they speak to us in the familiar tongue of diverse classes of society in France about seven centuries ago. Their authors are seldom known. One or two names are Huon le Roi, author of *Vair Palefroi;* Jean Bedel, author of *Barat et Haimet;* Gautier le Long; Jacques de Baisieu; Henri d'Andeli; Rustebeuf; Garin; Jean le Galois d'Aubepierre, author of *La Bourse pleine de sens;* and Jean de Condé.

See Montaiglon and Raynaud, *Recueil général et complet des Fabliaux des XIII^e et XIV^e Siècles* (6 vols. 1872–90); Gaston Paris, *Les Contes orientaux dans la Littérature Française du Moyen Âge* (1877), and *La Littérature Française au Moyen Âge* (1888); Bédier,

Les Fabliaux (1893); Petit de Julleville, *Littérature Française* (vol. ii. 1896).

Fabre, Ferdinand (1830–98), born at Bédarieux, gained Sainte-Beuve's approval by *Les Courbezon*, followed by *Mon Oncle Célestin*, *L'Abbé Tigrane*, and other novels.

Fabre, François Xavier Pascal (1766–1837), born at Montpellier, was a pupil of David, painted portraits at Florence, and directed a school at Montpellier. He was believed to have privately married the Duchess of Albany, widow of Prince Charles Edward Stewart.

Fabre, Jean Henri (1823-1915), born at St Léons, Aveyron, was a schoolmaster and professor at colleges in Ajaccio and Avignon, and gave himself to close and imaginative observation of insects. His books, including many series of *Souvenirs entomologiques*, have been much read and translated. See his Life by Legros (Eng. trans. 1921), and Bicknell (1923). There is another Life by his brother, the Abbé Augustin Fabre (trans. 1921).

Fabre, Marie Joseph Victorin (1785–1831), born in Ardèche, was a famous poet in his lifetime, but was soon forgotten.

Fabre d'Eglantine, Philippe François Nazaire (1755–94), an actor and dramatist, and a zealous revolutionist, was executed with his friends Desmoulins and Danton.

Fabretti, Raffaele (1618–1700), born at Urbino in 1618, became papal treasurer, chancellor to the papal embassy at Madrid, keeper of the papal archives, and wrote on the aqueducts of Rome, on the column of Trajan, and on ancient inscriptions.

Fabriano, at the eastern base of the Apennines, 44 miles SW. of Ancona, has a cathedral and paper and parchment manufactories, and was the seat of the Fabriano school of painting; pop. 25,000.

Fabriano, Gentile da (1370–1450), was born at Fabriano. His first teacher in art was, according to one account, Allegretto de Nuzio, according to another, Fra Angelico. His earliest work was perhaps the decoration of a chapel for Pandolfo Malatesta at Brescia. In 1423 he painted one of his best extant pictures, an 'Adoration of the Kings,' for the church of the Holy Trinity in Florence. Notable is also a Madonna with Saints (now in the Berlin Museum). A picture of the naval engagement between the fleet of Venice and that of the Emperor Barbarossa, painted for the Venetian senate, was destroyed by the fire at the ducal palace in 1574. Pope Martin V. employed Fabriano, who had a childlike love of splendour and rich ornamentation, in adorning the church of St John Lateran with frescoes from the life of John the Baptist.

Fabricius, or Fabrizio, Girolamo, commonly called of Acquapendente, from the place of his birth, near Orvieto, a celebrated anatomist and surgeon, was born in 1537. He was the son of humble parents, who notwithstanding their poverty sent him to the university of Padua, where he studied anatomy and surgery under Fallopius. On the death of the latter in 1562 Fabricius was appointed to the vacant professorship, a post which he continued to hold for nearly half a century. Harvey, the discoverer of the circulation of the blood, was one of his pupils. Fabricius died at Padua, 21st May 1619. He was a laborious investigator, treated the eye, the larynx, the ear, the intestinal canal, the development of the fœtus, and—his chief claim to remembrance—discovered the valves of the veins in 1574. See his *Opera Chirurgica* (1617).—David Fabricius (1564–1603), was a pastor at Resterhaave and at Osteel in East Friesland, and discovered several new stars. —His son, Joannes (1587–1615), was a doctor of medicine, famous in astronomy as having discovered the spots on the sun (1610) and the sun's revolution.—Joannes Albertus Fabricius (1668–1738), bibliographer, was born at Leipzig, studied theology and philology there, but spent most of his life as teacher and rector in a gymnasium at Hamburg. He may be regarded as the modern founder of the history of classical literature and bibliography in virtue of his *Bibliotheca Latina* (3 vols. 1697), *Bibliotheca Græca* (14 vols. 1705–28), *Bibliotheca Latina Mediæ et Infimæ Ætatis* (5 vols. 1734–36), *Bibliographia Antiquaria* (1713), and *Bibliotheca Ecclesiastica* (1718). See the monograph by Reimarus (1737).—Johannes Christian Fabricius, entomologist, was born at Tondern in Sleswick, 7th January 1745, and died at Kiel, 3d March 1808. At Uppsala he worked under Linnæus, and in 1775 he was appointed to the chair of natural history at Kiel. His classification of insects, based upon the structure of the mouth, is expounded in his *Systema Entomologiæ* (1775), *Genera Insectorum* (1776), *Philosophia Entomologica* (1778), *Mantissa Insectorum* (1787), and *Entomologia Systematica* (1792).

Fabroni, Angelo, biographical writer, was born at Marradi in Tuscany, 26th September 1732, educated at Faenza and Rome, and in 1773 appointed tutor to the sons of Leopold, Grand-duke of Tuscany. He died 22d September 1803. His *Vitæ Italorum Doctrina Excellentium* (20 vols. 1778–1805) contains quite a treasure of information; while his *Laurentii Medicei Vita* (2 vols. 1784) and *Vita Magni Cosmi Medicei* (2 vols. 1788–89) were reckoned model biographies.

Fabyan, Robert, an English chronicler under Henry VII., was descended from an Essex family, and followed his father's trade as a clothier in London, where he was sheriff in 1493, and seems to have died in 1513. Three years later was printed by Pynson the first edition of his history, *The New Chronicles of England and France.* It begins with the arrival of Brutus, and comes down to the battle of Bosworth, reaching in its second edition (1533) the death of Henry VII. From the accession of Richard I. it takes the form of a London chronicle, and indeed the whole work has little value save for some points in the history of the city. The best edition is that by Ellis (1811).

Façade (Fr.), the exterior front or face of a building. This term, although frequently restricted to classic architecture, may be applied to the front elevation of a building in any style. It is, however, generally used with reference to buildings of some magnitude and pretensions; thus, we speak of the *front* of a house, and the façade of a palace. The back elevation of an important building is called the rear façade, and a side elevation the lateral façade. The sides of a court or cortile are also called façades, and are distinguished as north, south, &c. façades.

Facciolati, Jacopo, lexicographer, was born in 1682 at Torreglia, near Padua, and educated in the religious seminary at Padua, where he subsequently became professor of Theology and rector. He held at the same time the chair of Logic in the university. Facciolati directed his attention chiefly to the revival of the study of ancient literature, and brought out (1715–19) a new edition of the *Lexicon Undecim Linguarum* or the *Calepine Lexicon.* In this work he was assisted by his pupil and brother-professor, Egidio Forcellini (1688–1768), to whom is mainly owing the conception of a totally new Latin dictionary. This Facciolati continued till his death on 27th August 1769, and it finally appeared in 1771 (new ed. by

De Vit, Prato, 1858–87; Eng. ed. 2 vols. 1826). Facciolati's Latin epistles and orations are remarkable for the Ciceronian purity and elegance of their style, and his remarks on Cicero's writings for their solidity, clearness, and taste. See Lives by Ferrari (1799) and Gennari (1818).

Facial Angle. See SKULL.

Facility, in the legal terminology of Scotland, is a condition of mental weakness short of idiocy, but such as makes a person easily imposed upon, and easily persuaded to do deeds to his own prejudice. The remedy is Interdiction, which may be granted by the Court of Session of its own motion, or at the instance of the heir or next of kin of the facile person. This is judicial interdiction. When a person conscious of mental infirmity places himself under the control of trustees, the case is one of voluntary interdiction. This interdiction generally takes the form of a bond granted by the facile person to the persons therein named, who are called the interdictors. The object of interdiction is to prevent the facile person from granting deeds to his own prejudice, and after it has taken place he cannot contract without the consent of his interdictors. Even without interdiction the deeds of a facile person, if to his prejudice, may be set aside if there be proof of his having been circumvented or imposed on. There is no corresponding term in English law.

Fac-simile (Lat. *factum simile*, 'made like'), an exact copy, as of handwriting. See COPYING.

Factor, in its most general sense, is the term applied to any one who is employed to do business for another. In its most frequent use the name is applied to an Agent (q.v.) employed to sell goods consigned to him by his principal. His remuneration is called factorage or commission, and such an agent a commission-agent or consignee. A broker is also an agent of this kind, rewarded by a commission; but a factor differs from a broker in this, that a factor may buy and sell in his own name, and has the possession and apparent ownership of the goods consigned, and a lien over them. A factor is not entitled to delegate his powers, although he may employ a third person in any ministerial capacity which he cannot himself fulfil. The duty of a factor is to procure intelligence of the markets at his residence, of the course of exchange, and of the price of goods and the probability of a rise or fall; and to account to his principal for his transactions. A factor may pledge the goods of his principal for advances made upon the principal's account, or for the duties on the goods, but not for advances made upon the factor's account. The Factors Acts, the earliest of which was passed in the reign of George IV., enact that under certain circumstances factors having goods in their possession, or having possession of bills of lading, dock warrants, and similar documents referring to goods, shall be deemed owners of such goods, to the effect of giving validity to contracts with persons dealing *bonâ fide* on the faith of that ownership. Factory may be revoked, and falls by the death of the principal. The appointment of a new factor to do the same act implies revocation of the old factory. These general principles are common to both English and Scots law. In Scotland, however, the term is rarely used in that sense, and there are special uses not known in England —e.g. as applied to an agent managing heritable estates for another, letting farms, drawing rents, and the like, in which sense it is nearly synonymous with the English *steward*. In Scotland, too, the class of factors appointed by the courts for the management of the estates of persons under some incapacity, where the English courts appoint receivers or trustees, has increased so largely in recent times as to call into existence a whole department of law dealing with their powers and duties. Such are called Judicial Factors.

Factor, in Mathematics. The numbers 6 and 4 multiplied together *make* 24; hence 6 and 4 are called *factors* of the product 24. All numbers except prime numbers are products of two or more factors; thus, $10 = 2 \times 5$; $12 = 3 \times 4$, or 2×6, or $2 \times 2 \times 3$. Every product can be divided by any of its factors without remainder; a factor, therefore, is often called a *divisor*, or measure. 2, 3, 4, 6, 8, 12 are all factors or divisors of 24. Numbers that have no factor or divisor above unity, such as 2, 3, 5, 7, 11, . . . 23, &c., are called *prime* numbers. See NUMBERS (THEORY OF).

Factory and Workshop Acts.—The first germs of factory legislation in Great Britain are to be found in the attempts made to remedy the evils attendant on the employment of children, and, in particular, of pauper children in cotton-mills and factories. In the later years of the 18th century thousands of pauper children, in order to save the cost of their maintenance, were brought from their parishes and apprenticed in factories. Apprenticeship had always been regarded not merely as a period of service, but as a period of training; but the children apprenticed in the early factories were without opportunities of instruction. Moreover, the conditions under which they lived and worked were so demoralising as to be injurious to the community. In 1784 the Lancashire magistrates, influenced mainly by considerations of public health, passed a resolution that in future they would not allow 'indentures of parish apprentices whereby they shall be bound to owners of cotton-mills and other works in which children are obliged to work in the night or more than ten hours in the day.' This resolution is noteworthy as being the earliest attempt of any public body to limit the hours of children's labour. The condition of parish apprentices in factories also attracted the attention of parliament, for these pauper children were, in a true sense, wards of the state. In 1802 an act, which bore the title 'Health and Morals of Apprentices Act,' restricted the working hours for apprentices to twelve hours a day, and contained provisions for the cleansing and ventilation of cotton-mills and other factories, and for the clothing and education of apprentices employed therein. Nothing was done for the protection of factory children who were not parish apprentices till 1819, in which year an act, applying to cotton-mills only, prohibited the employment of children under nine years of age, and limited the working hours of children under sixteen years of age to twelve hours a day, exclusive of meal-times. By Lord Althorp's Act of 1833 the prohibition of the employment of children under nine years of age was extended to the textile trades generally, and a distinction, as regards hours of work, was made for the first time between children under thirteen years of age and 'young persons' from thirteen to eighteen years of age. The time of work for children under thirteen years of age was limited to nine hours, and for young persons to twelve hours. But the main importance of this act lay in its provisions for the creation of a staff of inspectors responsible to a central authority. The previous statutes had been rendered almost nugatory by the lack of administrative machinery for their enforcement; but the Act of 1833 was from the first vigorously enforced by inspectors, who were unaffected by local influences. Thenceforth, too, these inspectors rendered valuable service by collecting information which guided public opinion and prepared the way for subsequent legislation. The Act of 1844 is notable

in that it extended to adult women the same protection as had been provided for young persons, and introduced regulations for safety and the fencing of machinery. By the Act of 1847 the working hours of young persons and women were reduced to ten. The fact, however, that the act set no limits to the working day within which the ten hours might be worked opened the way to evasion. In particular, the adoption of systems of working in relays rendered it difficult for the inspectors to detect overtime employment. The risk of evasion by working in relays was brought to an end by the Acts of 1850 and 1853, which established for all protected persons a normal working day of ten and a half hours, extending from 6 A.M. to 6 P.M., with an allowance of an hour and a half for meals. The legal working day was thus made to coincide with the legal period of employment, allowance being made for meal-times. Up to this point the legislation had applied only to textile industries and a few others allied to them. But henceforth a movement set in for an extension of the principles of regulation to industries outwith the textile group, and by acts passed in 1864 and 1867 certain non-textile factories and workshops were brought within the sphere of state control. In 1875 the law as to factories and workshops had to be sought for in no fewer than nineteen statutes, and the varying statutory regulations applicable to different work-places and to different classes of workers created confusion. In that year the whole subject was considered by a Royal Commission, whose report, issued in 1876, led to the Factory and Workshop Act, 1878, which consolidated the law and removed many anomalies. Soon after the passing of this act further extensions of the law were found necessary. A series of acts made new and increasingly stringent provision for protecting the health and safety of persons employed in dangerous trades. In 1891 the age at which children might lawfully be employed was raised to eleven years. So numerous were the extensions and changes effected by the successive amending acts, that it became necessary again to consolidate the law on the subject. This was done by the Factory and Workshop Act, 1901 (1 Edw. VII. chap. 22). This act, with the extensions and alterations effected by subsequent statutes, forms the existing law, which now constitutes a great system of industrial control exercised by the state in the interests of the community.

The changes made in the law since the Act of 1901 have been in the direction of extending the operation of state control and rendering it more effective. The Notice of Accidents Act, 1906, has substituted a more stringent set of provisions as to the notification of accidents in factories and workshops. By the Factory and Workshop Act, 1907, laundries carried on by way of trade, or for the purpose of gain, or as auxiliary to another business, or incidentally to the purposes of a public institution, were brought under the general law applicable to non-textile factories and workshops, special regulations being made as to hours of work, sanitation, and ventilation. The Act of 1911 gave power to the Secretary of State to make regulations as to humidity and ventilation in cotton-cloth factories, and, in exercise of this power, elaborate regulations were issued in 1912. The volume of special orders and regulations for other dangerous trades, issued under the Act of 1901, has been constantly increasing. The Shops Act, 1912, which re-enacted and amended earlier acts, has provided for shop-assistants a system of protection as regards conditions and hours of employment similar in kind to that provided under the Factory Acts for workers in factories and workshops. The growing sense of public responsibility in regard to children has led to further restrictions upon the employment of children, i.e. persons under fourteen years of age, imposed by the Employment of Children Act, 1903, and the Employment of Women, Young Persons and Children Act, 1920. The Education Acts of 1918 and 1921, extending the age for compulsory attendance at elementary schools, have also in effect raised the age at which children may be employed—it being expressly enacted by sect. 14 of the Act of 1918, which came into operation on 1st July 1922, that no child of school age shall be employed in any factory or workshop to which the Factory and Workshop Acts, 1901 to 1911, apply.

The Factory and Workshop Acts apply primarily to 'factories' and 'workshops.' Speaking generally, a place where a manufacturing process is carried on is a 'factory' if mechanical power is used, and a 'workshop' if mechanical power is not used. Some of the statutory provisions are also made applicable to docks, wharves, quays, and warehouses, to buildings in course of construction, and to railway lines or sidings used in connection with a factory or workshop.

Factories are either textile or non-textile. Textile industries are deemed to be more injurious to the health of the workers, and, accordingly, the regulations affecting textile factories, in particular as regards hours of labour, are more stringent than in non-textile factories. Thus overtime is not permitted in textile factories, but may be permitted in non-textile factories. Textile factories are places in which mechanical power is used to move or work machinery employed in preparing, manufacturing, or finishing cotton, wool, hair, silk, flax, hemp, jute, tow, china-grass, coconut fibre, or other like material, or in any process incident to the manufacture of such material. Certain works, however, in which such material is dealt with are declared not to be textile factories, viz. print-works, bleaching and dye works, lace warehouses, paper-mills, flax scutch-mills, rope-works, and hat-works. Non-textile factories consist of (*a*) the premises mentioned in Part I. of the sixth schedule of the Act of 1901, whether mechanical power is used or not —a lengthy list, including print-works, bleaching and dye works, earthenware-works, blast-furnaces, foundries, metal and india-rubber works, paper-mills, glass-works, tobacco-factories, bookbinding-works, electrical stations; (*b*) the premises mentioned in Part II. of that schedule provided that mechanical power is used—the list including hat-works, rope-works, bakehouses, lace warehouses, shipbuilding yards, quarries, dry-cleaning, carpet-beating, and bottle-washing works, and now also, under sect. 1 of the Act of 1907, laundries; and (*c*) all premises in which any manual labour is exercised by way of trade or for purposes of gain in a manufacturing process, provided that mechanical power is used in aid of the manufacturing process there carried on. 'Domestic factories'—that is, private houses or rooms which, though used as dwellings, are, by reason of the work carried on there, factories, in which no mechanical power is used and the only persons employed are members of the same family dwelling there—are subject to special regulations and exemptions as regards hours of labour, sanitation, ventilation, meals, holidays, accidents, and registration. Special regulations are also made for 'tenement factories,' that is, buildings containing separate factories which are occupied by different persons and supplied with mechanical power from the same source. The owner of a tenement factory (whether or not he is one of the occupiers) is, instead of the occupiers of the separate factories, responsible for the cleanliness and sanitary condition of the whole building, for the fencing of all machinery not supplied by the occupiers, and

for the affixing of notices with respect to the employment of children.

Workshops are premises which, if mechanical power were used, would be non-textile factories of class (*b*) or class (*c*) above mentioned, provided, in the case of class (*c*), that the employer of the persons working therein has the right of access or control. Workshops generally are subject to the same regulations as non-textile factories in respect of hours of employment. The supervision of the sanitary condition of workshops lies in the first instance with the local authority, not, as in factories, with the factory inspector; but the inspector may intervene in the event of the local authority neglecting to perform its duties. Special regulations are made for four classes of workshops: (1) 'men's workshops,' that is, workshops conducted on the system of not employing any woman, young person, or child; (2) 'women's workshops,' that is, workshops conducted on the system of not employing either children or young persons; (3) 'domestic workshops,' that is, private houses or rooms which, by reason of the work carried on there, are workshops, in which no mechanical power is used and the only persons employed are members of the same family living there; and (4) 'tenement workshops,' that is, premises in which, with the permission of or under agreement with the owner or occupier, two or more persons carry on any work which would constitute the premises a workshop if the persons working there were in the employment of the owner or occupier.

The statutory provisions fall into two main groups. The *first* group deals with matters affecting health and safety, such as cleanliness and ventilation, fencing of machinery, means of escape in case of fire, notice of accidents, and regulations for dangerous trades. These general provisions relating to health and safety are designed for the protection of all classes of workers, including adult men. The *second* group defines hours of employment, makes provision for meal-times and holidays, and lays down special regulations as to conditions of work. The provisions in this group do not, speaking generally, apply to adult men, but are designed for the protection of women (i.e. females of eighteen years and upwards), young persons (i.e. persons from fourteen to eighteen), and children (i.e. persons under fourteen). In addition to the provisions falling under these two main groups, the acts contain important provisions with respect to home-work and out-workers, the particulars of work and wages to be furnished to piece-workers, administration and inspection, and other incidental and supplementary matters.

Factories and workshops must be kept clean and free from effluvia. They must be ventilated so as to render harmless, as far as practicable, all gases, vapours, dust, or other impurities, generated in the course of the work, that may be injurious to health. In every room sufficient means of ventilation must be provided. Where the process carried on generates dust, gas, vapour, or other impurity, which is inhaled by the workers to an injurious extent, an inspector may require a fan or other mechanical means of ventilation to be supplied. Provision is made against overcrowding. A minimum space of 250 cubic feet is required for each person employed at one time in any room; but during any period of overtime, and in certain other circumstances, the proportion is fixed at 400 cubic feet. A reasonable temperature must be maintained in each room in which any person is employed, floors liable to be wet must be drained, and separate and suitable sanitary conveniences must be provided for workers of both sexes. Special regulations for the protection of health are made in the Act of 1901 with respect to bakehouses and certain other classes of premises and industries. The Act of 1907 contains special provisions as to the ventilation, temperature, and drainage of, and the periods of employment in, laundries. The Act of 1911 and the regulations made under that act lay down elaborate rules as to humidity and ventilation in cotton-cloth factories.

The Police, Factories, &c., Act, 1916, provides that a factory or workshop is not deemed to be kept in conformity with the acts if the occupier does not comply with orders of the Secretary of State relative to arrangements for preparing or heating and taking meals, the supply of drinking-water, the supply of protective clothing, ambulances and first-aid arrangements, the supply and use of seats in workrooms, facilities for washing, accommodation for clothing, and arrangements for supervision.

The provisions as to safety enact that hoists, fly-wheels, and all dangerous machinery must be securely fenced; that steam boilers are to be maintained in proper condition and examined by a competent person at least once in every fourteen months; and that means of escape in case of fire shall be provided and maintained in good condition and free from obstruction. Restrictions are placed on the cleaning of machinery while in motion. A child must not be allowed to clean any part of any machinery, or any place under any machinery (other than overhead mill-gearing), while the machinery is in motion. A young person must not be allowed to clean any dangerous part of the machinery while the machinery as a whole is in motion, even though the actual part being cleaned is at rest. No prohibition is put on the cleaning by women of the manufacturing parts of the machinery; but neither women nor young persons are to be allowed to clean the mill-gearing (which includes all shafts, wheels, and other appliances by which power is transmitted) while the machinery is in motion.

Accidents in a factory or workshop causing death or disablement for specified periods must, under the Notice of Accidents Act, 1906, be notified forthwith to the inspector of the district, and also, in some cases, to the certifying surgeon. The occupier must keep a register of all accidents of which notice is required to be given to an inspector. Dangerous trades are specially regulated by direct statutory provisions and by special regulations made by the Secretary of State. When any case of lead, phosphorus, arsenical, or mercurial poisoning, or any case of anthrax or toxic jaundice occurs in a factory or workshop, the occupier must at once send written notice to the inspector and to the certifying surgeon. In any factory where lead, arsenic, or any other poisonous substance is used, suitable washing conveniences must be provided. Prohibitions are put on the taking of meals in rooms where such poisonous substances are so used as to give rise to dust or fumes, and in factories and workshops, or parts thereof, in which the nature of the process carried on renders the taking of meals therein specially injurious to health. In a factory where wet-spinning is carried on the employment of women, young persons, and children is only permitted under prescribed conditions. There are also direct statutory provisions prohibiting the employment of girls under sixteen years in the making or finishing of bricks and tiles (not being ornamental tiles), or the making and finishing of salt; of children and young persons in the making of white lead or the mercurial silvering of mirrors; of children in any dry-grinding in the metal trade or the dipping of lucifer matches; and of children and female young persons in the melting

or annealing of glass. In addition to these direct statutory provisions, power is conferred on the Home Secretary, when he is satisfied that any manufacture or process is dangerous or injurious to health or dangerous to life or limb, either generally or in the case of women, children, or any other class of persons, to certify that manufacture or process to be dangerous, and thereupon to make regulations for the safety of persons employed therein. This general power has been freely exercised, and a great mass of orders and regulations has been issued imposing special conditions upon employment in trades and processes which have been certified to be dangerous.

The Factory and Workshop Act, 1901, enacts that a child under the age of twelve years shall not be employed in a factory or workshop, and makes minute regulations as to hours of employment, meal-times, holidays, and overtime work for (1) children—'child' being defined as a person who is under the age of fourteen years and who has not, being of the age of thirteen years, obtained an educational certificate; (2) young persons—'young person' being defined as a person who has ceased to be a child and is under the age of eighteen years; and (3) women of the age of eighteen years and upwards. The rules as to hours and conditions of work for these several classes of workers vary according to the type of factory or workshop in which the worker is employed. In textile factories overtime is not permitted to be worked by women, young persons, or children. In those non-textile factories and workshops in which overtime employment of women and young persons is permitted, stringent conditions are imposed upon such overtime work. Overtime employment of children is permitted only in specified non-textile factories and workshops, and is permitted there only for an extra period not exceeding thirty minutes in order to complete an incomplete process. No woman or girl may be employed in a factory or workshop within four weeks after child-birth. No child, young person, or woman may be employed in a factory or workshop on Sunday except in the case where both employer and employed are of the Jewish religion and the premises of the occupier have been closed during the whole of Saturday. The Employment of Children Act, 1903—amended, as regards England and Wales, by sect. 92 of the Education Act, 1921, re-enacting sect. 13 of the Education Act, 1918, and, as regards Scotland, by sect. 16 of the Education (Scotland) Act, 1918—imposes important general restrictions on the employment of children, and enacts that no child who is employed half-time under the Factory and Workshop Act, 1901, shall be employed in any other occupation. The Women, Young Persons, and Children Employment Act, 1920, which became operative on 1st January 1921, provides that no child under the age of fourteen years shall be employed in any industrial undertaking (except an undertaking in which only members of the same family are employed). The term 'industrial undertaking,' in this relation, is defined as including mines and quarries; industries in which articles are manufactured, altered, cleaned, repaired, or in which materials are transformed; the construction, maintenance, repair, or alteration of any building, railway, tramway, dock, road, electrical undertaking, gas-work, or other work of construction; and transport by road or rail or inland waterway, including the handling of goods at docks, wharves, and warehouses, but excluding transport by hand. This act also contains provisions relating to the employment of young persons, i.e. persons between fourteen and eighteen, and of women. In particular, it provides that no young person or woman shall be employed at night in any industrial undertaking except to the extent to which, and in the circumstances in which, such employment is permitted under the convention adopted by a general conference of the International Labour Organisation of the League of Nations, and set out in a schedule to the act.

The provisions (sects. 68–72) of the Factory and Workshop Act, 1901, relating to the education of children have been repealed by the Education Act, 1918. As regards England and Wales, the extant statutory law with respect to compulsory attendance at elementary schools and continuation schools is now embodied in the Education Act, 1921. A local education authority administers, under the general supervision of the Home Office, the law relating to the employment of children and young persons, and has wide powers of making and enforcing by-laws upon this subject. Sect. 14 of the Education Act, 1918—which came into operation on 1st July 1922 (the appointed day), and is not repealed by the Education Act, 1921—enacts that no child within the meaning of the act shall be employed in any factory or workshop to which the Factory and Workshop Acts, 1901 to 1911, apply, unless lawfully so employed on the appointed day. The word 'child' in the act means a child of any age up to the age when his parents cease to be under an obligation to cause him to receive efficient elementary education or to attend school; that is to say, up to the end of the school term in which he attains the age of fourteen years, unless, under sect. 46 (2) of the Education Act, 1921, the age of fifteen years has been fixed by by-law. For other statutory provisions with respect to compulsory education and the conditions on which children of school age may be employed in factories and workshops or elsewhere, see EDUCATION.

The occupier of a factory or workshop is directed to notify the inspector of such occupation; to fix up in the works an abstract of the act and certain other information; and to keep a register of various particulars as to employment, health, and accidents. Lists of out-workers must be kept in certain trades, and work is prohibited in premises which are unwholesome or in which there is infectious disease. The occupier of a textile factory is required to furnish particulars of the rate of wages applicable to the work to be done, and also particulars of the work to which that rate is to be applied, in order that piece-workers may compute the due amount of wages payable to them in respect of their work. The Secretary of State is empowered to extend this requirement to non-textile factories and workshops, and this has been done by a series of orders.

Inspectors, male and female, are appointed by the Home Secretary, and are furnished with certificates of their appointment, which must, if required, be produced on applying for admission to a factory or workshop. The inspectors are authorised to enter and inspect, at all reasonable times, by day and night, all parts of a factory or workshop; to require the production of registers, certificates, and other documents kept in pursuance of the acts; to make such examination and inquiry as may be necessary to ascertain whether the requirements of the Factory Acts and Public Health Acts are being complied with; to prosecute, conduct, or defend in courts of justice any proceeding arising under the acts; and to exercise such other powers as may be necessary for carrying the acts into effect. See also SHOPS ACT, TRUCK ACTS, PUBLIC HEALTH ACTS, TRADE BOARDS.

See Annual Reports of Chief Inspector of Factories and Workshops, commencing 1878; Redgrave, *Factory Acts* (12th ed. 1916); Abraham and Davies, *Factories and Workshops* (6th ed. 1908); Hutchins and Harrison,

A History of Factory Legislation (1911); Mrs Sidney Webb, *The Case for the Factory Acts* (1901); Markham, *Factory and Shop Acts of the British Dominions.*

Faculæ (Lat. *facula*, 'a torch'), brighter spots sometimes seen on the sun's disc. See SUN.

Faculty, a name formerly applied by philosophers (Reid, Hamilton, &c.) to each of the primary or fundamental powers or functions of the mind. But the view on which this nomenclature was based is rapidly becoming obsolete. According to modern psychology, the mind is a unity, and the so-called faculties are the different specific directions or modes in which its energy works. See PSYCHOLOGY. For the faculty of a university, see UNIVERSITY.

A Grant of Faculty by the Ordinary is an order by the bishop of a diocese to award some privilege not permitted by common law. A faculty is necessary in order to effect any important alteration in a church, such as the erection of a gallery or of an organ. Without a faculty, a person is not entitled to erect a monument within the walls of a church. —*The Court of Faculties* is a court established by Henry VIII., whereby authority is given to the Archbishop of Canterbury and his successors to grant dispensations and faculties, an authority formerly pertaining to the pope. The sittings of the court have always been held at Doctors' Commons (q.v.). Of late years the court has been chiefly occupied with granting licenses to marry without publication of banns. See ECCLESIASTICAL COURTS, MARRIAGE, DISPENSATION.

Fæces, the solid excrements, the matters which an animal ejects from the lower end of the intestinal canal, and in greater part consisting of those portions of food which, on passing through the alimentary canal, have been rejected as comparatively worthless in the office of nutrition. In the higher animals the fæces generally contain about three-fourths of their weight of water, the remaining one-fourth consisting in greater part of organic remains; in the case of the ox, sheep, and other herbivorous animals, of undigested woody fibre. See DIGESTION, MANURE.

Faed, JOHN, a Scottish painter, was born in 1820 at Burley Mill, near Gatehouse-of-Fleet, Kirkcudbrightshire, where his father was an engineer and millwright. His love of art was manifested at an early period, and when hardly entered on his teens he was in the habit of making tours through the villages of Galloway, painting miniatures. In 1841 he went to Edinburgh, where his talents ultimately won recognition; and he was elected an A.R.S.A. in 1847, an R.S.A. in 1851 (he resigned in 1896). He settled in Gatehouse-of-Fleet in 1880, and he died 22d October 1902. His first popular picture was 'The Cruel Sisters' (1851). Other works were, besides landscapes, 'Shakespeare and his Contemporaries,' 'The Cotter's Saturday Night,' and, after settling in London in 1864, 'The Wappenschaw,' 'Tam o' Shanter,' 'Haddon Hall of Old,' 'The Stirrup Cup,' 'John Anderson my Jo,' and 'The Hiring Fair.'

Faed, THOMAS, R.A., brother of the preceding, was born at Burley Mill, 8th June 1826, and in 1842 began his regular art studies in Edinburgh. At the Trustees' Academy he took several prizes; the first picture he exhibited was a water-colour of an incident from the *Old English Baron.* Shortly after, he discovered his true strength in 'Reading the Bible,' a simple subject from Scottish peasant life, and he was made an Associate of the Royal Scottish Academy in 1849, in which year he produced an interesting work entitled 'Scott and his Friends at Abbotsford,' which was engraved by his brother James Faed. In 1852 he removed to London, where his 'Mitherless Bairn,' exhibited in 1855, a popular and taking composition, was declared by some critics to be 'the picture of the season.' Of his subsequent works we need mention only 'Home and the Homeless,' 'The First Break in the Family,' 'Sunday in the Backwoods,' 'From Dawn to Sunset,' 'Baith Faither and Mither,' and 'The Last o' the Clan.' Faed was made A.R.A. in 1859, R.A. in 1864, and an honorary member of the Vienna Academy in 1875. He died in August 1900.

Faenza, a town of Italy, 31 miles SE. of Bologna by rail, has an imposing cathedral, a fine market-place surrounded with arcades and adorned with a fountain, and numerous palaces and ecclesiastical edifices. Its manufacture of glazed and coloured earthenware vessels, in Italy called 'majolica,' and in France 'faïence,' has declined in importance. Its chief industries are cotton-spinning, tanning, and the making of pottery, furniture, and carriages. Pop. 45,000. Faenza, the ancient *Faventia*, at one period a town of the Boii, and afterwards a *municipium* under the Romans, fell under the power of the Manfredi family; in 1509 it was captured by Pope Julius II.

Faeroe Islands (Dan. *Færöerne;* Faeroese, *Föroyar*, 'sheep islands'), a Danish group of islands, twenty-two in number, of which eighteen are inhabited, lying between the Shetlands and Iceland, 200 miles NW. of the former, in 61° 25′—62° 25′ N. lat., and 6° 19′—7° 40′ W. long. Their area is 513 sq. m., and their population (1850) 9150; (1901) 15,230; (1921) 21,364. The islands are the remains of a single continuous plateau, originally trenched by deep erosion valleys, which, being submerged by the sea during a subsequent era of depression of the land, became converted into fjords and sounds. Geologically they consist of volcanic rocks, horizontally disposed beds

of basalt predominating. Seaward they present rugged precipitous cliffs, ranging in height from 1000 to 2300 feet, whilst inland they rise into flat-topped pyramidal mountains, which attain maximum elevations of 2502 feet in Skellingfjeld in Strömö, and of 2895 feet in Slattaretind in Österö. The currents that run through the sounds are swift and dangerous; storms and whirlwinds are frequent; and the harbours and anchorages in the fjords and bays are not yet very secure, but, on the other hand, nearly always free from ice. For, though the climate is misty and moist, the winters are comparatively mild. Peat and coal are used for fuel. Trees there are none, owing to the storms; timber

for building purposes is imported from Norway. Tillage is confined to the cultivation of a few vegetables, and attempts, not always successful, to grow barley. The principal sources of wealth are sheep-farming, wild-fowling, and fishing; and the products of these, including wool, feathers, salt and dried fish, whale products, guano, and skins, are the principal exports, sent for the most part to Denmark. The largest islands are Strömö (28 miles long by 8 broad), Österö, Vaagö, Sandö, and Süderö. The capital of the group is Thorshavn in Strömö, with 2500 inhabitants; the town of Kirkebö, on the same island, was formerly the seat of a bishop. The inhabitants, of Norse descent, mixed with a darker element (indigenous, Irish, or Hebridean perhaps), are simple and grave in their manners, and industrious in their habits. They speak an Old Norse dialect, though modern Danish is the language of law-courts, churches, and schools. They belong to the Lutheran Church. Since 1854 the islanders have enjoyed a certain amount of self-government. The elected Lagting elects a representative to the Danish Landsting, and the people elect a representative to the Folketing. From the time of their first colonisation in the 9th century the Faeroe Islands belonged to Norway down to 1380, in which year they passed to Denmark. The natives possess a number of ancient epical ballads (*kvæði*), the most important group being the *Sjúrðar Kvæði*, or songs of Sigurd (ed. with grammar, glossary, &c. by Max Vogler, i. Paderborn, 1877). The chief names in the native literature are Svabo (1746–1824); N. Mohr (1742–90); J. H. Schröter (1771–1851), the first to devote much attention to the prose literature—some of the folk-stories he collected are to be found in *Antiquarisk Tidskrift* (1849–51); the patriotic Poul Nolsö (1766–1809), whose *Vogellied* is the most popular modern poem in the Faeroe dialect; and Venzel Ulrik Hammershaimb, editor of *Færöiske Kvæder* (1851–55).

There is a grammar (1854) by Hammershaimb, who also translated into modern dialect the so-called *Færeyinga-saga*. See Hammershaimb and Jacobsen's *Færøsk Anthologi* (Copenhagen, 1891); Jeaffreson's *The Faroe Islands* (1898); Annandale's *The Faroes and Iceland* (1905); *The Botany of the Faeroes*, by Warming and others (trans. 1909); French works by Leclercq (1883) and Labonne (1888).

Fagging, a usage in the great public schools of England, in virtue of which the senior boys are authorised to exact a variety of services from the junior boys. A lower form boy has certain duties to perform to all the upper form boys, as in stopping the balls for them when practising cricket—and others which he owes to a special master, such as stoking his fire and carrying his messages, of a more or less private kind. The risk of capricious exercise of the senior boys' privileges in harassing or humiliating the juniors is sufficiently obvious; but, on the other hand, the system is said by its defenders to make boys handy, helpful, and docile, while taking the nonsense out of bumptious lads. And the argument chiefly relied on in its favour is that the relation thus established between seniors and juniors prevents bullying. The origin of the usage, which is prominent in tales of school-life, such as *Tom Brown's School-days*, is sought for in the necessity felt in great boarding-schools for a scheme of definite relations amongst the boys, so as to secure definite rights and immunities during the time when they are not in the teacher's presence. A similar usage, called *Pennalism*, sprang up in the German universities in the 17th century; and the freedoms taken, under the name of *hazing*, by sophomore and senior students with freshmen in the American colleges is somewhat analogous.

Faggot-votes, votes manufactured, chiefly for county elections, by the nominal sale of property, under mortgage or otherwise, so as to qualify the holder to vote. The extension of the county franchise left faggot-votes practically no longer worth the trouble of procuring. The term *faggot* described formerly a person who was hired to fill up another's place at the muster of a regiment, or to conceal a deficiency in its strength.

Fagotto. See BASSOON.

Faguet, ÉMILE, French critic and man of letters, was born at La Roche Sur Yon, 17th December 1847, and educated at the École Normale in Paris. He taught at La Rochelle and Bordeaux, and from 1890 was professor of literature at the Sorbonne. In 1900 he was elected to the Académie. He died 7th June 1916. He wrote a history of French literature and numerous monographs, besides dramatic criticisms.

Fahlun. See FALUN.

Fahrenheit, GABRIEL DANIEL, the improver of the thermometer and barometer, was born at Danzig, 14th May 1686. He was originally destined for a commercial career, but he early abandoned trade for natural philosophy, and, after travelling through Germany and England, settled in Holland. About 1714 he conceived the idea of using quicksilver instead of spirits of wine in the construction of thermometers, by means of which the accuracy of the instrument was very much improved. For his determination of his zero, freezing-point, &c., see THERMOMETER. He fixed his freezing-point at 32° to avoid negative measurements. In 1724 Fahrenheit was elected a Fellow of the Royal Society of London; and the *Philosophical Transactions* of that year contain several papers by him on points in natural philosophy. He died 16th September 1736.

Fâ-hsien, a Chinese Buddhist monk and traveller of the beginning of the 5th century A.D., made a pilgrimage from Si-ngan-fu by the Gobi Desert, Khotan, and Hindu Kush, to India, where he spent many years in visiting the scenes of the Buddha's life, and thence to Ceylon, where he copied manuscripts. His book was translated by Giles (1877; revised 1923).

Faidherbe, LOUIS LÉON CÉSAR, French general, was born at Lille on 3d June 1818. His apprenticeship as a soldier was passed in Algiers and Guadeloupe. His activity as a seasoned soldier connects him with the history of the French colony of Senegal, and with the Franco-German war of 1870–71. Proceeding to Senegal in 1852, he became two years later governor of the colony, and in that capacity not only reduced to complete submission several more or less tributary tribes, but also extended the frontiers of the colony by the subjugation of the Moorish Trarza in 1858, and of the country of Cayor in 1861. Under the dictatorship of Gambetta, Faidherbe was summoned to France in December 1870, and given command of the army of the North. After successfully withstanding Manteuffel's attack near the river Hallue, 23d December, he was severely beaten near St Quentin on 19th January 1871. After the conclusion of peace, he was despatched by the French government to Upper Egypt to study the monuments. He died at Paris, 28th September 1889. Faidherbe published useful books on the languages, geography, and archæology of northern Africa, chief amongst which are two collections of *Numidian Inscriptions* (1870–72), *Anthropology of Algiers* (1874), *Épigraphie Phénicienne* (1873), *Le Soudan Français* (1884), a work on *Sénégal* (1889), and treatises on the *Poul Language* (1875) and the *Berber Language* (1877). His

Campagne de l'Armée du Nord appeared at Paris in 1871.

Faïence, or FAYENCE. See FAENZA.

Fainéants Rois (taken to mean the 'Do-nothing Kings,' though *fainéant* is really *faignant*, 'sluggard,' participle of Old French *faindre*, 'to shirk,' 'to feign'), the sarcastic designation of the later Merovingian sovereigns of France, under whom the famous Mayors of the Palace really governed the country. The first of the series was Thierry III., nominally monarch of Burgundy, Neustria, and Austria (i.e. Austrasia); the others were Clovis III., Childebert III., Dagobert III., Chilperic II., Thierry IV., and Childeric III. The last of these was dethroned in 730 by Pepin *le Bref*, Mayor of the Palace, who caused himself to be formally proclaimed king. Louis V., the last of the Carlovingians, and a descendant of Pepin *le Bref*, also received the epithet of *Fainéant*.

Fainting, or SYNCOPE (Gr.), is a condition in which, owing to a sudden mental or bodily impression, the circulation of blood is temporarily arrested or very much diminished in force and volume, the respiration and the functions of the nervous system being likewise suspended. The indications of fainting to a bystander are chiefly a sudden pallor, accompanied by loss of power over the limbs, with disappearance of the pulse and movements of respiration; the eyes are commonly half-open or closed, the countenance bloodless, but quite at rest, and not indicative of suffering or disturbance: the flaccid, motionless condition of all the limbs also tends to distinguish simple fainting from epilepsy and the other diseases attended with spasm; whilst the vanishing of the colour and the suppression of the pulse make a marked distinction between fainting and Catalepsy (q.v.) and other forms of Hysteria (q.v.); with which disorders, however, fainting may in some cases be associated. Minor degrees of fainting, where there is no more than a feeling of faintness and a little pallor, are also common. The mode and origin of fainting and the study of its phenomena alike lead to the conclusion that it is primarily an impression upon the nervous system, very much of the same nature as the Collapse, or shock of a severe bodily injury; this reacts, in the first instance, on the heart, and through the circulation on all the other functions of the body. Fainting may end in death, if too prolonged, or if associated with disease of the internal organs, and especially of the heart. See HEART (DISEASES OF THE). Ordinarily, a person who faints from mental emotion, a hot and close atmosphere, or other transient cause, is readily restored by being laid on the back with the head low, and allowed plenty of cool, fresh air. If the patient is or can easily be placed in a sitting posture, he is often still more quickly brought round by making him bend forward with the head between the knees. The worst possible treatment is to raise him or hold him up, the course nevertheless instinctively adopted by almost every one. Any tight articles of dress should be loosened, and a stream of cold air, or a little cold water, should be directed to the face and neck, so as to arouse the respiratory movements. It is desirable, also, to apply ammonia or aromatic vinegar to the nostrils; but a more effective way of exciting the respiration is to compress the ribs and allow them to expand again, so as to imitate the natural movement. A little alcohol or sal volatile should be administered if the patient can swallow. Care should be taken to ascertain that there is no obstruction in the throat or air-passages, as suffocation from mechanical causes has been mistaken for fainting, and the real origin of the mischief overlooked, with fatal consequences. For some time after coming out of the faint, the person should remain recumbent and quiet till the heart's action is fully restored.

Faioum. See FAYUM.

Fair. See FAIRS.

Fairbairn, ANDREW MARTIN (1839–1912), was born at Inverkeithing, studied at Edinburgh University, and after the requisite theological training became pastor of an Evangelical Union church at Bathgate, from which he obtained leave of absence to pursue his studies in Germany. After his return he preached in Aberdeen until his able theological writings earned him in 1878 the principalship of the Airedale Congregational College at Bradford. In the same year he was made D.D. by his own university, and in 1881–83 he was Muir lecturer there on comparative religions. His brilliant and learned essays in the *Contemporary Review* early attracted attention, and his *Studies in the Philosophy of Religion and History* (1876), *Studies in the Life of Christ* (1880), *Christianity in the First and Nineteenth Centuries* (1883), *The City of God* (1883), *Religion in History and in the Life of To-day* (1844), *The Place of Christ in Modern Theology* (1893), *Catholicism, Roman and Anglican* (1899), and *The Philosophy of the Christian Religion* (1902) secured him a place amongst leading theologians. In 1888–1909 he was principal of Mansfield College (Congregationalist) at Oxford. See Life by W. B. Selbie (1914).

Fairbairn, SIR WILLIAM, engineer, was born at Kelso, 19th February 1789. He was apprenticed (1804) to an engine-wright in a colliery at North Shields, where he studied mathematics, and made acquaintance with George Stephenson. In Manchester (1817) he took a lead in making iron boats; and his works at Millwall, London (1835–49), turned out hundreds of vessels. For the Menai tubular bridge (Robert Stephenson's idea) Fairbairn invented the rectangular tube ultimately adopted (see BRIDGE); and he erected a thousand bridges upon this principle. He aided Joule and Thomson (Lord Kelvin) in 1851 in investigations, and guided the experiments of the government committee (1861–65) on the use of iron for defensive purposes. A chevalier of the Legion of Honour, he was created a baronet in 1869. He died at Moor Park, Surrey, 18th August 1874. See his Autobiography (1877).

Fairfax, EDWARD, the translator of Tasso's *Jerusalem Delivered*, was a son (perhaps a natural son) of Sir Thomas Fairfax of Denton, in Yorkshire. The year of his birth is not known, but is believed to have been about 1580. His life was spent quietly, in literary pursuits, at Fewston, near Otley, where he died in Jan. 1635. His translation of *Gerusalemme Liberata* (1600; new ed. 1890) was dedicated to Queen Elizabeth. For poetical beauty and freedom it has been the theme of universal praise. Dryden ranked Fairfax with Spenser as a master of English, and Waller said that he derived from him the harmony of his numbers. Hallam, much less enthusiastic, says that it lacks the grace of the original, though not wanting in spirit and vigour. Fairfax also wrote a *Discourse of Witchcraft* (1621), describing how two of his own daughters were bewitched. It was published by Monckton Milnes in the *Miscellanies* of the Philobiblon Society (1858–59).

Fairfax, THOMAS, LORD, generally known as Sir Thomas Fairfax, parliamentary general, was the son of Ferdinando, Lord Fairfax, and was born January 17, 1612, at Denton, Yorkshire. He studied at St John's College, Cambridge, and from 1629 served as a volunteer in Holland,

under Lord Vere, whose fourth daughter, Anne, he married (1637) shortly after his return to England. On the outbreak of the Civil War in 1642 Fairfax espoused the cause of the Parliament, and was appointed general of horse under his father, who commanded the parliamentary forces in the north. He distinguished himself so much by his valour, prudence, and energy, especially at Marston Moor (1644), where he was wounded, that in 1645, when the Earl of Essex resigned the office of general of the parliamentary forces, Fairfax was appointed to the supreme command; but the real ruling genius of the army was Cromwell, who had risen to be lieutenant-general. In June 1650, on Fairfax's refusal to march against the Scots, who had proclaimed Charles II. king, Cromwell was appointed commander-in-chief in his stead. Fairfax now withdrew into private life. After the death of Cromwell he laboured for the restoration of the king, and gathered troops to assist General Monk against Lambert. He was appointed head of the commission despatched to the Hague in 1660 to arrange for the return of Charles II. He died at Nunappleton, Yorkshire, 12th November 1671. Fairfax wrote several works, prose and poetic, including two memoirs on the Civil War. See his Correspondence (4 vols. 1848–49), and a Life by C. R. Markham (1870).

Fairford, a village of Gloucestershire, 9 miles E. of Cirencester, and 26 WSW. of Oxford. Its fine Perpendicular church, built by John Tame in the 15th century, is famous for its splendid series of twenty-eight stained-glass windows, often erroneously attributed to Albert Dürer, but really of Flemish workmanship. Keble was a native. See the Rev. J. G. Joyce, *The Fairford Windows* (fol. 1872).

Fair Head, or BENMORE, a precipitous promontory of the north coast of Antrim, Ireland, opposite Rathlin Isle, which is 4 miles to the NW. It rises 636 feet above the sea, and consists of Carboniferous strata, overlaid by greenstone columns, 20 to 30 feet thick, and 280 to 300 feet high.

Fairies, Elves, supernatural beings, generally of human form but diminutive size, a belief in whom has been among the superstitions of the greater portion of the European nations. The word *elf* is from the Anglo-Saxon *ælf*, which corresponds to the Danish *alf*, the Icelandic *álfr*, and the German *alp;* but the Germans adopted in the 17th century *elf* and *elfe*, from the English for the same idea. Fairy is properly enchantment, or the realm of fairy spirits, *fay* being originally the name of the sprites themselves. Fay (Low Lat. *fata*, 'fairy;' Fr. *fée*) is from Lat. *fatum*, 'fate,' and once meant the goddess of destiny. From the Old French *fae* (=*fée*) comes *faerie*, 'enchantment;' whence fairy. The Celtic fées or fairies are undoubtedly relics of those *matres* and *matronæ* which appear on Gallo-Roman inscriptions as objects of popular belief. After the transfusion of the Teutonic and southern nations the northern elves (which were originally of two kinds—the light elves, or elves proper, and the dark elves, or dwarfs) became mixed up with their Celtic kindred, the fairies, in inextricable confusion.

Tracing back the antecedent history of this widespread belief, various fanciful theories have been suggested to explain its origin and growth; most of which cannot be accepted as satisfactory. But, like many other survivals of superstition, it is probably to be connected with the mythological conceptions of the Greeks and Romans; some folklorists referring the fairy to the Parcæ or Fates of primitive times, who were supposed to rule the destiny of man. The long occupation of Gaul by the Romans familiarised its natives with their mythological conceptions of nymphs and fauns; and indeed these closely resemble in many particulars the famous fays of the medieval romances. Again, the native Gauls themselves had a large pantheon of topical divinities, and doubtless these became fused with the other traditional figures, whether due to creative imagination or to more or less direct transmission, and thus helped to create the composite product forming the fairydom of our folklore, which through such literary mediums as the work of Straparola and the *Pentamerone* of Basil has exercised a profound influence upon western Europe. Fairies in literature have received the most different treatment: thus, Boiardo's, Ariosto's, and Spenser's fairies are mere diminutive men, with all the ordinary human emotions, while in the Oberon and Titania of Shakespeare's *Midsummer Night's Dream*, and in the fairies that touched the imaginations of Ben Jonson, Herrick, Drayton, and even the youthful Milton, we find that the aerial and supernatural quality is the predominant feature in the characterisation. Altogether they are more romantic and interesting figures, and at the same time in their other-worldly conception are more real to the human imagination.

Comparatively modern fairy legends tell us how these little beings preside at the birth of man; and we know how at the birth of Ogier le Danois six fairies attend, five of whom give good gifts. In those parts of the world where there are mountains, mists, dangerous morasses, cataracts, and stormy oceans, all superstitions, being a belief in supernatural agencies, are naturally exaggerated, and, from the dangers to which the people are liable from the agencies they deem supernatural, the belief takes deep root in their minds. Accordingly, in flat and well-cultivated countries like England, the fairy superstition is simple and homely, connecting itself with matters of domestic routine, such as the sweeping of the dwelling-house, the skimming of the milk, the preservation of the butter, and the like, numerous allusions to which are found in Shakespeare. In Scandinavia and the Highlands the fairy people are connected with storms and convulsions, betray people to their death, fly away with them into the infinite cloud-land, or lead them through endless caverns within the earth. It has been observed as a further distinction that the fairies of the German or Teutonic tribes are more harsh, fierce, uncomely, or deformed than those of the Celtic nations, which have a tendency rather to the aerial and the graceful. Still the amount of common characteristics in the superstition throughout Europe is enormous. Its peculiarities have been found so much more emphatically displayed in Scandinavia than elsewhere as to have suggested the earlier and less philosophical view that modern fairydom is merely a remnant of the old mythology of the northern nations, communicated by them to a greater or less extent in all the countries over which their vikings carried their ravages.

There is a further distinction between the fairies of poetic and heroic literature and those of popular belief—the former being princes and princesses of chivalry, only distinguished from human beings by their superhuman superiority in all the qualities which elicited respect in the age of chivalry; while those of popular belief are small in stature, sometimes decrepit, and endowed with dispositions generally more allied to malignity than magnanimity. In Ireland and the Highlands they have been spoken of as a wandering remnant of the fallen angels, and in the west of England the pixies are the souls of infants who died before they were baptised. Sometimes they

are supposed to be human beings, metamorphosed or disembodied, and this form of the superstition has made fairyland a place of purgation for those whose sins have condemned them to it. The analogy is carried out in the belief that the services of the living can extricate the souls so situated; but it is rather through dexterity and courage than pure piety that the feat is achieved, and the rescues from fairyland form some of the most wild and exciting of the elfin narratives—as, for instance, the exquisite ballad of *Tamlane*. The only dark cloud that obscures the brightness of fairydom is the periodical necessity of paying a teind to hell—a necessity which casts unexpected light upon the radical affinities of the fairies, in spite of all the seeming gaiety and happiness of their world. Hence their desire for kidnapping human children, in order to pay with them the inevitable tribute. Again, they do not possess spiritual souls like men and women, and consequently have no immortality of existence—this notion forms the heart of the most exquisite of artistic fairy-tales, the *Undine* of Fouqué.

There is still another broad distinction into fairies that dwell in the upper air and fairies that dwell within the bowels of the earth, while a third class frequent the waters. The Scandinavians called the fairy inhabitants of the air white elves, those of the earth black. Whatever was genial, light, playful, and benevolent in the superstition clustered round the former; the latter did all the work that was dark, cruel, and rapacious. Naturally enough, the black or subterranean kind frequented mining districts, where they might be seen extracting the ore for themselves, and thus unwittingly leading the miner to rich veins of metal. They might be seen in an occasional peep through an aperture of a hill in their underground retreats, in chambers supported on jasper columns, where they were stowing away their ample stores of gold and silver. Some of the most exciting tales about the German *kobold*, and the Irish *leprechaun*, who was a creature of the same kind, are founded on the efforts of adventurous mortals to get possession of their riches. There exists a legend, occurring in nearly identical terms in several countries, which connects some piece of valuable plate belonging to a church with the underground fairies. The story of the horn of Oldenburg is a type of these narratives. Pictures represent it as a beautiful drinking-vessel, in the shape of a horn, exquisitely decorated with the finest fanciful silver-work, in the style contemporary with the richest Gothic architecture. The legend is that one day Otho of Oldenburg, being exhausted with hunting, and very thirsty, exclaimed, 'O God, would that I had a cool drink!' Thereupon there appeared before him, as if coming out of the rock, a lovely maiden, who offered him a drink in the fairy-horn. He made off with it, and saved himself from evil consequences by bestowing it on the church. Hence these relics are generally in churches; but one of them is still in the possession of an English family, and, as their prosperity was traditionally believed to depend on retaining it, it was called the 'Luck of Eden Hall.'

Puck and the pixies belong to the same class of beings. Of the elf-folks of Scandinavia, the male is old and ill-favoured, but the evil element in the elf-woman or elf-maid consists in her beauty, which renders her perilous to romantic and lovelorn youths, whom she beguiles either with her own charms or by assuming the aspect of their mistress. To our own literature belongs one beautiful story of this character—the ancient tale of the love between 'True Thomas' and the Queen of Fairyland, which the genius of some nameless maker has woven into imperishable verse. A common feature, both here and elsewhere, in the stories of fairy-women who assume human form and give their love to men, is a restriction of some nature which must not be broken. All mermaids, lamias, and the like are subject to some such conditions. Thus, Melusine is once a week again a serpent from the waist downwards, and when her husband breaks her one condition and surprises her at her bath, she becomes a water-sprite again.

In Ireland, and also in the Border country of Scotland, the fairy superstition has been incorporated into innumerable poetic legends and mystic traditions. T. Crofton Croker, in his *Fairy Legends and Traditions of the South of Ireland* (3 vols. 1828), presents a full and amusing account of the Irish fairies or elves, which he describes as 'a few inches high, airy, and almost transparent in body; so delicate in their form that a dew-drop, when they chance to dance on it, trembles indeed, but never breaks. Both sexes are of extraordinary beauty, and mortal beings cannot be compared with them.' They do not live alone, or in pairs, but always in large societies, and are governed by a queen. The same author adds: 'They are invisible to man, particularly in the daytime, and, as they can be present and hear what is said, the peasantry never speak of them but with caution and respect, terming them the good people, or friends. They have their dwellings in clefts of rocks, caves, and ancient tumuli. Every part within is decorated in the most splendid and magnificent manner; and the pleasing music which sometimes issues from thence in the night has delighted those who have been so fortunate as to hear it.' There are Irish fairies, however, of more special character. Among these are the *banshee*, or female spirit who watches a particular family; the *leprechaun* or *cluricaun*, an elf of evil disposition, who usually appears as a wrinkled old man, and has a knowledge of hidden treasure; and the *pooka*, a spirit of diabolical disposition, who sometimes appearing as an eagle or a black horse hurries the person he gets possession of to destruction. Of similar varieties are the Scottish elves: the *brownie*, or domestic spirit nearly corresponding to the Banshee; and the *kelpie*, a kind of water-horse, not unlike the Pooka, and in form somewhat analogous to the being sung by Leyden in his charming ballad, 'The Cout of Keeldar' (*Minstrelsy of the Scottish Border*):

> 'Brown dwarf, that o'er the muirland strays,
> Thy name to Keeldar tell!'
> 'The Brown Man of the muirs, who stays
> Beneath the heather-bell.'

Fairies cannot be seen by mortal eyes with impunity—it is the main part of Falstaff's terror when he sees his assailants: 'They are fairies; he that speaks to them shall die' (*Merry Wives*, V. v.). But the greatest risk that mortals run from the denizens of fairyland is that already alluded to, of having their children stolen from the cradle, and a changeling substituted who bears a resemblance to the stolen infant, but is an ugly little creature and never thrives. On this theft of a maid, who is carried to fairyland, but in the course of time returns to her parents, James Hogg founded his fine ballad of 'Kilmeny' (*Queen's Wake*).

Besides being embalmed in imaginative literature, the fairy has a perpetual memorial in the small, exquisitely shaped arrow-heads found so abundantly in northern countries, where they were long known as elf-arrows, or bolts with which the more malignant fairies sometimes slew or injured cattle and human beings; thus, when a poor man's cow or heifer was suddenly affected with some deadly and incomprehensible illness, it was said to be 'elf-shot.'

See especially Keightley's *Fairy Mythology* (1850), and the articles DEMONOLOGY, and FOLKLORE; also Ritson's

Fairy Tales (1831); Halliwell's *Fairy Mythology of A Midsummer Night's Dream* (1845); Schreiber, *Die Feen in Europa* (1842); Maury, *Les Fées du Moyen Âge* (1843); Grimm's *Deutsche Mythologie* (1835; trans. 1879-88); Wirt Sikes, *British Goblins* (1879); Hartland, *Science of Fairy Tales* (1891); Evons Wentz, *The Fairy Faith in Celtic Countries* (1912); Floris Delattre, *English Fairy Poetry* (1912); also the collections of fairy tales of Grimm, Crofton Croker, Von Hahn, J. F. Campbell, Dasent, Ralston, &c.

Fair Isle, a solitary Shetland island, 24 miles SSW. of Sumburgh Head. It is 3 miles long by 2 broad, and 3 sq. m. in area, with high rocky cliffs and promontories, rising in the Sheep Craig to a height of 480 feet. The men are fishers; the women knit. At Stromceiler Creek was wrecked, in 1588, a ship of the Spanish Armada, commanded by Don Juan López de Medina. He escaped with a few of his crew; and from these shipwrecked Spaniards the natives of Fair Isle are said to have acquired their art of knitting parti-coloured woollen articles.

Fairs (Fr. *foire*, from Lat. *feriæ*, 'holidays'), great periodical markets, some of which are chiefly devoted to one kind of merchandise, while others, of a wider scope, afford opportunity for most of the sales and purchases of a district. Fairs have long been regularly held in most parts of Europe and in many parts of Asia; but, as they belong rather to a state of things which is passing away than to modern civilisation, they have not been established or have not acquired the same importance in America. In Italy, towards the close of the 5th century, we first find authentic accounts of fairs specially designed as marts for commerce, and in Greece it has been suggested that at the celebrated Greek games trade was no entirely subordinate object. Thus, Cicero tells us that as early as the age of Pythagoras large numbers of people attended the religious games for the purpose of trading; and we know how at Delphi and other places a fair was held almost every year. In modern Europe they appear to have been associated with the church festivals, which were found to afford convenient opportunities for commercial transactions, the concourse of people being such as took place upon no other occasion. This origin of fairs is commemorated in their German name *Messe*—i.e. 'mass' (compare the *-mas*, for 'mass,' in such words as Lammas, Martinmas, &c.) Some festivals, from circumstances of place and season, speedily acquired a much greater commercial importance than others, and began, therefore, to be frequented by buyers and sellers even from remote parts of the world. When the ordinary means of communication between countries and opportunities for the exchange of commodities were very limited, fairs were of great use. Princes and the magistrates of free cities found it to their advantage to encourage them, and many privileges were granted, which in some places still survive. Courts of summary jurisdiction—commonly called in English 'pie-powder' (Fr. *pied poudré*), from the dusty feet of the suitors—were established distinct from the ordinary courts of the county or city, for the determination of questions which might arise during the fair. In connection with all this the practice was necessarily adopted of publicly proclaiming the commencement and duration of the fair, and this still subsists where scarcely any other vestige remains of the old privileges of fairs.

In western Europe the goods exposed for sale at fairs are chiefly those in respect of which there is a frequent change of fashion. While in some parts of the Continent persons of all ranks still wait (or did lately) for the great yearly fairs to make their principal purchases of clothing and of manufactured articles of all kinds, such things as corn, wine, spirits, tea, coffee, sugar, tobacco, oil, &c. are seldom seen in them. It is otherwise, however, in places on the outskirts of civilisation; and almost all the produce of great provinces is sold, and all that their inhabitants require is bought, at such fairs as those of Kiakhta and Nijni-Novgorod. In France much of the European commerce of the middle ages was transacted at the famous fairs of Champagne and Brie, where the merchants of Italy, Spain, and France congregated. The British fairs really of much use at the present day are those at which horses and live-stock are exposed for sale, and even these have greatly decayed in importance: of these some held on the borders of the Scottish Highlands and elsewhere in Scotland were wont to be frequented by buyers and sellers from all parts of the kingdom. Such are the fairs or trysts, as they are called, at Falkirk, Doune, &c. At other great yearly fairs in the south of Scotland lambs are sold; and fairs chiefly for the sale of the annual produce of pastoral districts are common in almost all parts of the world.

Of the three annual fairs at Leipzig the most important are the Easter and Michaelmas fairs, each of which lasts three weeks. The chief articles sold are leather, cloth, and furs. The Leipzig Book-fair is a fair in name only, being really an occasion for the settlement of accounts among booksellers and publishers; it occurs at the time of the Easter fair. Next to the Leipzig fairs those of Frankfort-on-the-Main are the most important in Germany. The great fairs of Lyons and Beaucaire in France, of Frankfort-on-the-Main and Frankfort-on-the-Oder in Germany, of Budapest and Debreczen in Hungary, of Sinigaglia, Alessandria, and Bergamo in Italy, and of Nijni-Novgorod (q.v.) in Russia are, or were, among the most important in Europe; the last, which attracted representatives from all parts of Russia, occupying a site comprising 7 sq. miles. The fairs of Tanta in Lower Egypt, of Kiakhta and Irbit in Siberia, of Mecca in Arabia, and of Hurdwar in Western India are also of very great importance. That of Kiakhta is a sort of barter-market, where formerly almost all the commercial transactions between Russia and China took place. The fairs in Britain have latterly sunk for the most part to insignificance, and in many instances have entirely disappeared. They were gatherings adapted to a comparatively backward state of society, when the provincial stores of goods were few, and the means of communication defective. The prevalence of good roads, populous towns with dealers in miscellaneous wares, and improved methods of transport have superseded the necessity for the ordinary class of fairs, and in consequence they have in some cases degenerated into mere scenes of merriment. Such were Bartholomew Fair (q.v.), Greenwich Fair, Glasgow Fair, and Donnybrook Fair, near Dublin; all either extinct or nearly so. The boisterous merriments at these fairs were of old the devices employed as likely to attract a great concourse of people; hence each fair had its sport or drollery—football, wrestling, yawning, cudgel-playing, throwing at cocks, sack-races, flying dragons, grinning through horse-collars, mock-giants, monstrous fishes, soaped pigs, smoking-matches, eating hot hasty-pudding, whistling, wheelbarrow races. At Stourbridge Fair, one of the most important in the kingdom, an excellent proclamation was issued in 1548 by the university of Cambridge in 'crying the fair,' containing among other 'comaunds' this clause: 'No brewer sell into the fayer . . . a barrell of good ale above tuo shillings—no long ale, no red ale, no sopye ale, but good and halsome for man's body, under ye payne of forfeyture.' It has been remarked that fairs were

established for the most part on the frontiers of the kingdom, or on the marches of ancient provinces; or at the foot of high mountains, at the beginning or end of the snow-season, which for months shuts up the inhabitants in their valleys; or in the neighbourhood of famous cathedrals or churches frequented by flocks of pilgrims; or in the middle of rich pastures. A fair at Christ's Kirk, in Aberdeenshire, held in May, when the nights are very short, began at sunset, and ended an hour after sunrise: it was called 'Sleepy Market.' In America the word fair is used rather for what would in England be called an industrial exhibition, bazaar, or 'fancy fair.' See Cornelius Walford's *Fairs, Past and Present* (1883).

Fair Trade. See FREE TRADE, PROTECTION.

Fairy Rings are spots or circles in pastures, which are either more bare than the rest of the field, or more green and luxuriant. Frequently a bare ring appears, like a footpath, with green grass in the centre, and the circle which the ring forms, or of which it might form a part, is often some yards in diameter. Apart from supernatural hypotheses, it was sometimes imagined that they might be the effect of lightning. Dr Withering appears to have been the first, in 1796, to ascribe them to the growth of fungi; and they are now known to be due to the outwardly spreading growth of the perennial subterranean mycelium of various fungi, chiefly species of Agaricus, even the Common Mushroom (*A. campestris*) showing a tendency to grow in the same manner. The spot where the agaric has already grown is unfitted for its continued nourishment, and the mycelium (spawn) extends outwards to new soil, the fungus exhausting the soil to which it extends for the immediate nourishment of grass, but enriching it afterwards by the highly stimulating products of its own decay. Fairy rings of large size sometimes occupy the same situation for many years. The circle is almost always imperfect, some accidental obstacle having broken the completeness of the expanding ring of mycelium.

Faisal, king of Iraq, was born at Taif in 1885, a younger son of Husein, afterwards king of the Hejaz. In his youth he lived in Constantinople, took part in the revolutionary movement, and returned with his father to Mecca in 1908. He served against the Idrisi, and sat in the Turkish parliament, but in 1915 became a leader in the Arab nationalist movement. In the Great War he organised rebellion, and with an army accompanied the British to Damascus, where he set up an administration. He attended the Peace Conference, and in 1920 was proclaimed king of Syria by the National Congress, but the French expelled him by force of arms. Next year, recommended by Britain, he was elected king of Iraq.

Faith is used by theologians in various senses. It is sometimes taken to denote the mere assent of the understanding to a set of facts or of propositions set before it; but it is more peculiarly used to express the living reception by the heart of the 'truth as it is in Christ.' Some divines have enumerated no fewer than four kinds of faith: (1) The faith of miracles, or that immediate persuasion of the almighty presence and power of their Master, which enabled the early Christians to work miracles—a persuasion, apparently, which might exist and issue in astonishing results without being associated with moral excellence. 'Though I have all faith,' says St Paul, 'so that I could remove mountains, and have not charity, I am nothing.' (2) Historical faith, or the assent of the understanding to truth, the evidence of which is irresistible, such as we have described above. (3) Partial or temporary faith, such as our Lord implies in his exposition of the parable of the Sower, and as appeared to animate those who, after having followed after Christ, turned back and walked no more with him; and (4) Saving faith, or the persuasion of Christian truth wrought in the heart by the Holy Spirit.

These distinctions are rather theological refinements than anything else; the proper and characteristic meaning of the term faith in Scripture has little to do with any of them except the last. 'Faith,' says the writer of the Epistle to the Hebrews, 'is the substance of things hoped for, the evidence of things not seen.' It is a vision, quality, or capacity of soul whereby spiritual truth is apprehended, and spiritual life engendered. The distant is brought near by it, and substantially appropriated; the unseen is felt to be a reality. Faith is the organ by which the soul passes beyond the present and the visible to the eternal and the invisible. Still more characteristically, perhaps, faith is the living affection which binds the Christian to Christ *as a Saviour*.

Faith, in the distinctively Christian sense, can only exist by the operation of God's Holy Spirit. 'For by grace are ye saved, through faith; and that not of yourselves; it is the gift of God.' Orthodox divines greatly insist on the necessity of this operation of the Spirit of God, yet not so as to exclude the active co-operation of man. The Pelagian and Antinomian extremes respectively throw out—the former the divine, the latter the human element. Orthodoxy combines the two, attributing to God the effective agency, but to man a real and voluntary concurrence. For the theological controversies connected with faith, reference must be made to the theological treatises of the different communions.

Faithfull, EMILY (1835–95), born at Headley Rectory, Surrey, early became interested in the condition of working-women, and in 1860 founded in London a printing establishment where women were employed as compositors. She was appointed printer and publisher in ordinary to the queen. In 1863 she started the *Victoria Magazine*, in which the claims of women to remunerative employment were set forth; and in 1868 she published *Change upon Change*, a novel.

Faith-healing, a system of belief based on James, v. 15, that sickness may be treated without any medical advice or appliances, if the prayer of Christians be accompanied in the sufferer by true faith. Dorothea Trudel, at Maunendorf in Switzerland, is said to have wrought marvellous cures by faith and prayer alone between 1850 and 1860. Pastor Blumhardt began a similar system of cure at Möttlingen, in Württemberg. He ultimately resigned his charge, and bought a property with a sulphurous mineral spring at Boll, near Göppingen, where his system was fully developed in a large and much-frequented building specially arranged for his patients. He died in 1880, aged seventy-five. See his Life by Zündel (2d ed. Zurich, 1881). There are homes for faith-healing, called *Bethshan* (Heb., 'house of rest'), at various places in Britain and the United States. Some diversity obtains amongst believers whether the cures are to be accounted miraculous or not, and whether, in addition to the laying on of hands, anointing with oil should be practised. A committee of physicians and clergymen was, in 1914, of opinion that the physical results of what is called 'Faith' or 'Spiritual' healing do not prove on investigation to be different from those of mental healing or healing by 'suggestion.' See PECULIAR PEOPLE, CHRISTIAN SCIENCE.

Faithorne, WILLIAM (1616–91), English engraver. See ENGRAVING.

Faizabad, the capital of the Afghan dependency of Badakhshan (q.v.), stands on the Kokcha, a tributary of the Amu-Daria, 180 miles NE. of Kabul. It is noted for the rubies found near it.—For the Indian town of this name, see FYZABAD.

Faizpur, a town of Bombay Presidency, about 200 miles E. of Surat, with a reputation for its dark-blue and red dyes and cotton prints; pop. 7000.

Fakîr, an Arabic word meaning 'indigent' (not to be confused with *fakîh*, vulgarly pronounced *fiki*, 'a pedagogue'), and commonly used to designate a member of an order of mendicants or penitents, chiefly in India and the neighbouring countries. In Persia and Turkey the word is also synonymous with Dervish (q.v.), and in Egypt is particularly assigned to that class of dervishes which performs *zikrs* and chants funeral dirges. The origin of Fakîrism, an institution which reaches back to the most remote antiquity, is lost in mythical darkness. The common account of the son of a mighty raja, who, expelled from his home and country by the cruelty of his father, made a vow, half in revenge and half in contrition, henceforth to roam a beggar through the world, and to win proselytes to a life of poverty and self-mortification, as most befitting man and most pleasing to the Deity, can hardly be called historical. The same yearning for rest, for peace and pious contemplation, for escape from the noise and turbulence of the world, has everywhere and always led pensive minds into retirement and solitude; and constant seclusion and ceaseless meditation in India, as elsewhere, produced in all but exceptional minds their sad results. Thus abstinence became mortification and self-torture; mental repose was turned to mystic self-absorption or frenzied exaltation. This leaning of the Hindus to a life of asceticism was fostered by their religion, which enjoins various exercises of penance and mortification upon the three higher castes in general, but upon the Brahmins in particular. The world and its usages have no more any claim upon them; even religious ceremonies are no longer necessary to the 'United with God.' They go naked, or in filthy rags, receive the meanest food only, and that without either demand or thanks. Their ethical code consists in the observance of truth, chastity, internal purity, constant repentance, and contemplation of Deity. Fakîrism seems chiefly to have been framed upon this phase of Brahminism, and its adherents were not only pious men, but occasionally saints, believed to be workers of 'miracles' and healers of all ills, especially epilepsy and sterility. But the halo which from the first surrounded Fakîrism, and the ready homage offered by the people, attracted to its ranks at a very early date many whose motives were anything but pure, and who under a garb of humility and mendicity collected fabulous treasures. Strabo already distinguishes these vagabonds from the more honest members of their class, and, if we may trust the travellers of our own day, the more respectable element has now altogether disappeared. Their number is variously stated. In the time of Tavernier's visits (1643–69) there were more than 1,200,000 Hindu and 800,000 Mohammedan fakîrs in the East Indies, and a modern estimate is something over 3,000,000. At times, especially on their return from distant pilgrimages, they are even dangerous, as the killing of an unbeliever is supposed to be an infallible introduction to the glories of paradise. They either live separately as hermits or solitary mendicants, or unite in large gangs, carrying arms and a banner, beating drums, and sounding horns as they approach a town or village. Their appearance is often disgusting in the extreme; they go naked, besmeared with the dung of the holy animal, the cow. Some bedeck themselves with the skins of serpents, some with human bones; others array themselves in the garb of women. Their fearful shrieks, and the rollings of their eyes, add to the hideousness of their appearance. Imitating madmen, they generally end by becoming madmen. Some pass their whole lives in iron cages, laden with heavy chains; some clench their fists till their nails grow through the hand; others hold aloft both their arms till they become like withered branches; while others, again, tie their hands and feet together, and roll head over heels for long distances—for thousands of miles in some cases, it is said. Some forms of Christian Asceticism (q.v.) have produced types, such as Simeon Stylites (q.v.), worthy to be compared with Mohammedan fakîrs.

Falaise, a town in the French department of Calvados, on the Ante, a feeder of the Dives, 23 miles (by rail 31) SSE. of Caen. Crowning a rocky platform, with a steep cliff or *falaise*, stands the noble ruined castle once the seat of the dukes of Normandy, and the birthplace of William the Conqueror. Its keep is Norman, whilst 'Talbot's' Tower is said to have been built by Talbot, after the capture of Falaise by Henry V. of England. The town has cotton works and tanneries. At the suburb of Guibray a fair, established by the Conqueror, is held in August. Pop. 6000.

Falashas. See ABYSSINIA.

Falb, RUDOLF, weather prophet, born 13th April 1838 at Obdach in Styria, was trained a priest, but devoted himself to science, especially meteorology, and after extensive travels settled in Berlin. He held that earthquakes, storms, heavy rainfalls, and other terrestrial phenomena took place on 'critical days,' brought about by the conjoint attraction and influence of sun and moon on the atmosphere and the fluid interior of the earth—a view rejected by most meteorologists—and could therefore be calculated beforehand. He wrote many works on astronomy, physiography, and meteorology, and till his death in 1903, issued half-yearly prognostications of the weather.

Falcón, a maritime state of Venezuela (q.v.), on both sides of the Gulf of Maracaybo. The chief towns are Maracaybo and Coro. Pop. 128,000.

Falcon (*Falco*), the crowning genus in the family Falconidæ, including numerous species which excel even the eagles as birds of prey. They are represented in all parts of the world except the South Sea Islands, and are almost always distinguished by their carnivorous habit, active life, and that evolved hunting talent which has led to the frequent use of not a few forms in the sport of Falconry (q.v.). The beak is short and strong, with a sharp-hooked point and an upper tooth fitting into a depression in the lower half; the claws are strong and sharp, and the outer toe is rather longer than the inner; the lower part of the leg is covered with a net-like pattern of scales; the regions round about the keen eyes are bare; the wings are long and pointed; the tail is also long and rounded. The falcons are pre-eminent for boldness, keen sight, and muscular power. One is said to have traversed the distance between Fontainebleau and Malta, not less than 1350 miles, in 24 hours; and the speed attained when in pursuit of prey has been estimated at 150 miles an hour. They are able to soar to an immense height, and always endeavour to get above the bird they wish to strike. The distinctness of the various falcons is much disputed by experts; the fivefold grouping here followed is that adopted by Professor A. Newton.

(1) The cosmopolitan Peregrine Falcon (*F. peregrinus* or *communis*) was formerly a firmly established British species, but, though still persisting in some parts, has suffered enormously from unreason-

able persecution. It is a powerful bird, though only about 16 inches long, and is brave and masterly in its hunting. In colour the adult is blackish-brown to grayish-blue above, and whitish, with a reddish shade, beneath. Especially on the lighter under surface are seen the dark bars, which in this and the gyrfalcons are longitudinal before and transverse after the first moult. The female is larger and more powerful than the male, with a slightly longer body, and decidedly longer wings; she is *the* 'falcon' of the falconers, the male is a 'tiercel,' the more rufous young forms are 'red falcons' or 'red tiercels.' The peregrine preys upon flying birds, such as wood-pigeons, all sorts of grouse, partridges, and plovers, or by the seashore on puffins, auks, and other marine birds. The falconers pit them against herons, and on its own account a falcon has been known to attack an intruding eagle. The cogent argument used against exterminators of falcons is that which may be urged against any disturbance of the balance of nature: that they kill grouse, pheasants, and other game-birds is undoubted, but they naturally tend to weed out the weaker forms, and thus, unless they predominate unduly, do more good than harm. Some even regard the grouse disease as a nemesis of the destruction of the nobler falcons. Peregrines usually live in pairs, and build large nests, generally of sticks and herbage, on very varying sites—sea-cliffs, inland rocks, or even trees. The Australian Peregrine (*F. melanogenys*) and the North American form (*F. anatum*) are probably only varieties of the above species.

Greenland Falcon (*Falco candicans*).

(2) Next come a number of northern gyr- or jer-falcons, like the preceding, formerly much used in falconry. The Scandinavian Gyrfalcon (*F. gyrfalco*), which sometimes wanders farther south, and has been seen wild in Britain; the Icelander (*F. islandus*), which also comes to Britain; the nearly pure white Greenland Falcon (*F. candicans*), of which the migrating young have been seen in Britain; and the North American Gyrfalcon (*F. labradorus*) are important forms. In their native haunts they feed on ptarmigan, geese, and other such birds.

(3) Somewhat distinct are the desert falcons, by some authorities distinguished as the 'lanners' (*F. lannarius*) and 'sakers' (*F. sacer*) of south-eastern Europe, North Africa, and south-western Asia, both used in falconry.

(4) The Merlin (*F. æsalon*) is a British species, like the peregrine in process of extermination. The male is bluish above and rather ruddy beneath. It is decidedly smaller than the peregrine, and preys upon smaller birds, such as finches, larks, and thrushes; yet so bold is it that it has been known to turn threateningly upon man.

(5) The English Hobby (*F. subbuteo*), with upright carriage and long wings, is a summer visitor in Britain, an eager enemy of larks, and sometimes even condescending to eat insects. Both of the last species have been used in British falconry. The Kestrel (Tinnunculus) is a nearly allied genus, separately discussed.

Falcone, Aniello, Italian battle-painter, born at Naples in 1600. He studied under Ribera (Lo Spagnoletto), and subsequently founded a school of painters at Naples. During Masaniello's outbreak (1647) he organised his scholars and dependents into a secret band (Compagnia della Morte) for assassinating Spaniards at night. On the suppression of the insurrection Falcone betook himself to France, but subsequently returned to Naples, where he died in 1665. His works, few in number, represent chiefly military scenes.

Falconer, Hugh, an eminent botanist and palæontologist, was born at Forres in Elginshire, 29th February 1808. He graduated M.A. at Aberdeen in 1826, and M.D. at Edinburgh in 1829, and joined the medical service in Bengal of the East India Company. Appointed in 1832 keeper of the botanic garden at Saháranpur, he distinguished himself by the discovery of a large number of fossils in the tertiary deposits of the Siwálik hills. It was under his care that the first experiments were made by government in the growth of tea in India; and it was he who discovered during a journey in Kashmir the asafœtida plant of commerce. Overwork told upon his health, and in 1842 he had to return to England, whither he carried five tons of fossil bones and seventy large chests of dried plants. In England Falconer devoted himself to writing memoirs and papers on Indian botany and palæontology, to arranging the Indian fossils in the British Museum and East India House, and to preparing his great illustrated folio, *Fauna Antiqua Sivalensis* (parts i.–ix. 1846–49). He returned to India in 1847 to become superintendent of the botanic garden and professor of Botany in the Medical College at Calcutta. He came home finally in 1855, and in spite of failing health continued his palæontological studies with heroic energy. He died in London, 31st July 1865. A fund of £2000 was raised to provide a memorial of this devoted martyr to science. A memorial fellowship was also founded at Edinburgh University to promote the study of palæontology and geology. The *Palæontological Memoirs and Notes of the late Hugh Falconer* were published in 1868.

Falconer, William, poet, was born in Edinburgh on 11th February 1732. A barber's son, he went early to sea, and before he was eighteen years of age was shipwrecked off Cape Colonna in Greece. The incidents of this voyage and its disastrous end form the subject of Falconer's principal work, the poem entitled *The Shipwreck* (1762). He then entered the royal navy, being appointed towards the end of 1769 purser on the *Aurora* frigate, which foundered at sea, with all hands, shortly after 27th December, the day on which she left Capetown. Falconer wrote several poems, but *The Shipwreck* is the one on which his fame rests; it went through three editions during its author's lifetime. His *Demagogue* is a satire on Wilkes and Churchill (1764), and he was also author of the *Universal Marine Dictionary* (1769).

Falconet, a name used in the 15th and 16th centuries for a small field-gun. The ball weighed from 1 to 2 lb., and the gun from 5 to 15 cwt.

Falcon'idæ, a large family of Birds of Prey (q.v.), occupying a position similar to that of Felidæ among carnivores. The muscular strength and power of flight; the habit of preying upon living animals, and that in daylight; the world-wide representation by over 300 species, are to be noted. The beak is rather short, but very strong, and highest at the root; the partition between the nostrils is complete; the upper margin of the eye-

socket projects; the feet bear strong, sharp, rending claws and large sole-pads. The family includes the Falcons *par excellence*—e.g. the genus Falco; the Eagles—e.g. Aquila, Haliaëtus; the Buzzards—e.g. Buteo; the Kites—e.g. Milvus, Elanus; the Hawks—e.g. Nisus, Astur; the Harriers—e.g. Circus; the Caracaras—e.g. Ibycter, Polyborus—for which see the separate articles.

Head and Foot of Brazilian Eagle.

Falconry (from Old Fr. *faulconnerie*), the art of training falcons and hawks to the chase. The term hawking (from M.E. *hauk*, O.E. *hafoc*), though often used synonymously, is more correctly restricted to the practice of this art in the field. In the East falconry has been traced back to a period anterior to the Christian era, and was practised there and also in Europe long before its introduction into Britain. It was known to our Saxon ancestors, and is mentioned in the *Colloquy* of Archbishop Ælfric, written in the 10th century. In the celebrated Bayeux tapestry Harold is represented with a hawk upon his glove; and the Norman nobles, who were as much addicted to hawking as to hunting, gave a great impetus to the sport in England by the importation of falcons (especially jerfalcons) from abroad, and by the large sums they expended upon this diversion. Henry II. used to send every year for young falcons from the cliffs of Pembrokeshire. Richard I. while in the Holy Land amused himself with hawking at Jaffa, in the plain of Sharon, with hawks which he had brought with him from England. King John used to send to Ireland for his hawks—amongst other places to Carrickfergus, County Antrim, and was especially fond of a flight at the crane with jerfalcons which he received from the king of Norway. He used to hawk in Dorsetshire and Somersetshire, as appears by entries in the court rolls of payments for the expenses of the journeys. When Edward III. invaded France, he had with him, according to Froissart, thirty falconers, and every day either hunted or hawked as his fancy inclined him. The Paston Letters, written in the reign of Edward IV., give an insight into the ways and doings of English falconers in the middle ages, as do also the various 'Household Books' which have come down to us. Henry VII. used to import his goshawks from France, and Henry VIII.'s love of the sport nearly cost him his life, if we may believe the anecdote told of him in Hall's *Chronicle*. During the reign of Elizabeth hawking was much in vogue in England, and Nichols in his *Progresses* has given some interesting details of the queen's participation in this pastime. James I. was a most enthusiastic sportsman, and gave a great impulse to hunting and hawking in England by inviting those of the French nobility who were the greatest adepts in these field-sports to come over to this country, and compete in friendly rivalry with his own subjects. He was especially fond of kite-hawking with jerfalcons, and carried this branch of the sport to great perfection on the wide heaths of Royston, Newmarket, and Thetford. It may be well to correct here an erroneous statement which has been many times repeated in print to the effect that Sir Thomas Monson in the reign of James I. gave £1000 for a *cast*—i.e. for two hawks, the truth being (as stated by Sir Antony Weldon in his *Court and Character of King James*, 1650) that he spent £1000 before he succeeded in obtaining a cast which he considered perfect for kite-hawking.

These were the palmy days of falconry, when the sovereigns on both sides of the Channel (James I. and Louis XIII.) were enthusiastic falconers, giving every encouragement to the sport, when the species of hawk carried was indicative of the rank of the owner, and when the best books were written by English and French masters of the craft.

The disastrous state of the country during the period of the civil wars naturally put an end for the time being to the general indulgence in field-sports; and it may be said that at the Restoration hawking had ceased to be popular, although from that time until the present it has never ceased to be practised by a few admirers of the old sport in various parts of the country. The last member of the royal family, it is believed, who sent for or received hawks from abroad was Frederick, Prince of Wales, son of George II., who occupied the 'palace of Durdans' at Epsom, now a seat of the Earl of Rosebery's, and used to hawk over the downs, where in 1825 there was a spot still known as 'the Hawkery.' Fashion, no doubt, had a good deal to do with the decline of hawking, for so soon as the reigning sovereign ceased to take an interest in the sport the courtiers and their friends followed suit. Between the years 1751 and 1791 the third Lord Orford did much to encourage the practice of falconry in England; and during the first quarter of the 19th century Colonel Wilson (afterwards Lord Berners) in Norfolk, and Colonel Thornton, of Thornville Royal in Yorkshire, not only practised game-hawking with great success (as did also Sir John Sebright, who wrote a practical treatise on the subject in 1826), but excelled in those higher branches of the sport, kite-hawking and heron-hawking, which have long since become impracticable by reason of the extinction of the former quarry and the impossibility of securing the requisite conditions for a flight at the latter.

In 1840 the formation of the Loo Hawking Club, whose headquarters were at the summer palace of the king of Holland, kept the sport alive for many years, and several English falconers who kept hawks of their own annually repaired to Loo for the enjoyment of heron-hawking, which was there carried out to perfection by the Dutch falconers Van der Heuvel, the brothers Bots, and the veteran Adrien Mollen. The last owner of heron-hawks in England was Mr Edward Clough Newcome, of Hockwold in Norfolk, a most accomplished falconer, who died in 1871. About this time was formed the Old Hawking Club, and there are now a great many owners of hawks who carry on the old sport with more or less success in different parts of the United Kingdom, rook-hawking in the spring and game-hawking in the autumn, the interval being devoted to lark-hawking with merlins and flights with the goshawk at rabbits and hares. It may therefore be said that, although from various causes hawking in England has declined since the days of the Stuarts, it has never actually died out.

The birds employed by falconers belong to two classes—the long-winged, dark-eyed falcons, and the short-winged, yellow-eyed hawks. To the former class belongs the Jerfalcons, Peregrine, Lanner, Saker, Barbary Falcon, the Indian Shahin,

the Hobby, and the Merlin; to the latter the Goshawk and Sparrow-hawk. The former take their prey by rising above it in the air, and *stooping* at it from a considerable height, and striking it to the ground; the latter pursue in a straight line, and, overtaking the quarry by superior speed, clutch it, and come down with it. The larger falcons are flown at winged game of all kinds—crows, magpies, rooks, herons, and wild-fowl; the smaller falcons, such as the merlin and hobby, are used for taking larks; while of the short-winged hawks the sparrow-hawk is flown at blackbirds and thrushes, partridges early in the season, and quails, the goshawk taking pheasants, partridges, and wild-fowl, rabbits and hares. With all birds of prey the females are invariably larger and more powerful than the males, and the sexes are consequently selected according to the quarry they have to pursue. Jerfalcons are now rarely employed, partly owing to the difficulty of procuring them, partly because the peregrine falcon is preferred, and experience has shown that except in a woody or inclosed country, where the goshawk and sparrow-hawk are preferable, the peregrine is the most useful of all the birds of prey.

Hawks are either taken young from the nest before they can fly, when they are termed *eyesses*, or are caught later, during the period of their migration, by means of a decoy-pigeon and a bow-net, when they are called *passage-hawks*. The mode of treatment is a little different, inasmuch as the latter have already learned to catch and kill prey for themselves, and only require to be tamed; the former have everything to learn. A passage-hawk on being caught is hooded, and has jesses, or soft leather straps, fastened on her legs. She is then set down on a block of turf to prevent damage to feathers, and fed once a day, at first through the opening of the hood, afterwards with the hood removed. The bird is always fed upon the gloved hand, and gradually learns to step on to it from the perch, increasing the distance daily until she is obliged to fly to reach the fist. The training then commences. The hawk is *called off*, as it is termed, *to the lure*, which means that after tying a long line to the ends of the jesses she is held hooded on the hand of an assistant, until the falconer at the distance of five-and-twenty yards swings the lure to which the bird has been accustomed to come to be fed. The hood being then removed, the hawk flies to the lure, and is exercised in this way for some time daily, until she is sufficiently tractable to be trusted without a line, care being taken not to feed her until she has flown, and always to reward her for coming to the lure with a morsel of the meat with which it is garnished. She is then

Fig. 1.—Leg and foot of Hawk, showing the method of attaching the jesses and bell:
a, end of the leash; *b*, *b*, jesses; *c*, the bell; *d*, bewit; *e*, varvels.

entered at the *quarry* at which she is intended to be flown (partridge, rook, or whatever it may be) by first giving her a live bird at the end of a long line, and allowing her to go off the fist and kill it; eventually the line is dispensed with, and she is flown at wild quarry.

Such, briefly, is the mode of training a passage-hawk. An eyess is somewhat differently treated. A straw-covered platform is put up in some shed or outhouse, and on this the nestlings (which should not be taken too young, or they will turn out *screamers*) are placed, the platform being about as high up as one can reach to feed the birds. They are fed three times a day on fresh lean beaf, while growing, to keep up their strength, or *hunger-traces* will appear, like cuts across the webs of the feathers, and the latter breaking will render the birds useless. When they are strong enough and able to fly, jesses are put on the legs, and a spherical brass bell (of Dutch or Indian make) on one leg, fastened just above the *jess* with a little narrow strip of leather termed a *bewit* (see fig. 1). At feeding time, now once a day, they are called to the lure, and, being allowed their liberty for some weeks (in which state they are said to be *flying at hack*), they daily gain strength and wing-power, until the time comes for taking them up and commencing their training, which after this stage does not differ much from the method above described for passage-hawks. When flying at hack, a hawk sometimes becomes wild, wanders away to a distance, and kills game for herself. When this is perceived, a bow-net or other device for snaring is set for her, to which she is decoyed and recaptured. The first operation in training is *hooding*, which, if successfully performed, overcomes much difficulty. It requires some patience and dexterity, and should be practised at first in a darkened room, in which the hawk will be much quieter than in broad daylight. The hood is simply a cap of leather (see fig. 2) made to fit the head in such a manner as to obscure the light, a single aperture only being left, through which the beak protrudes, and a slit behind, which is opened and closed, when the hood is put on and off, by means of *braces*, one pair of which opens, the other pair closes the slit; the eye-pieces, which to prevent injury to the eyes are carefully *blocked out*, are covered for ornament with red or green cloth. By temporarily blindfolding the hawk, the hood causes her to sit perfectly quiet, and prevents her from *bating*, or fluttering, at the risk of breaking feathers, as she would do if frightened by passers-by until gradually accustomed to them.

Fig. 2.—Hooded Peregrine on the block:
One end of the leash is attached to the jesses, the other to a ring driven into the side or top of the block; and thus the hawk is prevented from escaping.

Allusion has already been made to the jesses, or soft straps of leather (dog-skin is best), which are fastened to the legs of the hawk, by which to hold her on the glove and tie her to the perch or block. These jesses are about 6 inches long, and are never removed when the hawk is flown. In former times *varvels*, or flat rings of silver with the owner's name engraved thereon, were permanently attached to the ends of the jesses, and through

these one end of the leash was passed, the other end being prevented from going through by a leather button. At the present day, however, most falconers prefer using a figure-8 swivel, which is always detached before the hawk is flown.

The *lure*, already referred to, is a device for luring the hawk back to her owner after an unsuccessful flight, and on this account the hawk is early made acquainted with it by being fed upon it daily while being trained. There are various patterns; one of the simplest and most easily made consists of a couple of pigeons' wings tied together on a flat circular leaden weight covered with leather, upon which a piece of raw meat is tied on both sides. The *tabur-stick* and *drawer*, which were formerly used as lures, have long been discarded.

The beaks and claws of wild caught hawks are generally so long and sharp as to require paring or *coping*, as it is termed; but this operation requires to be very carefully performed (the hawk being hooded and held by an assistant), and not more than the tenth of an inch removed, or the efficiency of the beak and claws will be impaired. Indeed some falconers will never cope a hawk, except when the beak is overgrown; and with goshawks especially, which have to hold such powerful prey as hares and rabbits, strong and sharp talons are indispensable.

Eastern falconers carry their hawks upon the right hand; but European falconers always carry them on the left, leaving the right hand free for detaching leash and swivel, and removing and replacing the hood.

The following are some of the technical terms used in falconry. The wings of a hawk are termed the *sails;* the tail, the *train;* the legs, *arms;* the toes, *petty singles;* the claws, *pounces;* the crop, *gorge;* the stomach, *panel;* the pellets of feathers and undigested food which are thrown up after feeding are termed *castings*. A young hawk from the nest is an *eyess;* one that can perch but not fly, a *brancher;* an eyess reared at liberty, a *hack-hawk;* one taken later on migration, a *passage-hawk;* a young hawk in the first year's plumage is called a *red-hawk*, or a *soar-* or *sore-hawk*, from the Fr. *sorel*, 'a reddish-brown colour.' A wild caught adult hawk is a *haggard*. After the first moult a hawk is said to be *intermewed;* when completely moulted, *full summed;* when purged of all superfluous fat and in good condition, *enseamed*. A broken feather is repaired by a process termed *imping;* cutting or paring the beak and claws is termed *coping*. The prey when living is called the *quarry* (from the Fr. *curée*); when dead, the *pelt*. A hawk is flown either *out of the hood*—i.e. off the fist—as in rook-hawking, or is *put up*, or *cast off*, as in game-hawking before the game is sprung. In the latter case, when a hawk soars in circles at a height above the falconer's head, she is said to *wait on*. She *stoops* when descending with closed wings from a height at the quarry, *binds* when she seizes it in the air and comes down with it, *carries* when she flies off with it, *rakes off* when she flies straight away without soaring, and *checks* when she changes the bird in pursuit. At home she sits either indoors upon the *perch* or out of doors upon the *block*, and is carried to the field hooded upon the *cadge*, a padded wooden frame of square or oval shape, which is borne by an assistant with the aid of shoulder-straps. In this way six or eight hawks may be carried without difficulty, since, being hooded, they sit perfectly quiet.

The principal works on falconry in English are the treatise on hawking in *The Boke of St Albans* (1486) of Dame Juliana Berners (q.v.), from which very little practical instruction is to be gained; Gervase Markham, *Gentleman's Academie* (1595), a later version of the last named; Turberville, *Book of Falconrie* (1575-1611); Latham, *Falcon's Lure and Cure* (1615-18 and 1633); Bert, *Approved Treatise of Hawks* (1619); Nicholas Cox, *The Gentleman's Recreation* (1674, and numerous later editions); John Ray, *Summary of Falconry* (1678); Campbell, *Treatise of Modern Falconry* (1773); Sir John Sebright, *Observations on Hawking* (1826); Belanay, *Treatise upon Falconry* (1841); Salvin and Brodrick, *Falconry in the British Isles* (1855 and 1873); Freeman and Salvin, *Falconry* (1859); Freeman, *Practical Falconry* (1869); Harting, *Essays on Sport* (1883), *Hints on the Management of Hawks* (1884), *A Perfect Booke for kepinge of Spar Hawkes* (1886), and *Bibliotheca Accipitraria* (1892); Cox and Lascelles, *Coursing and Falconry* (1892); and Michell, *Art and Practice of Hawking* (1900).

Faldstool, a small desk in churches in England at which the litany should be sung or said. The name is also given to a folding-stool used by Roman Catholic bishops and other prelates.

Falemé, one of the most important tributaries of the Senegal, rises in Futa-Jallon, and after flowing in a northerly direction joins the main stream above Bakel. About 120 miles above its mouth the Falemé is interrupted by rapids and waterfalls. Up to that point it is navigable for small steamers during two months of the year.

Falerii, a city of ancient Etruria, and the capital of the Falisci, was situated west of the Tiber, and north of Mount Soracte. After its capture and destruction by the Romans (241 B.C.), the inhabitants settled on a new site a few miles off. See ETRURIA.

Falernian Wine, so called from *Falernus Ager*, the district in which it was grown—and which lay in the northern portion of Campania, between the Massican Hills and the northern bank of the Vulturnus—was one of the favourite wines of the Romans. It is described by Horace as, in his time, surpassing all other wines then in repute. In the time of Pliny Falernian wine had declined in quality. Red Falerno and white is still largely made and exported.

Faliero, MARINO, Venetian general and doge, was born about the year 1274. At the siege of Zara, in 1346, he defeated an army of 80,000 Hungarians, and afterwards, whilst in command of the fleet, captured Capo d'Istria. Subsequently he became ambassador of the republic to Rome and Genoa. He was elected Doge of Venice in 1354. In the following year, dissatisfied, it is said, with the punishment inflicted by a patrician tribunal upon a young noble, Michele Steno, who had publicly insulted the youthful wife of the aged doge, Faliero conspired with the plebeians to assassinate the oligarchy and make himself supreme ruler of Venice. The conspiracy was, however, revealed on the eve of its execution, and Faliero was arrested and beheaded on the 17th of April 1355.

For the true story, see F. Marion Crawford's *Venetian History* (1906) and the *Edinburgh Review* for July 1906, rather than Byron's and Swinburne's tragedies.

Falk, ADALBERT, Prussian statesman and leader in the *Kulturkampf* with the Roman Church, was born at Metschkau, in Silesia, 10th August 1827. Educated for the law, he held various judicial and administrative posts in his native province, until he was appointed Minister of Public Worship and Education in 1872. In this capacity he was mainly instrumental in carrying the so-called May laws (because passed in May 1873, 1874, and 1875), aimed against the excessive influence of the Church of Rome, by limiting the influence of the clergy in the schools, by reorganising the seminaries for the training of teachers, and by defining in a stricter and more comprehensive manner the relations generally of the clergy to the state. When, how-

ever, Bismarck came to bid for the support of the clerical party, in order to carry out his later internal policy, Falk resigned in 1879. Thereafter he lived in retirement, and died 7th July 1900.

Falke, GUSTAV, German poet and novelist, born at Lübeck 11th January 1853, taught music at Hamburg, where he had for friends Liliencron and Dehmel, and died 8th February 1916. Falke was late in developing, and holds an intermediate position between the older poets and his younger contemporaries. He was much influenced by Liliencron, who suggested the title of his first book, *Mynheer der Tod* (1891). Many books of lyrics and children's tales followed, characterised by simplicity, feeling for nature, melody of verse and artistic spontaneity of form. Some prefer his novels of Hamburg life to Frenssen's. See his autobiographical *Die Stadt mit den Goldenen Türmen* (1912).

Falkenhayn, ERICH VON, German statesman and general, was born 11th September 1861 near Thorn. He spent some time in China before and after the expedition of 1900. In 1913–15 he was Prussian war minister, and from December 1914 to August 1916, as chief of the general staff, directed the push against Warsaw. His success in the east did not save him from the consequences of failures in the west, and Hindenburg took his place. In 1916–17 he commanded in the invasion of Rumania. He wrote *Die oberste Heeresleitung* (1920) and other books of literary quality, and died 9th April 1922.

Falkirk, a town of Stirlingshire, finely situated on a rising ground in the midst of a populous mineral and manufacturing district, and overlooking an expansive 'carse,' is 3 miles SW. of its seaport, Grangemouth, 20 NE. of Glasgow, and 21 WNW. of Edinburgh. Including now the suburbs of Grahamston, Bainsford, Laurieston, and Camelon, it was constituted a parliamentary burgh in 1832, and since 1918 has combined with Stirling and Grangemouth to return one member. Its parish church—the *Eglais Bhrec, Varia Capella,* or *Faw* ('speckled') *Kirk* of chartularies and local tradition—was rebuilt in 1810. There are also the county buildings (1868), burgh buildings (1876), town-hall (the former corn exchange, 1859), an equestrian statue of Wellington (1854), a science and art school (1878), the Dollar Free Library (1888), and a hospital. The famous cattle 'trysts' or fairs, where stock was annually sold to the value of £1,000,000, have been largely superseded by the weekly auctions. The iron manufacture is carried on busily at Carron (q.v.). Pop. (1921) 33,308. At Falkirk on 22d July 1298 Edward I. inflicted a disastrous defeat on Wallace, and on 17th January 1746 Prince Charles Edward defeated Hawley. Antonine's Wall (see ANTONINUS PIUS) is the chief antiquity.

Falkland, a royal burgh (since 1458) of Fife, at the north-eastern base of the steep East Lomond Hill (1471 feet), 22 miles north of Edinburgh. Nothing remains of the old castle of the Earls of Fife, in which David, Duke of Rothesay, is believed to have been starved to death by the Regent Albany (1402); but there are extensive and stately remains of the later royal palace (*circa* 1450–1542), with singularly fine Renaissance details. It was the death-place of James V., and has memories of almost all the other Stewart sovereigns. With the estate and a modern mansion (1844), it was purchased in 1888 by the Marquis of Bute, who thoroughly restored it. Pop. 800.

Falkland, LUCIUS CARY, VISCOUNT, was born most probably at Burford, Oxfordshire, in 1610, son of Sir Henry Cary, himself of literary tastes and a friend of Ben Jonson. His father, created Viscount Falkland in the Scottish peerage in 1620, was the well-meaning but unfortunate lord-deputy of Ireland from 1622 to 1629; his mother was learned in languages and in the Fathers, was an early friend of Chillingworth, and, while still a girl, became a convert to the Catholic faith, though she did not avow it for twenty years. Lucius went to Ireland with his parents, and had his education at Trinity College, Dublin, succeeded to his maternal grandfather's property at nineteen, according to Clarendon, and soon after married, to his lasting happiness, Letice, daughter of Sir Richard Morrison. But the marriage irritated his father, who had been ambitious of a more splendid match, and moreover seems to have been displeased at the descent of his father-in-law's property to his son. With that instinctive unselfishness, linked with impulsive temper, so characteristic of his nature, Lucius at once offered, but to no purpose, to give up all claim upon the estate; he next crossed to Holland to volunteer into the service of the young republic, but soon returned to devote himself to his studies, especially of Greek. His father's death in 1633 gave him the title, and for a time he lived with his mother and listened dutifully to all her anxious arguments for his conversion. But his rational temper could not find rest in her summary solution of his questionings, and ere long, guided by the resistless intellect of Chillingworth, he reached conclusions as alien, in their large tolerance, to Puritanism as to Papistry. He soon settled down in his house at Tew, in Oxfordshire, to a severe course of study, and to that *convivium philosophicum* or *convivium theologicum* which the loving pen of Clarendon thirty years after described with so peculiar a charm. Hither came constantly the brightest intellects of the university, but sixteen miles distant, as well as the poets and wits from London. In the group of closest intimacy Clarendon enumerates Sheldon, Morley, Hammond, Earle, and Chillingworth, and to these we may add John Hales and the historian himself—great writer and constant friend. There is hardly another picture in our literary history so attractive as that of this 'university in a purer air' under the oaks and limes of Tew, and of the Tusculan disputations there of Falkland, Hales, and Chillingworth, three friends united by so warm a friendship, yet unlike in everything save supremacy of intellect, littleness of stature, and largeness of charity. To this period belong Falkland's pleasing but not striking poems, which were edited by A. B. Grosart in 1871. His *Discourses of Infallibility,* and the longer *Reply to the Answer thereto,* are a truer index to what lay closest to his heart.

For some years high thinking entirely occupied Falkland's mind, but in 1639 we find him offering his sword for service against the Scots, and actually accompanying Essex's expedition as a volunteer. After his return he sat in the Short Parliament for Newport in the Isle of Wight, and was again returned to the Long Parliament for the same place. Here he distinguished himself by his ardour and eloquence in behalf of constitutional liberty, which he felt to be endangered by the high-handed absolutism of Laud and Strafford. Although his innate love of fairness and justice impelled him at first to demand delay in the impeachment of the latter until the charges made could be fully inquired into, he both spoke and voted with the majority on the third reading of the bill of attainder. He took the same part in the question of ship-money, and vigorously attacked the real illegalities of Finch, the Lord-keeper; but, though he assailed the bishops' claims to divine right, he refused to support the abolition of Episcopacy, while willing enough at first to exclude the bishops from the House of Lords. But the popular party moved too fast for his wise and temperate patriotism, and, in his alarm at the threatening

domination of a no less intolerant Presbyterianism he found himself compelled to resist the second Bishops Exclusion Bill.

At the commencement of 1642, after much persuasion, he accepted the secretaryship of state, although he evidently mistrusted the character of the king, and had no share in the counsels of the queen and the inner party that really ruled his actions. It was characteristic of the man that he refused to make use of spies or to open letters; and, as was to be expected, we find him active in the last ineffectual efforts to bridge the ever-widening breach betwixt the Court and the Commons. When the inevitable war broke out he gave his sword loyally to the king, but his heart sank within him to see his much-loved country bleeding in civil strife. There is no more touching figure in our history than this large-hearted patriot in his last few months of life, so real yet romantic is the pathos that enshrines him. Already the shadow of death hung over him, and Clarendon tells us, in the most famous passage of the *History*, how, his cheerfulness and vivacity gone, and even his customary carefulness in his dress abandoned, 'sitting amongst his friends, often, after a deep silence and frequent sighs, he would, with a shrill and sad accent, ingeminate the words "Peace, peace," and would passionately profess that the very agony of the war, and the view of the calamities and desolation the kingdom did and must endure, took his sleep from him, and would shortly break his heart.' On the morning of the battle of Newbury, 20th September 1643, he knew that the hour for which he longed had come. He was cheerful beyond his wont, and put on clean linen as if for a banquet. Placing himself in the front rank of Sir John Byron's regiment, he rode forward to meet his death at a gap in the hedge where the enemy's bullets flew thickest. 'Thus fell that incomparable young man, in the four and thirtieth year of his age, having so much despatched the business of life that the oldest rarely attain to that immense knowledge, and the youngest enter not into the world with more innocence: and whosoever leads such a life need not care upon how short warning it be taken from him.'

See Clarendon, both in the *History* and the *Life*; also S. R. Gardiner's *History*. There is no better account of Falkland than that in chap. 3 (vol. i.) of Tulloch's *Rational Theology in England in the Seventeenth Century* (1872). See also the characteristically urbane yet irritating essay by Matthew Arnold (*Nineteenth Century*, March 1877), with the sufficient reply by Goldwin Smith (*Contemporary Review*, April 1877); and that by Lord Carnarvon in the *Fortnightly Review* for November 1882. The *Life and Times* by J. A. R. Marriott (1907) defends Falkland from the charge of weakness admitted by Gardiner as by Macaulay.

Falkland Islands, a British colony in the South Atlantic, lying between 51° and 53° S. lat. and 57° and 62° W. long., some 250 miles E. of Patagonia, with which they are geologically connected by a submarine plateau. The group consists of East Falkland and West Falkland, with about 100 small islands. Dependencies are South Georgia (q.v.), and, since 1909, the South Shetlands, the South Orkneys, the South Sandwich group, and Graham's Land. Area, East Falkland, 3000 sq. m.; West Falkland, 2300 sq. m.; and of the 100 small islands, 1200 sq. m. Some of the islets are occupied only by myriads of penguins. Pop. (1871) 811; (1911) 3275; (1921) 2094. The shores are deeply indented with bays and inlets, containing many good harbours; the surface is for the most part undulating (Mount Adam, the highest point, 2315 feet), with numerous small streams and lakes; there are no trees, brown cannel-coal is found, and peat is plentiful. The climate is healthy, resembling that of the Orkneys, characterised by severe gales and abundance of moisture. The mean temperature is about 42°; the annual rainfall varies from 25 to 27 inches; while the average number of days in the year on which rain falls is about 200. Tussock grass and balsam bog are the principal vegetable products. The chief industries are sheep-breeding and whaling. Wool, frozen meat, live sheep, tallow, skins, and hides are exported to Britain. The capital is Stanley (pop. 1000) on East Falkland. The group appeared (as Ascension Islands) in Spanish charts of 1527–29. Davis was driven amongst them in 1590. Sir Richard Hawkins (Sir John's son) coasted them in 1594, and called them Hawkins' Maiden-land. A Dutch navigator was here in 1598. Captain Strong named them in 1690 after Lord Falkland, then treasurer of the navy. They were occupied by France in 1764, but ceded to Spain in 1767. In 1765 Commodore Byron had taken possession of part of the islands, and this nearly led to war between Spain and Britain. But in 1771 Spain yielded the islands to Britain. In 1826 a German household established itself in East Falkland, but was driven out by a U.S. corvette in 1831 for showing hostility to American sealers. But the group was definitively occupied by Britain in 1833, and has since remained a British possession. It is a crown colony, administered by a governor, with an executive and a legislative council. In 1908 the Dependencies of the Falkland Islands were set up, and in 1917 their boundaries were defined. Between 20° and 50° W. long. they include everything south of 50° S. lat., and between 50° and 80° W. long. everything south of 58° S. lat.—that is, the South Orkneys, South Shetlands, South Georgia, the Sandwich group, as well as a sector of the Antarctic continent, of which Graham Land is part. South Georgia is a very important whaling centre; the South Shetlands and South Orkneys are also notable whaling stations. See Lucas's *Historical Geography of the British Colonies* (vol. ii. 1890); *The Story of the Falkland Islands* (1909), by Sir W. L. Allardyce, K.C.M.G. (then governor); Skottsberg's *Wilds of Patagonia* (1911); the *Oxford Survey of the British Empire* (vol. iv. 1914); and Boyson, *The Falkland Islands* (1924). For the naval battle (8th December 1914) see WAR (GREAT).

Fall, the name applied in theology to the change of state with respect to sin which befell Adam and Eve in Eden. Various versions of the story, and the allegorical and other spiritualised explanations that have been offered by theologians, are already discussed under ADAM; here it only remains to point out the special use made of it in the orthodox Augustinian and Calvinistic scheme of theology. The Fall was due to an external temptation offered by the devil, and the inheritance of sin and a corrupted nature descended through the first sinners to all their natural descendants, to whom the guilt of the first sin was imputed in what is called *original sin*. This was possible, because Adam, as the covenant head or federal representative of the whole human race, necessarily involved all mankind—his descendants—in the consequences of his breach of the *covenant* which God made with him at his creation. Christ is 'the second man' and 'the new Adam' (Rom. v. and 1 Cor. xv.), and in the new covenant made with God the believer, through Christ's merits imputed to himself, is freed from the consequences of the Fall in so far as the after-life is concerned. See ADAM, EVIL, and SIN.

Falla, MANUEL DE, Spanish composer and pianist, born 23d November 1877 at Cadiz, studied there and at Madrid, lived for a time in Paris, afterwards in Spain. Leader of the modern Spanish school, he excels especially in orchestral music and in such operas as *Le Vida Breve*, *El Amor Brujo*,

The Three-cornered Hat, The Puppet-show of Mr Peter (1921).

Fallacy, the incorrect performance of the process of reasoning so as to lead to error. The science of Logic reduces sound reasoning to certain rules, and when any of these rules is violated a logical fallacy is the result. The time-honoured division was into two classes, according as the error lay in the *form* of the reasoning or in the *matter:* the formal were entitled *in dictione*, or those appearing in the expression; the material were entitled *extra dictionem*, implying that the fault could not be detected from the language, but must be sought in a consideration of the meaning or subject-matter. Mill proposed to classify all fallacies under (1) Fallacies of Simple Inspection, or Fallacies *a priori*, which includes the whole of what may be termed Natural Prejudices; (2) Fallacies of Observation; (3) Fallacies of Generalisation, including Induction; (4) Fallacies of Ratiocination or Syllogism; and (5) Fallacies of Confusion, comprehending the *petitio principii*, the *ignoratio elenchi*, and ambiguous language generally. Other classifications have been more or less elaborately carried out. But, owing to the enormous variety and intricacy of inaccurate and confused modes of thought, it is difficult to draw up a scheme at once complete and rigorously scientific. See the articles LOGIC, INDUCTION, SYLLOGISM; for Bacon's *eidōla*, prejudices influencing the judgment, see BACON; and for the subject of fallacies generally, see the text-books of logic, as those of Whately, Mill, Jevons, and Fowler.

Fallersleben. See HOFFMANN, AUGUST.

Fallières, ARMAND, French President (1906–13), was born at Agen in 1841, and became an advocate, deputy, premier (1883), and president of the senate, 1899–1906.

Falling Bodies. See GRAVITATION, KINEMATICS, ATTWOOD'S MACHINE.

Falling Sickness. See EPILEPSY.

Falling Stars. See METEORS.

Fallmerayer, JACOB PHILIPP, a German traveller and historian, was born 10th December 1790, at Tschötsch, near Brixen, in the Tyrol. At the university of Landshut he studied law, history, and philology, and in 1826 was appointed to its chair of History and Philology. In 1831–34 he accompanied the Russian general, Count Ostermann-Tolstoi, in a journey through Egypt, Palestine, Syria, Cyprus, Rhodes, Greece, Turkey, and Italy, and twice afterwards (in 1840 and 1847) he revisited the East. The events of 1848 recalled him to Bavaria, and for a short time he sat as a deputy in the Frankfort parliament. Fallmerayer spoke a great number of European and oriental tongues. He died at Munich on 26th April 1861. His principal works are *Geschichte des Kaiserthums Trapezunt* (1827), *Geschichte der Halbinsel Morea im Mittelalter* (2 vols. 1830–36), and *Fragmente aus dem Orient* (2 vols. 1845). His views on the Slavonic origin of the modern Greeks excited the liveliest controversy at the time of their publication (1835). His complete works, with a Life, were edited by Thomas (3 vols. Leip. 1861).

Fallopius, GABRIEL, Italian anatomist, born at or near Modena in 1523. He was professor of Anatomy in 1548 at Pisa, and in 1551 at Padua, where he died, 9th October 1562. He devoted special attention to the anatomy of bones, and wrote careful descriptions of the ethmoid and sphenoid bones, and of the internal ear. The canal which transmits the facial nerve after it leaves the nerve of hearing is still known as the aqueduct of Fallopius. In myology he corrected various errors into which Vesalius had fallen. He also studied the organs of generation in both sexes; and the Fallopian tube which connects each ovary with the uterus (see OVARIOTOMY, WOMB) is named after him. He was superintendent of the Botanical Garden at Padua, and had a reputation as a botanist. A complete edition of his works in four folio volumes was published in 1600.

Falloux, FREDERIC ALFRED PIERRE, COMTE DE, a French author and statesman, was born at Angers, 7th May 1811. He first drew attention to himself by two works penetrated by an ardent love of the old Bourbon order of things—*L'Histoire de Louis XVI.* (1840) and *L'Histoire de Saint Pie V.* (1844). In 1846 he was chosen deputy for the department Maine-et-Loire. In religion he advocated the ideas of Montalembert, in politics those of Berryer, and united with his Legitimist sentiments a love of liberty and education strangely incongruous with the historic character of his party. After the revolution of February 1848 he exhibited much energy as a member of the Constituent Assembly, was one of those who organised the resistance to the insurrection of the 15th May, and, as reporter on the national workshops, pronounced for their immediate dissolution. He was also one of the most ardent promoters of the expedition to Rome. On the election of Louis Napoleon to the presidency, Falloux was appointed Minister of Public Instruction, an office which he held for only ten months. After the *coup d'état* he retired from public life to a country-seat near Angers, where he occupied himself with agricultural pursuits, and where he died, 6th January 1886. He was a member of the French Academy. His writings include *Souvenirs de Charité* (1857), *Méditations et Prières* (1863), and *Le Convention du 15 Septembre* (1864).

Fallow (from the same root as Ger. *fahl* or *falb*, expressing a pale dun, tawny colour). This word sometimes signifies waste, untilled land; but usually it is applied to land that is ploughed and otherwise cultivated for a season without being cropped. The most of the wheat raised by the Romans was sown after the land was fallowed; indeed, the usual rotation was fallow and wheat alternately. It was only fertile soils that could long support such an exhausting system; hence resulted the decreasing produce which the later Roman agricultural authors so often speak of and lament.

The fallowing of land was introduced into all the countries which fell under the dominion of the Romans. Britain during their sway soon exported large quantities of wheat, and for centuries after the Romans left no other mode of cultivating the land was followed. It may here be observed that, wherever the system of fallowing without giving manure to the crops is practised, it necessarily supposes that the soil is at least moderately fertile. This system is most successful on argillaceous soils, which are retentive of organic manure, and which cannot be cleaned by any other method. The destruction of weeds, such as couch-grass (*Triticum repens*) with its long jointed root-stocks, is the first great object of fallowing. The exposure of the soil-substance to the weathering action of the air and the rest given to the land are minor objects. The loss from washing out of valuable soluble substances, more especially nitrogen, by rain, is a serious disadvantage of fallowing; and this, along with the possibility of the land becoming more and more foul with weeds during a wet summer, makes the benefits of the practice extremely doubtful, unless under exceptional circumstances.

It was long before fallowing was introduced to any extent in Scotland; but about the beginning of the 19th century it was largely practised.

Owing, however, to the draining of the soil and the extension of the green-cropping system, it is now confined to the most retentive clay-soils, where it affords the only means of thoroughly cleaning the land. Sometimes as many as three or four ploughings are given in summer before the seed is sown in autumn. In old cultivated countries land is commonly so much reduced in its organic matter that fallows require to be dressed with farm-yard or other organic manure, in order to yield satisfactory crops. Since the general introduction of green crops the term fallow has departed in some measure from its original meaning. These crops are sown on what was formerly the fallow-break, and are now often styled fallow-crops. The land, no doubt, receives in some measure a fallowing; it is freed from weeds, and allowed to rest from the growth of grain crops. Bastard-fallowing is a term which is used in Britain when hay-stubble is ploughed up in the end of summer, freed from weeds, and sown with wheat in autumn.

Where arable cultivation is carried on in semi-arid regions (dry farming), the land is commonly fallowed in alternate years. The object in this case is to enable the land to accumulate moisture, surface tillage being carried out repeatedly in order to prevent evaporation. Under this system, and with other devices for the conservation of moisture, good crops can be grown every second year where the annual rainfall is as low as 12 or 14 inches.

Fallow-chat. See WHEATEAR.

Fallow-deer (*Cervus dama*), a native of the Mediterranean districts of Europe and Asia, whence it has spread or been introduced into other countries, such as Britain, where it leads a vigorous semi-

Fallow Deer (*Cervus dama*).

domesticated life in many parks. Some authorities refer its introduction into Britain to the Romans; others point to fossilised remains and regard it as indigenous. It may have been exterminated and subsequently reinstated more than once. It is a very graceful animal, standing about 3 feet high at the shoulders, coming in stature between the Roe-deer (q.v.) and the Red Deer (q.v.). The usual summer colour is reddish-brown with white spots, while in winter the spots are fewer and the general shade grayer. A quite unspotted type also occurs, and white or other sports or varieties are common. The tail is black above, white below. The antlers, confined as usual to the bucks, or males, are cylindrical at the base, give off two tines at some distance apart, and then form a shovel-like or palmate expansion. The young male of the first year has no antlers, and the increasing annual development is marked for six years. Fawn, pricket, sorrel, soare, buck of the first head, and buck complete are the names used to distinguish the various grades. The eyes and ears are large, and under the former there lie conspicuous sub-orbital cavities, which are wholly glandular, and not 'breathing places,' as Gilbert White and others have supposed. The breeding season is in October, and the doe bears in June. There is generally a single fawn, though occasionally two. The fallow-deer seem naturally timid and gentle, and become readily accustomed to man. The flesh is much esteemed. See DEER; Lydekker, *British Mammals;* Sir Harry Johnston, *British Mammals;* Millais, *British Deer.*

Fall River, a busy manufacturing city and port of entry of Bristol county, Massachusetts, at the mouth of the Taunton River, 51 miles S. of Boston by rail. The town, founded in 1803, and incorporated in 1854, is well built, the handsome city hall, Durfee High School, Bradford Durfee Textile School, and many other buildings being largely constructed of a fine granite quarried in the vicinity. It has a splendid harbour, and is connected with New York daily by steamboat. Fall River is the largest cotton manufacturing city in the United States, and has also large print works and bleacheries. Other manufactures are thread, yarn, hats, &c. The city has an excellent water-supply. Pop. (1870) 26,766; (1890) 74,398; (1911) 119,295; (1920) 120,485.

Falls. See WATERFALLS.

Falmouth, a municipal (formerly parliamentary) borough and seaport of Cornwall, on the southern side of the estuary of the Fal, 18 miles NNE. of the Lizard, and 66 by rail WSW. of Plymouth. It chiefly consists of a narrow street, a mile long, with suburban terraces and villas on the heights behind; and it has a marine drive, several pleasure-grounds, a library, a polytechnic society (1833), and a town-hall (1866). The harbour, one of the best in England, is 5 miles long by 1 to 2 miles wide, and 12 to 18 fathoms deep. The entrance is defended on the west by Pendennis Castle (*c.* 1538–44), which crowns a rock 198 feet high, and which in 1646 surrendered to Fairfax after a five months' siege; on the east, by St Mawes Castle (1543). Pop. of the municipal borough (1851) 4953; (1891) 4273; (1921, as extended in 1892) 13,318. The parliamentary borough, including Penryn, was merged in the county in 1918. From 1688 to 1850 Falmouth was one of the principal packet-stations for foreign mails. There is much ship-repairing and building, and a considerable pilchard-fishery off the neighbouring coasts. Here orange and lemon trees yield plenty of fruit on open garden-walls. Falmouth has arisen since 1613, Sir Walter Raleigh having drawn notice to its capabilities. Charles II. incorporated it in 1661; and at one time it was a stronghold of Quakerism.

False Acacia. See ROBINIA.

False Bay. See CAPE OF GOOD HOPE.

False Decretals. See CANON LAW.

False Pretences. See FRAUD. For False Money, see COINING; for False Swearing, see PERJURY; and for False Weights, see WEIGHTS.

False Point, a cape and harbour of Orissa, 43 miles E. of Cuttack by canal. The harbour, which has a lighthouse, is safe and roomy, and is considered the best between Calcutta and Bombay; it is the entrepôt for the trade of Orissa, and a regular port of call for steamers.

Falsetto, a term in singing for the highest register of a man's voice, which joins the natural or chest-voice, and which, by practice, may be so blended with the chest-voice as to make no perceivable break. See VOICE.

Falstaff. See OLDCASTLE, and FASTOLF.

Falster, a Danish island in the Baltic, south of Zealand, which measures 26 miles by 16 at its widest part, and has an area of 183 sq. miles. It is flat, remarkably fruitful, and well cultivated. Its inhabitants employ themselves chiefly in agriculture and cattle-breeding.

Falun, or FAHLUN (called also *Gamla Kopparberget*—i.e. 'the old copper-mine'), a town of Sweden, 50 miles W. of Gävle. It has for more than six centuries been famous for its copper-mines, though the quantity of ore now obtained is much smaller than formerly. The excavations extend for miles underground. Destroyed by fire in 1761, Falun was rebuilt on a regular plan; but its wooden houses have a sombre appearance, being blackened by the fumes of the numerous smelting-furnaces. Pop. 13,000.

Faluns, a term given by the agriculturists of Touraine to shelly sand and marl, which they use as manure, and applied by geologists to the deposits from which they are obtained.

Fama (Gr. *Phēmē*), the goddess of rumour, a personification which appears in the works of the earliest poets. Sophocles makes her the child of Hope; Virgil, the youngest daughter of Terra, and sister of Enceladus and Cœus.

Fama Clamosa, in the ecclesiastical law of Scotland, is a widespread and prevailing report imputing immoral conduct to a minister, probationer, or elder of the church. When such report exists, a presbytery may commence process against a minister without the instance of any particular accuser, but as acting for the vindication of their own order, and in behalf of the morals of the community. If satisfied that the *fama* is not groundless, the presbytery serves the offender with a libel when no private party comes forward to execute it.

Famagosta, or FAMAGUSTA, a seaport on the east coast of Cyprus, on the supposed site of ancient Arsinoë. It was a place of importance during the Crusades; and under the Venetians from 1487 to 1571 it became a rich and flourishing seaport, with 30,000 inhabitants. On falling into the hands of the Turks after a long siege (1571), it began to decay; an earthquake in 1735 completed its ruin. The church of St Nicholas is a fine specimen of mediæval architecture; in it Richard I. of England crowned Guy de Lusignan king of Cyprus in 1191. Famagosta, which has only some 6000 inhabitants, possesses a natural harbour, 1½ mile long by ½ mile wide, improved in the 20th century. The chief exports are corn and its famous pomegranates.

Familiar (Lat., 'servant'), a supernatural being in attendance upon a magician, wizard, or other professor of the black art. The belief in spirits as especial patrons or guardians of individuals is very ancient, and is still widely spread among more than savage races. The guardian angel is indeed an integral part of his faith to many a Christian, as much as the *torngak* to the Eskimo, or the *genius natalis* to the ancient Roman. The genial and sportive guardian spirit of the household is also a venerable belief, and we find in Leviticus (xix. 31) a warning against familiar demons who give occult knowledge. During the middle ages the belief in 'enchanted rings' containing familiar spirits was widely diffused throughout Europe, the magicians of Salamanca and Toledo being especially famous for their skill in thus subjugating and imprisoning demons. The notion of familiar spirits is one perfectly natural to the Persians and Hindus, and Aladdin's 'slave of the lamp' is an example in point. A favourite form assumed by the familiar spirit in western Europe was that of a black dog. Such was the case with the famous Cornelius Agrippa, who was always accompanied by a devil in the shape of a black dog. When he saw that his death was at hand, according to Paulus Jovius, he took from the dog's neck a collar inscribed with magic symbols, and let him go with the words: *Abi, perdita Bestia quæ me totum perdidisti.* Butler, in his *Hudibras*, gives the dog the respectable office of tutor to the sage, and Wierus, the pupil of Agrippa, assures us that the animal was no cacodæmon but a natural pet. At least there is no doubt about the black dog in Goethe's *Faust* and his association with Mephistopheles, and there is good tradition that Simon Magus also had a familiar in the same form. See DEMONOLOGY and WITCHCRAFT.

Familiars. See INQUISITION.

Familistère. See GUISE.

Family (from Lat. *familia*, formerly identified with Oscan *famel*, slave, now connected with Sans. *dhâ*, to settle), in the restricted sense, the group formed by a man, his wife, and his children, but also in Roman law, and in the practice of primitive peoples, including household slaves. In a more extended sense, family is or was used to mean those descended from a common ancestor, the kindred (cf. Roman *jus civile*) or all those connected by blood on the male or female side (*jus gentium*), or even the *gens*, the agnatic descent of which was a matter of belief only.

By *natural family* is meant the group of descendants of an ancestor still alive; when the eldest ascendant is supreme in this household, we get the *patriarchal family*. The *joint* or *extended family*, also called *house community*, is an association of many living in a common dwelling and governed by a common chief, often the oldest male; from the joint family may be developed the *village community*. The joint family is the important social unit in Indian law; it is also found in West Africa, though the comparative absence of property and the undeveloped condition of law make it less important.

The patriarchal family played an important part in the discussion, based on very limited knowledge of the relevant facts, which raged round the theories of Maine, Morgan, McLennan, and others in the latter half of the 19th century. Maine (*Dissertations on Early Law and Custom*, 1883, p. 199) held that all early societies that had any permanence or solidity were or claimed to be descended from a common ancestor. This theory will hardly hold good of primitive peoples known to us at the present day, even if we note that Maine has dropped from his definition the element of the supremacy of the oldest male, which is an essential feature of the patriarchal family. It is clear that the pretence of common descent may well be an *ex post facto* explanation of the unity of the society, which was in fact due to quite other causes.

Generally speaking, the first historians of human society regarded the facts at their disposal from a crude evolutionary standpoint, which attempted to conceive of all human societies as so many stages on a single line of progression. Morgan, for example, postulated, first, a stage of promiscuity; second, the intermarriage of brothers and sisters (consanguine family); third, polygamy (Punaluan family), in which either the males or the females were blood or tribal brothers and sisters. Out of this developed temporary marriage (the pairing family), the patriarchal family (conceived by him as polygynous), and monogamy. He held that from the Punaluan family developed the Turanian system of kinship, under the influence of promiscuity regulated by totemic exogamy. Our present European system arose in place of, though not out of, the Turanian.

It has now been shown (*Tylor Essays*, 1907, p. 309) that the Hawaiian system (Punaluan family), which Morgan put at the base of his whole system, inasmuch as the consanguine family was a purely hypothetical stage, is not only a relatively late stage, but was in vogue mainly if not entirely among the chiefs. Our available knowledge provides not one shred of testimony—either from social facts or from the philological evidence of the classificatory system of kinship—that promiscuity was the earliest stage or at any time a ruling principle of human society. Customs of avoidance between brother and sister, on which Morgan laid much stress as evidence of a stage of promiscuity, are probably late developments.

It is a little difficult for the present generation to understand the causes which led to the vehement controversy between Morgan and McLennan, who differed mainly in their interpretation of classificatory terms of relationship, and in the details only of their scheme of evolution of society. Both postulated primitive promiscuity, from which, according to McLennan, owing to infanticide causing scarcity of women, was evolved first Nair and then Tibetan polyandry, involving kinship (i.e. the reckoning of descent) through women. This led, through marriage by capture, to exogamy and the loss of homogeneity in groups. Neither infanticide, polyandry, nor capture had the importance which McLennan attached to them, and his explanation of the origin of exogamy is quite unconvincing. He supposed that women, being scarce, were valuable (obviously as wives), and would not be allowed to leave their own group (though the ordinary custom of exchange of sisters satisfies the conditions). Many men were, however, compelled to look for wives outside their own group, and eventually their own women ceased to be regarded as possible wives, and were in the end forbidden as spouses to men of their own group.

It is certain that the exogamous social group has developed in many parts of the world from the family, and that the rule of exogamy is an extension of the rule against incest between kin, the origin of which is uncertain.

The tendency of modern research is to work out the history of society for each cultural area. Dr Rivers showed for Melanesia (*History of Melanesian Society*, 1914) that terms of relationship will give us a clue to social institutions, especially forms of marriage, which have left no other trace.

Unless the Melanesian facts are deceptive, it is certain that the history of society has been a far more complicated process than the earlier theorists recognised. Dr Rivers supposed that the family (in the restricted sense) was the starting-point of the evolution of society in Melanesia. With the development of the dual system (see TOTEMISM) the classificatory system came into use. At a later period, owing possibly to the intrusion of a new race which brought few women with it, sexual communism took the place of individual marriage, but this communism was a state of regulated promiscuity, inasmuch as society was divided into two groups, and men of one group had relations only with women of the other group.

Sexual jealousy began to play an important part later, especially in the case of the old men, who attained a position of dominance; and old men monopolised the young women of the community, taking them as individual wives. Such communistic relations as continued were limited to those between men and women of the same generation. Old men were in the habit of handing over one or more wives to their sister's sons or to their son's sons (in this connection it should be noted that a marriage between a man and his daughter's daughter or his brother's daughter's daughter was known; the grandfather's wife was not, therefore, necessarily old), in order to satisfy their desire for individual wives. As, under a dual organisation, the father's sister is also the mother's brother's wife, we find also a custom of marrying the father's sister. At a later period the mother's brother handed over his daughter instead of his wife to his sister's son, and thus gave rise to the very important form of union to which the name 'cross-cousin' marriage is given. Normally, the cousins who marry are the children of own, not tribal, brother and sister. At this time originated also marriage by capture. A man appears to have given his daughter not only to his sister's son, but also to his younger brother; hence a widow may not marry the elder brother of her husband. More especially in the Banks Islands there is a widespread custom of adoption of children. Dr Rivers gave reasons for supposing that this is due to the state of sexual communism, which gave rise to a community of children. It seems probable that the customs of adoption are due in large measure to an increasing recognition of the bond between father and child.

The data for studying the history of social evolution in other parts of the world are at present lacking. The Melanesian results are largely based on the study of kinship and systems of relationship, the close dependence of which on forms of marriage has been amply demonstrated. Generally speaking, the history of marriage in Melanesia has been from a (hypothetical) stage where it was regulated by kinship to a stage in which phratry or clan exogamy laid down the prohibited degrees. The pendulum is now swinging back, or has already swung back, to regulation of marriage by kinship. It is not improbable that this general sketch will be found to be true of other large areas.

It has been shown elsewhere (see TOTEMISM) that the rule of descent, by which is meant solely the regulation of the membership of the social unit (i.e. moiety, clan, or caste) may be either matrilineal (following the female line), or patrilineal; we have now less reason to believe that the former rule is earlier (cf. Graebner, *Methode der Ethnologie*, 1911, p. 90; Rivers, *Melanesian Society*, ii. 568). The rule of descent may depend on the kind of marriage.

Among aberrant forms of the family must be mentioned the *pirrauru* custom of the Australian Dieri, who also recognised, like the Melanesians, the marriage with the brother's granddaughter. The facts are not absolutely established, but it appears that a woman, after contracting an individual marriage, was united in a secondary union (cicisbeism) with one, usually several, men. In like manner a man was united in *pirrauru* with several women. But, as in Tibetan polyandry, all children were reckoned the offspring of the primary husband. The institution is probably due to the scarcity of women caused by the dominance of the old men. It has often been quoted as an example of 'group marriage,' but this term cannot correctly be applied to it.

In recent years American observers have maintained the priority in time of the so-called 'loose' organisation. This is not exactly a form of descent, for in it kinship is recognised through both parents, an impossibility when the meaning of 'descent' is the 'rule by which membership of a social group is determined.'

It must not be supposed that matrilineal descent, which regulates marriage, implies the supremacy of women, for among primitive peoples the authority of the husband over the wife is independent of descent (Malinowski, *Family*, 77). Nor yet does it exclude the recognition of the kinship of father

(or mother) and child (Thomas, *Kinship and Marriage*, p. 23). Inheritance of property and succession to chieftainship are equally independent of the mode of descent (Rivers, *Melanesian Society*, ii. 319), though it is certain that in some matrilineal societies, at any rate, the sister's son is a man's natural heir.

Some authors (*Jour. R. Anthrop. Inst.*, xviii. 245–89) have laid much stress on the importance of matrilocal (formerly called *beena*) marriage, in which a man goes to live with his wife's family. Closely related to this is bilocal marriage, in which the husband takes his wife to his own kin after remaining a longer or shorter time with her family; the classical instance is the case of Jacob, who served seven years for his wives. Patrilocal marriage (termed *ba'al* marriage by Robertson Smith) appears to be the normal type.

On the whole, customs of residence are less important in their influence on the family than the method by which the wife is obtained. Where she becomes one of her husband's family, usually by purchase, the children naturally belong to the husband, independently of the rule of residence; where she remains a member of her own kin, the children are members of her kin, whether she resides with her husband or not. In parts of West Africa two forms of marriage exist side by side; the purchased ('bond') wife's children alone can succeed to property, and the 'free' wife's children remove at the husband's death to their mother's town. If a free wife or her children die, the husband may not bury them, but must hand them over to the mother's family for interment. It is, however, possible for the father's family to purchase such children, who can then succeed their father as chief, or inherit his property.

Generally speaking, even among peoples who do not recognise the free wife as a normal type, a woman's children belong to her family until the bride-price is paid, or their claims are satisfied in some other way; and a wife repudiated without cause can also, in some parts of West Africa, claim her children, and take them with her to her family.

Conversely, after payment of bride-price, the paternity of a woman's children is often a matter of indifference. The husband may claim children born before wedlock (provided he is the first to pay bride-price), or after his wife has quitted him (provided his purchase-money is not refunded). Children begotten by a brother after the first husband's death are frequently accounted those of the original husband (Levirate), and, exceptionally, the children begotten by a stranger belong to the same category.

In some parts of West Africa the wife is free, with her husband's consent, to cohabit with any one, and in other parts she quits her husband after a few months of wedlock, and practises free love till she is pregnant.

This free recognition of children, regardless of paternity, makes it clear that purchase, i.e. *potestas*, is the important element. The position of a household slave, who occupies a place hardly, if at all, differing from that of a child, bears out this view.

Fosterage may set up a relationship closely akin to that of the actual children of a man, and adoption is also of much importance; it is either penal, to replace a murdered member of the family, or voluntary, by purchase or simple declaration.

Ancestor worship is a further important element; it maintains the unity of the joint family, and gives cohesion to groups varying in composition from the individual family, recruited as has just been shown, to the exogamic social unit, where the ancestor may replace the totem as the sign of common origin, real or assumed. It sometimes happens that worship of ancestors in the female line is also kept up; and in this case there is *primâ facie* reason to suppose that kinship was originally reckoned through females.

In other respects, also, a child stands in close relation to its mother's family, not only as regards marriage prohibition, but also in respect of property; in West Africa, if there is a lack of land in the father's family, the normal resource is to apply to the mother's relatives for an allotment.

The law of inheritance has a deep influence on the form of the family. Family property may remain undivided (joint family) after the death of the male head in whose hands it is concentrated; or it may be equally divided among the sons (gavelkind), sometimes with a larger share to the eldest, or to both eldest and youngest; or it may pass to the eldest son, or the eldest sons of each of the wives (in polygyny), or to the youngest son (Borough English). The importance of these modes of distribution lies especially in the fact that the heir to property may also be heir to children, and therefore not only receives the bride-price of unmarried daughters, but is the head of all males of the family.

It seems clear that there has been a tendency to pass from a condition in which matrilineal descent and inheritance are recognised to one of which patrilineal descent is the rule. The simple reason is that there is a closer bond between a father and his own children than with his sister's, and the change was simplified by the fact that wife-purchase put the wife, and therefore by analogy the children, in a man's power. Rights of succession (to chieftainship, &c.) usually pass in the male line, and the rise of chieftainship must have been another powerful lever in forwarding the change to agnation (patrilineal descent or kinship). It must not, however, be supposed that inheritance and succession are necessarily in the male line. In the case of the Iroquois tribe, titles, rights, and property were transmitted in the female line, though a man's own brothers as well as his sisters' children were possible heirs. Woman owned the lodge and all within it, the clan burying-ground and all other lands, and her own children; she had the right to select from her sons the candidates for clan and tribal chieftainship, and to initiate proceedings for their deposition; she alone could adopt aliens into her group, and a man could adopt an alien as a kinsman only with the tacit or expressed consent of the matron of his clan; a mother could forbid her sons to go on the warpath; a woman received prisoners of war as spoils, with liberty to kill them or replace slain kinsmen by them; she might demand from her husband's clansmen a captive or a scalp to replace a loss in her family. The representatives of women formed the clan, tribal, and other councils; there were chieftainesses who levied contributions for ceremonials and assemblies, and they guarded the treasure of the tribe, consisting of wampum, feather-work, &c.; a woman might even be made regent when the ordinary male chiefdom was vacant. The penalties for killing a woman were double those for killing a man. To this state of things the name matriarchy can properly be applied.

The term matriarchy has often been applied to the institution of matrilineal descent, and it has been maintained on insufficient grounds that this alone tends to elevate the social status of women. Generally speaking, woman among primitive peoples enjoys a larger measure of independence and authority in agricultural communities, in which she is, at least to some extent, the provider. But even in Australia the old women occupied an important position in certain tribes.

See KIN, MARRIAGE; also ANCESTORS (WORSHIP OF), TOTEMISM.

Family, in biological classification, means an alliance of nearly related genera. Individual, species, genus, family, order, class, and phylum are the common categories of classification in ascending order, with intermediate ranks, such as sub-genus, sub-order, sub-family, section, and sub-phylum. Thus, the dolphin family—Delphinidæ—includes the genera Delphinus or Dolphin, Monodon or Narwhal, Delphinapterus or Beluga, Phocæna or Porpoise, Orca or Grampus, &c., and is itself included in the order Cetacea, in the class Mammalia, in the phylum Vertebrata. See GENUS, SPECIES, TAXONOMY, ZOOLOGY.

Family Compact, the name given to certain political leagues entered into by the Bourbon kings of Europe. Of these, two deserve mention. The first, an agreement concluded between the kings of France and Spain in 1733, was aimed on the one hand against the ascendency of Austria in Italy and on the other against the mercantile supremacy of Britain on the sea. Out of this arose a war between Britain and Spain in 1739. The second compact, signed in 1761, had for its object the union, in a close offensive and defensive alliance, of the Bourbon sovereigns of France, Spain, and the two Italian kingdoms Naples and Sicily, and Parma and Piacenza; and next year Britain declared war.

Family of Love, or FAMILISTS, or DAVIDISTS, a sect which appeared in Holland in the middle of the 16th century. It was founded by David Joris or George (1501–56), an Anabaptist of Delft, who left the Anabaptists about 1538, and founded the new communion, while apparently conforming to the Reformed Church (see ANABAPTISTS). In the reign of Edward VI., according to Fuller, Henry Nicholas, a disciple of Joris, came over to England, and commenced the perversion of silly people in a secret way. By 1572 they had apparently increased in numbers considerably, for in that year one John Rogers published a work against the *Horrible Secte of Grosse and Wicked Heretiques naming themselves the Family of Love.* In 1580 Queen Elizabeth issued a proclamation for the hunting out and punishing of this 'damnable sect.' The Family of Love, 'or Lust rather,' as old Fuller has it, tried in vain to insinuate themselves into the good graces of King James, and the society gradually disappeared in the 17th century. They disregarded dogma and church ceremonies, and insisted that religion consisted simply in love, which makes us one with God—a doctrine that led to extreme Antinomianism (q.v.).

Famines, or times during which there is a scarcity, more or less severe, more or less local, of food-supplies, are due to a variety of causes. They have been perhaps oftenest caused by drought or deficiency of rainfall, especially in tropical regions; by excess of rainfall, giving origin to floods and inundations, more particularly in northern climes; by excessive frosts and other irregular incidences of climatic conditions; by the ravages of insects (flies, locusts, ants, grasshoppers, &c.) and vermin (rats, mice, &c.); by the devastations of war; and by the wholesale destruction of forests, especially on hillsides, giving rise to drought—a cause which has operated more particularly in northern China. Apart from these causes, the occurrence of famine in a particular locality depends upon the ratio between the population and the food-supply for the time being of that district, or, more correctly, between the amount and extent of the failure in the supplies and the density of the local population. Amongst the factors which exert an injurious effect upon the food-supply must be mentioned not only backward and inadequate methods of agriculture, but sometimes also the system of agriculture in vogue; deficient means of communication and transport; misappropriation of the soil—i.e. using it for growing crops which add nothing to the food-supply when the land that is devoted to the production of the necessaries of life is inadequate for the normal wants of the population; legislative interference, either preventing the free exploitation and development of the complete resources of the soil, or throwing obstacles in the way of the natural distribution of food-supplies; the ill-regulated distribution of food-supplies apart from governmental interference; sudden immigrations of large bodies of people into districts of confined area; the social customs and agricultural habits of a people making them principally dependent upon one kind of food, as the Irish upon the potato; the religious belief of a people restricting them to certain prescribed kinds of food; lack of foresight and energy in the administrative authorities, provincial, national, or general, as the case may be, together with the limited extent and inaccessibility of the resources they have at their command; insufficient resources and powers of organisation of private merchants; undue facilities for commercial speculation in grain and other necessaries of subsistence; and the misapplication of grain, &c.—i.e. the using of it in undue quantity for brewing or distilling, and the like. Attempts have also been made to trace some law of relation between the occurrence of famines, more particularly in India, and the sun-spot cycle, the links of connection being the meteorological effects that are supposed to manifest themselves on our planet in dependence upon the cyclical phases of the waxing and waning of the sun's spots.

Famines cannot be wholly prevented. The powerful climatic causes to which they are principally due cannot be controlled by human agency, except to an extremely small degree, chiefly by the maintenance of river-banks and sea-banks, and by the regulation of the forests. The local conditions are in every case so diverse, and often so complicated, that it is fruitless to attempt to give more than a few general rules. In cases where the country is dependent upon irrigation for its fertility, it should be the first care of the inhabitants, or, failing them, of the government, to make provision for the storing of water, to regulate its distribution, and to utilise it in the most economical ways. But the most efficient methods of rendering governmental assistance are to improve the means of transport, to encourage more scientific systems of agriculture, to give warning to districts that are likely to be affected of the threatened approach of a period of scarcity, and then to leave the rest to the enterprise of private merchants. There should be no legislative restrictions on the free transmission of food-supplies from centres of abundance to districts which are suffering from famine. The systems of agriculture best calculated to prevent the occurrence of famines and counteract their devastating effects are perhaps those in which the quantity of land in each farm is large enough to allow of a sufficient variety of crops being produced year by year, so that the cultivator need not be dependent upon the success of one single crop for his sustenance, or even his livelihood. In India each province is required to maintain a famine fund.

The appended list includes a few of the more important famines of the world, either from their historical significance or from the great destruction of life that attended them. A much more detailed list, together with a couple of excellent papers on the subject, by C. Walford, will be found in the *Journal of the Statistical Society* (1878–79).

879 A.D.	Universal famine.
1005.	England.
1016.	Throughout Europe.
1022.	In many parts of the world.
1051.	Mexico.
1052–60.	In Ghor, India.
1064–72.	Seven years' famine in Egypt.
1069.	In north of England.
1162.	Universal famine.
1314.	Silesia, Poland, and Lithuania.
1344–45.	India, especially in the Deccan.
1347.	Italy.
1491.	Ireland.
1586–89.	Ireland.
1600.	Russia.
1631.	India, Asia generally.
1711.	Carniola; lasted several years.
1769–70.	India; three million people perished.
1781–83.	In Carnatic and Madras.
1782–84.	India.
1790–91.	India.
1822.	Ireland.
1846–47.	Ireland; potato famine.
1866.	Bengal; one million and a half died.
1877.	India.
1877–78.	North China.
1888–89.	North China.
1891–92.	Russia.
1897.	India.
1899–1900.	India.
1905.	Russia.

A widespread famine followed the Great War in Europe, especially Russia. It was after a famine in 1586 that the poor-law in England had its beginning. Famines have been unhappily frequent in India, as in 1889, 1892, 1897, and 1899–1900 (Romesh-Dutt, *Open Letters*, 1900).

Fan, an implement for creating a current of air, generally with the view of cooling the person. The term comes from the Latin *vannus*, the broad, shallow basket into which corn and chaff from thrashing were received to be tossed in the air so that the wind might carry away the chaff. The ordinary fan may consist of any light, flat, expanded surface set in rapid reciprocating motion by the hand; but for many mechanical operations, such as sifting, winnowing, ventilating, and extracting gases, rotating fan-blades are mounted, under such names as Fans, Fanners (q.v.), or Fan-blasts, by which strong and continuous air-currents are raised. The Punkah (q.v.) employed in India for circulating air in apartments is simply an enormous fan.

The common hand-fan, used as a personal accessory, is an implement of great antiquity, which naturally was prized most in regions where the heat was greatest. It is known to have been in use among the ancient Assyrians and Egyptians, and from its frequent representation on early Greek vases it must have been a familiar implement among that people. These ancient fans were sometimes made of very large size, and carried on long shafts or poles by female slaves (*flabelliferæ*), eunuchs, or boys, whose duty was to keep the air in circulation, and to drive away flies from the table or the person. The *flabellum*, or fan to brush away flies from the sacred vessels, was used in the Western Church from the 4th till the 14th century; and gorgeous *flabella* of peacocks' feathers are still borne by the pope's attendants in solemn processions. Similar fans, used to keep flies from settling on the embroidered case of the *torak*, may be seen in Holman Hunt's picture of 'The Finding of Christ in the Temple;' and Mr Butler's *Ancient Coptic Church* contains several pages on the use of the fan in that communion. Among eastern nations generally the fan was an implement of great importance, and large fans—like sunshades, to which they are closely allied—possessed special significance as symbols of authority and emblems of royalty. In Japan, where to this day the fan is an indispensable adjunct of the daily life of all classes, large rich fans are used in ceremonial dances, in which they are accessories of peculiar significance.

Fans are of two kinds, the folding and the non-folding. To the latter class belong all state and ceremonial fans, while those carried about by ladies belong to the folding class. Beyond those distinctions, however, it is impossible to define the material, form, or structure of fans, these, especially in the case of non-folding fans, being endlessly diverse. The folding fan consists of two principal portions, the mount or leaf (Fr. *feuille*) and the stick (*bois*). The leaf, which forms a segment of a circle, consists of two equal pieces of paper, fine parchment, satin, crape, tulle, or cotton, folded into from twelve to twenty-four equal folds. The stick consists of a number of 'brins' equal to the folds in the leaf, with two stout outer guards (*panaches*) These may consist of wood, ivory, mother-of-pearl, or metal, richly carved, inlaid, or otherwise worked in the case of fine fans, the leaf of which may be elaborately painted. The upper part of the brins is continued by thin, flat strips of wood between the folds of the leaf. The brins with the outer guards are collected and held together at the head or end (*tête*) by a pin passing through them, which forms the pivot on which the fan opens or closes. The folding fan is said to have been a Japanese invention which originated in the 7th century, the idea having been supplied by the wing of the bat. From Japan the invention passed into China; but it was not till about the beginning of the 16th century that such fans began to be used in Europe. They first found their homes in Italy and Spain, but early in the 16th century they came into use in France, and their manufacture was established in Paris, where since that time they have formed the most prominent of the small industries known as *articles de Paris*. In 1673 the *maîtres éventaillistes* were formed into a corporation by Louis XIV. French fans of the 18th century became real works of art, on which frequently the ability and taste of the most skilful goldsmiths, jewellers, metal-workers, and carvers were combined with the decorative painting of artists of the foremost position. Fans painted by the 18th-century artists Watteau, Lancret, Pater, Boucher, &c. command very high prices; and such eminent artists of the 19th century as Diaz, Lami, Glaize, Isabey, Jacquemart, &c., devoted their talents to fan-painting. See Uzanne, *The Fan* (trans. 1883); Lady C. Schreiber, *Fans and Fan Leaves* (2 vols. 1888–90); *Éventails* (Par. 1891); Cust, *Fans and Fan Leaves* (Brit. Mus. 1893); Salwey, *Fans of Japan* (1894); G. W. Rhead, *History of the Fan* (1910).

Fanariots, the Greeks inhabiting the Fanar or Fanal quarter of Constantinople appear to have been descendants of such noble Byzantine families as escaped the fury of the Turks, recruited by emigrants from different parts of the old Byzantine empire. They figured in Turkish history principally as diplomatists, administrators, and bankers. From 1669 onwards the Dragomans of the Porte were usually chosen from amongst them. From them too were chosen, until the outbreak of the revolution in 1882, the hospodars of Wallachia and Moldavia, while, in addition, the disposal of most of the civil and military posts under the Turkish government was in their hands. In the Greek struggle for freedom (1821–26) the Fanariots displayed no great zeal or activity, but nevertheless were severely punished by the Turks.

Fandango, like the *Bolero*, is an old Spanish national dance, in $\frac{3}{4}$ time. It is danced most gracefully in the south country, usually to the accompaniment of a guitar, while the dancers beat time with castanets. It proceeds gradually from a slow and uniform to the liveliest motion; and, notwithstanding the simplicity of the *pas*, expresses vividly all the gradations of the passion of love. See DANCE.

Faneuil, PETER, a merchant in Boston, U.S., was born of a Huguenot family at New Rochelle, N.Y., in 1700, and died in 1743. His name is remembered from his having built the Faneuil Hall in Boston at his own cost (1742), and presented it to the town. Originally the building contained a hall for public meetings, with lesser apartments above, and a basement used as a market. In 1761 it was

destroyed by fire, and rebuilt. During the revolutionary struggle with England the hall was so often used for important political meetings that it became known as 'the cradle of American liberty.' In 1805 the building was increased in height by an additional story, and also increased in width.

Fanners, a machine employed to winnow grain, driven by hand or by machinery. In passing through the machine the grain is rapidly agitated in a sieve, and as it falls through a strong current of wind, created by a rotatory fan, the chaff is blown out at one end, whilst the cleansed particles fall out at an orifice beneath. The fanners superseded the old and slow process of winnowing, which consisted in throwing up the grain by means of sieves or shovels, while a current of wind, blowing across the thrashing-floor, carried away the chaff. A machine for the winnowing of corn seems for the first time to have been made in Britain by Andrew Rodger, a farmer on the estate of Cavers in Roxburghshire, in the year 1737. Strangely enough, there was a strong opposition to the use of this helpful instrument, the objectors seeing in it an impious evasion of the Divine will. To create an artificial wind was a distinct flying in the face of the text Amos, iv. 13: 'He that formeth the mountains and createth the wind.' See BLOWING-MACHINES.

Fanning, a coral island in the Pacific, lying in 3° 51′ N. lat. and 159° 22′ W. long. It has about 150 inhabitants, and was formally annexed by Britain in 1888, as on the line of the (already projected) submarine cable between Canada and Australia and New Zealand. Massive mortarless masonry has been found buried under guano. English Harbour is the port. Fanning Island is included in the Gilbert and Ellice Islands Colony. On Fanning Island and on Washington Island (70 miles NW.), which have a heavy rainfall (100 inches or more), coconut-palms are cultivated.

Fano (Lat. *Fanum Fortunæ*, so called from the temple of Fortune commemorating the defeat of Hasdrubal on the Metaurus), a town and seaport of Italy, on the Adriatic, 29 miles NW. of Ancona by rail. Its cathedral of St Fortunato and numerous churches contain paintings by Domenichino, Guido, Guercino, &c.; and there is a triumphal arch of white marble, raised in honour of Augustus. The inhabitants (28,000) carry on considerable trade in corn, oil, and silk goods; but the harbour is now greatly choked up with sand.

Fanö, the northernmost of the North Frisian Islands of Denmark, is a pleasure-resort.

Fan-Palm, a name common to all those palms which have fan-shaped (palmate) leaves, but more particularly applied to Chamærops (q.v.), and in the United States to the Palmetto. The Talipot Palm (*Corypha umbraculifera*) is also called the Great Fan Palm. For the Ethiopian Fan Palm, see DELEB PALM.

Fans, a race of aborigines, but apparently not true Negroes, in western equatorial Africa, between the Gabun and the Ogowe rivers, first accurately described by Du Chaillu. They are a fine race of savages, but are avowedly cannibals.

Fanshawe, SIR RICHARD, was born at Ware Park, Hertfordshire, in 1608, studied at Jesus College, Cambridge, and afterwards entered the Inner Temple, but found law distasteful, and went abroad to study languages. On the outbreak of the Civil War he took part with the king, and while with him at Oxford met and married in 1644 the lively and brave Anne Harrison (born 1625), with whom he lived in the most complete happiness throughout life. In 1648 he became treasurer to the navy under Prince Rupert, in 1651 was taken prisoner at the battle of Worcester, and on Cromwell's death withdrew to the Continent. After the Restoration he was appointed ambassador at the courts of Portugal and Spain, but was superseded by Lord Sandwich early in 1666, and before his return died suddenly at Madrid on the 26th June of the same year. His devoted wife carried his body to England for burial in Ware church, had much difficulty in recovering but a part of her husband's arrears of salary and money expended in the king's service, and survived till 1680. Fanshawe's works include *The Faithfull Shepheard* (1647), a translation from the Italian of Guarini; *Selected Parts of Horace* (1652); and *The Lusiad, or Portugal's Historicall Poem* (1655), a translation from Camoens. Lady Fanshawe wrote charming *Memoirs* (ed. H. C. Fanshawe, 1907).

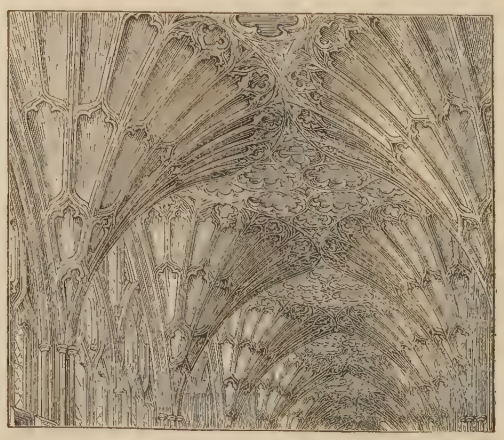
Fantasia is, like Capriccio, a title given to an instrumental composition whose form cannot be classified under any of the recognised species, but is a product of the individual fancy of the composer. In the music of the 17th and 18th centuries it was applied to pieces containing imitative passages, similar to the vocal madrigal; and hence the 'working-out' section in the sonata form obtained the name of 'free fantasia.' The later fantasia is, however, usually a pot-pourri—a medley of favourite airs, with intermediate 'brilliant' passages—a species of effusion to which unfortunately an impetus was given by pianists of the rank of Thalberg and Liszt.

Fantin-Latour, IGNACE HENRI JEAN THÉODORE (1836–1904), painter and lithographer, was born at Grenoble. His portrait groups and his flower studies are most noteworthy. See Life by Jullien (1909).

Fantis, a Negro people on the Gold Coast, belonging to the same stem as their Ashanti (q.v.) neighbours, but possessing a greater muscular development. They were once the most powerful race in that part of Africa, but early in the 19th century were subjugated by the Ashantis, and since the Ashanti wars have come completely under British rule. In the war of 1873–74 they proved cowardly and worthless allies.

Fantoccini. See PUPPET.

Fan-tracery Vaulting, a kind of Late Gothic vaulting (15th and 16th centuries), so called from its resemblance to a fan. The ribs or veins spring from one point, the cap of the vaulting shaft,



Fan-tracery:
From the Cloisters, Gloucester Cathedral.

and radiate with the same curvature, and at equal intervals, round the surface of an inverted curved cone or polygon, till they reach the semicircular or polygonal ribs which bound the upper part of the cone and divide the roof horizontally at the

ridge level into diamond and other patterns. The spaces between the ribs are filled with foils and cusps, resembling the tracery of a Gothic window; hence the name *fan-tracery*. The spaces between the outlines of the fans at the ridge level are called by Professor Whewell (*German Churches*) ridge lozenges. In Henry VII.'s Chapel, Westminster, one of the best examples of this kind of vaulting, these lozenges are occupied by pendants, which produce a very astonishing effect, looking like arches resting on nothing. They are, however, supported with great ingenuity by internal arches, rising high above the visible vaulting. This arrangement is one of those *tours-de-force* which astonish the vulgar, but are only adopted when art has reached a low level and has in a great measure given place to artifice. Fan-tracery is a very beautiful kind of vaulting, and is peculiar to England, where it originated, and where alone it was practised. Among the finest examples are St George's Chapel, Windsor, and King's College Chapel, Cambridge. Fan-tracery is also frequently used in the vaulting of cloisters, as at Gloucester, Canterbury, and Chester.

Farad (from Faraday), the name of the practical unit of electrical capacity, first given by the British Association Committee on Electrical Standards in 1863, and authorised by the International Electrical Congress held in Paris in 1884. Under ELECTRICITY will be found the definitions of the ampère, the volt, and the ohm, which are respectively the practical units of current, potential, and resistance. The Coulomb is the name given to the unit of quantity, and is the quantity of electricity transferred by a current of one ampère in one second; and then the farad is defined as the capacity of a conductor which when raised to a potential of one volt has a charge of one coulomb. The farad is, however, an inconveniently large quantity, so that it is customary to measure capacities in *microfarads*, the microfarad being the millionth part of a farad. See also MAGNETISM.

Faraday, MICHAEL, one of the most distinguished chemists and natural philosophers of the 19th century, was born, a blacksmith's son, at Newington Butts, near London, 22d September 1791. At thirteen he was apprenticed to a bookbinder; yet even then he devoted his leisure hours to science, and made experiments with an electrical machine of his own construction. Chance having procured him admission, in 1812, to the chemical lectures of Sir H. Davy, the latter engaged him as his assistant at the Royal Institution. He travelled to the Continent with Davy, as his assistant and amanuensis. On their return to London Davy confided to Faraday the performance of certain experiments, which led in his hands to the condensation of gases into liquids by pressure. In 1827 he succeeded to Davy's chair of Chemistry in the Royal Institution. He was created D.C.L. in 1832.

In chemistry his treatise on *Chemical Manipulation* (1827; 2d ed. 1842) is even now a very valuable book of reference. As discoveries or investigations of a high order in this branch of science we may mention new compounds of chlorine and carbon (1821); alloys of steel (1822); compounds of hydrogen and carbon (1825); action of sulphuric acid on naphthaline (1826); decomposition of hydrocarbons by expansion (1827); and the very valuable series of experiments, made in 1829–30, on the manufacture of glass for optical purposes, which resulted in one of his greatest discoveries, to be afterwards mentioned.

As practical applications of science his suggestions as to the preparation of the lungs for diving and the ventilation of lighthouse lamps are conspicuous, as are also his celebrated letter on table-turning and his lecture on mental education.

To enumerate only the most prominent of his publications on physical science, we may commence with the condensation of the gases (already referred to); then we have limits of vaporisation, optical deceptions, acoustical figures, re-gelation, relation of gold and other metals to light, and conservation of force. Of these the condensation of gases into liquids and solids, though in some cases previously effected by others (and Faraday was ever the foremost to acknowledge another's priority), he really made his own, not only by the extent and accuracy of his experiments, but by the exquisite experimental methods by which he obtained the results. His ideas on re-gelation and its connection with the motion of glaciers have not met with universal acceptance, though (see HEAT, ICE, GLACIER) there is no dispute as to his being correct in his *facts*. In regard to conservation of force, he seems to have been misled by the incorrect use of the word Force (q.v.), for in his article on the subject he describes experiments made with the view of proving the conservation of force proper; whereas the doctrine of conservation asserts merely the conservation of 'energy,' which is *not* in any sense force. He *may* be right also; but, if so, it will be by a new discovery having no connection whatever with 'conservation of energy.'

His Christmas lectures at the Royal Institution, though professedly addressed to the young, contain much that may well be pondered by the old. His manner, his unvarying success in illustration, and his felicitous choice of expression, though the subjects were often of the most abstruse nature, were such as to charm and attract all classes of hearers. Besides his *Lectures on the Non-metallic Elements* and *Lectures on the Chemical History of a Candle*, we have his *Various Forces in Nature*, a simple work, but in reality most profound, even in its slightest remarks.

But the great work of his life is the series of *Experimental Researches on Electricity*, published in the *Philosophical Transactions* during forty years and more. Fully to understand all the discoveries contained in that extraordinary set of papers would require a knowledge of all that has been discovered during that time as to electricity, magnetism, electro-magnetism, and diamagnetism. We may merely mention the following, almost all of which are discoveries of the *first* importance. They are given in the order of publication, which is nearly that of discovery: (1) Induced electricity (1831), comprehending and explaining a vast variety of phenomena, some of which have already been applied in practice (especially as magneto-electricity) to lighthouses, electro-plating, firing of mines, telegraphy, and medical purposes—electric currents derived from the earth's magnetism; (2) the electrotonic state of matter (1831); (3) identity of electricity from different sources (1833); (4) equivalents in electro-chemical decomposition (1834); (5) electrostatic induction—specific inductive capacity (1838); (6) relation of electric and magnetic forces (1838); (7) the electricity of the Gymnotus (1839); (8) hydro-electricity (1843); (9) magnetic rotatory polarisation (1846), effected by means of the optical glass already mentioned; (10) diamagnetism and the magnetic condition of all matter (1846); (11) polarity of diamagnetics, and the relation of diamagnetism to crystalline forms (1849); (12) relation of gravity to electricity (1851)—this, as before remarked, is Faraday's attempt to prove a conservation of force proper; (13) atmospheric magnetism (1851), an attempt to explain the diurnal changes of the earth's magnetic force by the solar effect on the oxygen of the air, a very interesting paper. Faraday's work is not only of extreme importance in itself, but it

has been of the utmost consequence to science by leading Clerk-Maxwell to his wonderful investigations of the dynamics of the electro-magnetic field and the electro-magnetic theory of light, and preparing the way for the great advance in physics in the 20th century.

Faraday, who had received a pension in 1835, was in 1858 given a house in Hampton Court. In 1862 he delivered his last discourse on 'gas-furnaces,' and advocated the use of magneto-electric light in lighthouses. In 1865 he resigned the position of adviser to the Trinity House, also that of director of the laboratory of the Royal Institution. Faraday, who was a devout Christian and a member of the Sandemanians or Glassites, died at Hampton Court, 25th August 1867. See Life by Tyndall (1868; 5th ed. 1894), Bence Jones (1870), and J. H. Gladstone (1872); W. Jerrold (1891), and S. P. Thompson (1899).

Faradisation. See ELECTRICITY (MEDICAL).

Faráizí, a sect of reformed Mohammedans in eastern Bengal since the middle of the 19th century. They differ from the orthodox Sunnites (of whom they may be regarded as a branch) in rejecting traditional custom, and in holding that the Koran is the sole and complete guide to spiritual life.

Farce (Ital. *farsa*, from Lat. *farcire*, 'to stuff'), a dramatic piece of a broad comic character. The difference between it and comedy proper is one of degree and not of kind. The aim of both is to excite mirth; but, while the latter does so by a comparatively faithful adherence to nature and truth, the former assumes to itself a much greater license, and does not scruple to make use of any extravagance or improbability that may serve its purpose. It does not therefore exhibit, in general, a refined wit or humour, but contents itself with grotesque rencontres and dialogues provocative of fun and jollity. The beginnings of Greek and Roman comedy consist of rustic farces or pantomimes (see ATELLANÆ); the first farces, in the modern sense, were composed by the fraternity of the Bazoche (q.v.) in Paris, as a contrast to the ecclesiastical plays performed by the religious orders. The most widely celebrated and most important of early farces is that of the advocate *Maistre Pierre Patelin*, which was acted in the 15th century, and quickly spread itself over Italy and Germany. It is full of genuine comic quality, and its dialogue has brightness and reality. Subsequently Molière elevated and refined the farce into his wonderful series of comedies of character. In England the origin of the modern farce dates from about the commencement of the 18th century. Of all the numerous farces which have been performed before English audiences only those of Samuel Foote, who reverted, however, to the abuse of personal mimicry which characterised the earliest farces, have kept a place in literature. See DRAMA.

Farcy. See GLANDERS.

Fardel-bound. See CONSTIPATION.

Far Eastern Republic, in south-eastern Siberia, coincided roughly with the old Transbaikal, Amur, and Maritime provinces, with Chita for its capital. It extended from Lake Baikal to the Seas of Okhotsk and of Japan, and included north Sakhalin. This region, inhabited mainly by Russians, with some Buriats and others, was, after the fall of the tsardom, a theatre of military operations for Czechs, Russian 'Whites' under Koltchak, Cossacks under Semenov, Japanese and other foreign troops, against whom the peasantry gradually made headway. In its difficult position between the Japanese and the Bolsheviks, the country, under the influence of Alexander Krasnostchekov, adopted a democratic constitution (1920), recognised by Russia, and set up a coalition government. The expulsion of the 'White' government from Vladivostok in October 1922, and the evacuation of the town by the Japanese, removed obstacles to union, and in December the republic joined the Soviet Republic as an autonomous region. Area, 675,000 sq. m.; pop. 2,000,000.

Fareham, a market-town and watering-place of Hampshire, on a creek at the north-west end of Portsmouth harbour, 12 miles SE. of Southampton and 9 NW. of Portsmouth. It has earthenware, sackcloth, and rope manufactures. The population has increased from 3450 in 1851 to about 10,000.

Farel, GUILLAUME, one of the most active promoters of the Reformation in Switzerland, was born in 1489 at Gap, in Dauphiné. He studied at Paris, and was at first distinguished by his extravagant zeal for the practices of the Catholic Church; but, moved to the study of the Scriptures, he was converted to Protestantism, and, being by nature vehement even to indiscretion, he immediately commenced to proselytise. The chief scene of his labours was France and Switzerland. At Basel, in 1524, he opened his career of controversy and evangelisation by publicly sustaining thirty theses on the points in dispute between Roman Catholicism and Protestantism. He subsequently preached at Strasburg, at Montbéliard, and at Neuchâtel. In 1532 he went to Geneva, but soon had to leave the city. He returned in 1533, was again compelled to withdraw, but once more entered it in 1534; and in 1535 the town-council of Geneva formally proclaimed the Reformation. Farel, however, was a missionary, not a legislator, and the organisation of the Genevan Church passed into the hands of Calvin (q.v.). The severity of the new ecclesiastical discipline produced a reaction, and in 1538 the two Reformers were expelled from the city. Farel took up his residence at Neuchâtel. In 1557, along with Beza, he was sent to the Protestant princes of Germany, to implore their aid for the Waldenses, and on his return sought a new sphere of evangelistic labour in the Jura Mountains. When trembling upon threescore-and-ten, he married a young wife. In 1560 he proceeded to his native Dauphiné, and passed several months preaching against Catholicism; and in November 1561 he was thrown into prison for a time. He died at Neuchâtel on the 13th September 1565. His works were mainly polemical.

Farewell, CAPE, the southern extremity of Greenland, lying in 59° 44′ N. lat. and 43° 54′ W. long., consists of a rocky hill, nearly 1000 feet high, situated on an island off the coast. It is generally beset with ice, which appears to come from the north-east and to sweep round into Davis Strait. Hence the cape is but little known; and, in fact, the Danish traders and seamen generally round it at more than 100 miles' distance.

Fargo, capital of Cass county, North Dakota, on the Red River of the North, 234 miles W. of Duluth by rail. From an insignificant village in 1874 it has become the financial and commercial centre of the state, with flour and other manufactures and a Congregational college and state agricultural college. Pop. 22,000.

Fargus, FREDERICK. See CONWAY (HUGH).

Faria y Sousa, MANUEL DE, Portuguese historian and poet, was born near Pombeiro in 1590, was secretary to his kinsman the Bishop of Oporto, and became in 1631 secretary to the Spanish embassy at Rome, where he enjoyed the favour of Pope Urban VIII. Three years later he returned to Spain, and died at Madrid in 1649. His writings fill more than sixty volumes, partly in Spanish, and comprise works on Portuguese history, on Portugal and its possessions in America and Africa, and commentaries on

Camoens. His Portuguese poems comprise about two hundred good sonnets and twelve eclogues, and it is mainly by these, and also by three theoretical treatises on poetry, that he has influenced the development of the poetic literature of Portugal, in which he was long regarded as an oracle. His poetry exhibits talent and spirit, but is on the whole tasteless and bombastic.—He must not be confounded with Manuel Severin de Faria (1583–1655), who was one of the most learned numismatists of his age.

Faribault, capital of Rice county, Minnesota, on the Cannon River, 53 miles S. of St Paul, with a state institution for the deaf, dumb, and blind, and the Seabury divinity school. It has manufactures of flour, woollens, furniture, &c. Pop. 11,000.

Faridkot, one of the Sikh cis-Sutlej states, south-east of Firozpur (area, 642 sq. m.; pop. 130,000). It is ruled by a raja, resident in the town of Faridkot (pop. 12,000), 60 miles SSE. of Lahore.

Faridpur, chief town of a district of the same name in the delta of the Ganges, 110 miles NE. of Calcutta; pop. 13,000.

Farina, a Latin term for meal or flour, is also applied to many substances which agree with the meal of the corn-plants or Cerealia in containing much starch.—*Fossil farina*, *mountain milk*, or *Agaric mineral*, is a deposit of silicified animalcules, obtained from China, &c.

Farina, J. M. See EAU DE COLOGNE.

Farinelli, the name under which the Neapolitan *castrato* (see EUNUCH) Carlo Broschi (1705–82) became famous for his marvellously powerful and flexible soprano voice in Rome (where he made his début in his seventeenth year), in Vienna, and in London (in 1734; see PORPORA, HANDEL); and in Madrid, where he settled in 1737, he was not merely adored as an opera-singer by the court and the populace, but was made a royal favourite and, consulted by the king on all matters of state, was lavishly pensioned, knighted, and made a grandee of Spain. Ferdinand VI. founded an opera-house according to his suggestions and made him director. In 1761 he retired, enormously rich, to a country house near Bologna, where he lived and died respected for his character.

Farington, JOSEPH (1747–1821), born a vicar's son at Leigh, was known only as an R.A. potentate and landscape artist till the discovery of his diary (ed. James Greig, 1922 *et seq.*) from 1793 to the day of his death (by falling downstairs in church), full of vivid jottings on great men and events.

Farini, LUIGI CARLO, born in 1812 at Russi, in the province of Ravenna, studied medicine at Bologna, and practised with success in his native city, but in 1841 had to leave the Papal States. The amnesty and liberalism of Pius IX. attracted him to Rome in 1846, where he held office under Rossi. Called to Piedmont, in 1851 he became minister of Public Instruction, in 1859 provisional governor of Modena, in 1861 minister of Commerce in the last cabinet of Cavour, and he was himself premier from December 1862 till the breakdown of his health in the following March. A strenuous labourer in the cause of a united Italy, he died near Genoa on 1st August 1866; and in 1878 his remains were translated to Russi. Among Farini's works may be mentioned *Il Stato Romano*, translated into English under Mr Gladstone's supervision (4 vols. 1851–54), and *Storia d'Italia*, a continuation of Botta's celebrated work.

Farm (O.E. *feorm;* Low Lat. *firma*, from Lat. *firmus*, 'durable'), the term usually employed to denote a piece of land, either pasture or arable, held in lease by a tenant from the proprietor; but of course the term farmer is often applied to a person who owns as well as cultivates land. In America the farmer usually owns the land he cultivates. In this work the history and present position of agriculture, agricultural statistics, and the division of land are dealt with under the head AGRICULTURE; and other matters relevant to farming (such as cattle, dairy, landlord and tenant, lease) are treated under the various heads cited at the end of that article.

FARM BUILDINGS.—The buildings of a well-appointed farm in Great Britain consist of a residence for the farmer and his family, cottages for the farm-labourers, and the farm-steading. The dwelling-house varies to some extent with the size and character of the holding, the 'rules of the estate,' the fashion of the district, and the taste and social standing of the tenant. Modern farm dwelling-houses upon holdings of about 200 acres and upwards are, as a rule, both commodious and comfortable, substantial in construction if not ornate in external appearance, usually surrounded by simply but tastefully laid out grounds, with a moderately sized garden —for, despite the old adage, farmers are not now all bad gardeners. The dwelling-house should be from 50 to 200 yards distant from the steading, and, if possible, upon a slightly higher level, and so situated that from the farmer's parlour and bedroom windows the whole of the steading and stack-yard may be in view.

The servants' cottages should be near the steading, perhaps at the opposite side from the farmer's dwelling-house. The cottages should be plain, substantial, and roomy; they are often in one continuous row, often in pairs, seldom built singly. Each family may have three or four compartments, with a separate door, and a separate plot of ground for garden produce. Cottages for farm-servants are now more fully provided than prior to 1870; and it is well known that, where there is ample cottage accommodation, the supply of agricultural labour is, as a rule, both abundant and of good quality.

The *farm-steading*, as the term is understood in its narrowest and most generally accepted sense, consists of erections provided for the accommodation of the crops, stock, and farm implements and machines. The cost, character, and capacity of the farm-steading vary not only with the extent of the holding, the system of farming pursued, and the situation of the farm in regard to climate, but also to no small extent with the tastes and desires of the land-owner, and perhaps likewise, although to a smaller extent, with the fancies of the tenant. It is the presumption that all the buildings and other permanent equipments of the farm are provided by and are the property of the owner of the soil. The character of the steading is therefore, as a rule, determined by the 'rules of the estate. These estate rules too often enforce the observance of certain plans irrespective of the exceptional necessities and peculiarities of individual farms. On this account, and through a widespread ambition on the part of both landlords and tenants for imposing and almost luxurious farm buildings—an ambition fostered by, if not born of, the times of exceptional prosperity experienced prior to 1875—an excessive and unreasonable amount of capital has in many cases been sunk in the buildings of the farm, thus placing upon the land a burden which it is ill able to bear, and which is therefore detrimental alike to the land-owner and to the tenant. The greatest amount of steading accommodation is required upon mixed husbandry farms, where a large quantity of home-grown produce is consumed by cattle in winter. Unfortunately upon such a farm the maximum expenditure is required where the land is, as a rule, least able to bear

heavy burdens—viz. in the cold northern districts, where substantial and comfortable houses have to be provided for the stock during the long and severe winters. In many instances there is four or five times as much money sunk in buildings—i.e. apart from the dwelling-houses—upon mixed husbandry farms in the north of Scotland as upon similar farms in the south of England.

The farm-steading is usually situated as near as possible to the centre of the holding, on a dry, airy, yet well-sheltered elevation, with the water-supply abundant, if such is to be had on the farm, but not in close proximity to stagnant water or swampy ground. The open part of the steading should, as a rule, have a southern exposure, yet the immediate situation as to shelter may warrant variations from this rule. The most common and convenient plan for a farm-steading is in the form of three sides of a square or parallelogram, with a wing down the centre, and perhaps also stretching out a short distance at the back of the cross wing, the dimensions of the square or parallelogram being so regulated as to provide the required capacity in the various compartments. Modern experience has fully demonstrated the advantages of covered courts for cattle. In most improved steadings, therefore, the whole or greater part of the spaces between the centre and side wings is roofed and arranged as courts for cattle. The whole of the season's dung is often accommodated in these courts, and is benefited by the treading of the cattle, while the roof saves it from damage by washing with rain-water. Where good management prevails, the liquid manure is collected in a tank close to these courts, and periodically pumped over the heap of solid manure. Quantities of gypsum are sprinkled over liquid manure wherever it is exposed, to fix free ammonia, which would otherwise volatilise and pass away in the atmosphere.

A point worthy of careful consideration is the placing of the various compartments of the steading in such relation to each other that there may be no unnecessary moving of food, manure, or dairy produce, so that time in performing the various operations going on in the steading may as far as possible be economised. The straw-barn should be near the centre of the steading, and the classes of stock receiving most straw accommodated nearest to the straw-barn. The root-stores should be easily accessible from the cattle compartments, the hay-store from the stable, the dairy from the cow-house, and the stack-yard from the threshing-mill and straw-barn. The cart and implement sheds should be near to the stable.

In close steadings most careful attention should be given to *ventilation*, so as to secure a sufficient current overhead to keep the atmosphere pure and equable without allowing draughts to play directly upon the animals. Besides stone and bricks, concrete—1 part of stale Portland cement to 6 parts of broken stones or pure gravel (free from earthy matter)—is now largely employed in the construction of farm buildings, notably servants' cottages. Galvanised corrugated sheet-iron is extensively used in roofing courts for cattle. Covered stack-yards have not come into use, as was at one time expected, but large hay-barns, roofed with corrugated iron, are now very common, and are a valuable acquisition to farm-steadings.

On the American continent farm buildings are generally constructed of wood. It is common there to find all the compartments of the farm-steading grouped under one roof, which is often of great dimensions.

Farmer, JOHN, English madrigalist, born probably about 1565, was appointed organist of Christ Church Cathedral, Dublin, in 1595, deserted and in 1597 resumed his post, and in 1598 was presented to the vicarage of Kilsheelan, to which, not being in orders, he appointed a deputy. He went to London in 1599, and died there in 1605. His *First Set of English Madrigals* appeared in 1599, his treatise, *Divers and Sundry Ways of Two Parts in One*, in 1591. He contributed to East's *Whole Book of Psalms* (1592) and Morley's *Triumphs of Oriana* (1601). See Fellowes, *English Madrigal Composers* (1921), and for his music, *English Madrigal School* (vol. viii. 1914).

Farmer, RICHARD, D.D., a well-known 18th-century scholar, was born at Leicester, August 28, 1735, and in 1753 was entered a pensioner of Emmanuel College, Cambridge, where four years later he graduated a senior optime. Appointed classical tutor of his college, he took orders, and served the curacy of Swavesey, a village 9 miles from Cambridge. On Dr Johnson's visit to Cambridge the two scholars had a 'joyous meeting,' and ever after kept up the most friendly relations. Dr Farmer became a member of the famous Literary Club, and helped Johnson with Cambridge notes for his *Lives of the Poets*. He soon abandoned his projected history of Leicester, and published in 1767 his only work, the once famous *Essay on the Learning of Shakespeare*, which showed that the great dramatist derived his knowledge of the ancients from translations, having often preserved the phraseology and even the errors of the translators. In 1775 Farmer was elected to the mastership of Emmanuel College, and in 1778 became chief-librarian to the university. In 1780 he obtained a prebendal stall at Lichfield, in 1782 at Canterbury, which he exchanged in 1788 for a residentiary prebend in St Paul's. The remaining years of his life he divided betwixt residence in London and at Cambridge, beloved alike by the members of his college and by London men of letters for his geniality and his brilliant talk over a pipe of tobacco and a bottle of port. He was careless of his appearance, an inveterate collector of old books, and habitually indolent—a failing which alone prevented his making a figure in literature. He died September 8, 1797.

Farmers-general (Fr. *fermiers-généraux*) was the name given before the Revolution of 1789 to the members of a privileged association in France, who farmed or leased the public revenues of the nation. This system of tax-gathering became general in France from the year 1546, when Francis I. let out the *gabelle* or salt-tax in this way. The privileges of the position were sold to the highest bidder; but they were largely in the hands of the king's favourites. The powers, rights, and duties of the class were defined by special decrees; but, however severe may have been the fiscal laws against fraud and contraband, it is notorious that shortly before the Revolution abuses of the most flagrant description had demoralised the system and the men. During the Revolution most of these odious tax-gatherers perished on the scaffold, the innocent among them being occasionally confounded with the guilty. Farmers of the revenue were an institution of ancient Rome (see PUBLICANS). Tolls on roads and duties of various kinds were at one time farmed also in Great Britain. See MONOPOLY.

Farnborough, an urban district on the east border of Hampshire, 32 miles SW. of London, contains part of the camp of Aldershot (q.v.). Near it is Farnborough Hill, the residence of the Empress Eugénie, with a mausoleum, in which she is buried with her husband and son. Farnborough gave a title to Sir T. Erskine May (q.v.). Pop. (1921) 12,645.

Farne Islands, or the STAPLES, a group of seventeen islets and rocks (area, 80 acres), some being visible only at low-tide, two to five miles off

the north-east coast of Northumberland, opposite Bamborough, are an important bird-breeding station, acquired by the National Trust in 1924. On House Island are remains of a Benedictine priory, dedicated to St Cuthbert (q.v.). The passage between the isles is very dangerous in rough weather; and on the group there are two lighthouses. Here the *Forfarshire* was wrecked in 1838 (see DARLING, GRACE); and here, in 1843, the *Pegasus* met the same fate, when sixty persons were drowned.

Farnell, LEWIS RICHARD, born at Salisbury, 10th January 1856, studied at Oxford, Berlin, and Munich, travelled in Greece and Anatolia, and wrote *Cults of the Greek States* (1896), and other works on Greek and comparative religion.

Farnese, the name of an illustrious Italian family, three members of whom occupy a prominent position in history. ALESSANDRO FARNESE was raised to the papal see in 1534 as Paul III. (q.v.). He founded the duchy of Parma and Piacenza.—ALESSANDRO FARNESE (1546–92), son of the second duke, and one of the most skilful generals of his age, first distinguished himself at Lepanto (1571). Afterwards, as governor of the Spanish Netherlands, he captured Antwerp (1585) for Philip II., and compelled Henry IV. of France to raise the siege of Paris (1590).—ELIZABETH FARNESE (1692–1766) became the wife of Philip V. of Spain in 1714, and was a warm supporter of the policy of Alberoni, Philip's minister. See Life by E. Armstrong (1892).—The three pieces of antique sculpture (the Farnese Hercules, Flora, and Bull) were removed about 1790 from the Farnese Palace at Rome to the national museum at Naples.

Farnham, a town of Surrey, 38 miles SW. of London by rail, stands on the Wey, embosomed in hop-gardens. The principal feature is the old castle of the bishops of Winchester, first built by Bishop Henry de Blois, King Stephen's brother. Razed by Henry III., and afterwards rebuilt, it was garrisoned by Charles I., and restored in 1684 to its present state by Bishop Morley. A handsome Italian town-hall was built in 1866. Moor Park, the seat of Sir William Temple, with memories of Swift and 'Stella,' is in the vicinity; so, too, are the remains of Waverley Abbey (1128), whose *Annales Waverlienses* suggested to Scott the name of his first romance. The chief trade is in hops, a very fine variety being grown here. Pop. 12,000. Toplady and Cobbett were natives. Aldershot Camp (q.v.) is 3 miles NE. of Farnham.

Farnworth, an urban district of Lancashire, 3 miles by rail SE. of Bolton, with cotton-spinning, coal-mining, machine-making, and chemical manufactures; pop. 28,000.

Faro, the capital of the Portuguese province of Algarve, on the south coast, behind three islands which form a good roadstead. It has considerable exports of fruits, cork, sumach, and fish. Pop. 13,000. Faro was burned by the English in 1596, and partly destroyed by the earthquake of 1755.

Faro, a widely-known game of hazard, played with cards by a 'banker' against an indefinite number of players. It is so called from Pharaon or Pharaoh, the old name of one of the court cards.

Faroe Islands. See FAEROE ISLANDS.

Farquhar, GEORGE, was born at Londonderry in 1678, and received his education at Trinity College, Dublin, where, although he did not take any degree, he secured among his comrades the reputation of a wit who was a spendthrift of his witticisms. When he left the university he was engaged as an actor at one of the Dublin theatres, but, like most dramatists who have figured on the stage, he proved but an indifferent performer. Playing a part in Dryden's *Indian Emperor*, and forgetting that he wore a sword instead of a foil, he accidentally wounded a brother-performer, and was so shocked by the occurrence that he at once quitted the boards. Accompanied by the actor Wilks, he proceeded to London, and shortly after received a commission in the regiment commanded by the Earl of Orrery, which was then stationed in Ireland. Urged by Wilks, and perhaps stimulated by the gaiety and leisure of a military life, he in 1698 produced his first comedy, entitled *Love and a Bottle*, which proved a success. Two years afterwards his *Constant Couple* appeared, which met with a brilliant reception, and to which he wrote a sequel, called *Sir Harry Wildair*. In 1703 he produced *The Inconstant*, founded on the *Wild-goose Chase* of Beaumont and Fletcher, a version in which all the coarseness, and none of the poetry, of the elder dramatists is retained. Having married in the same year, he fell into serious pecuniary difficulties, sold his commission, and, struggling with adverse fortune, succumbed. He died of decline in 1707, leaving 'two helpless girls' to the care of his friend Wilks. During his last illness he wrote the best of his plays, *The Beaux' Stratagem*—in six weeks, it is said—and died while its wit and invention were making the town roar. *The Recruiting Officer* had been produced in 1706.

Farquhar is one of the best of our comic dramatists, although Pope called him a 'farce writer;' less brilliant than Congreve, the Smollett, not the Fielding, of the stage, he possesses on the whole more variety and character than any of his compeers. With wit in abundance, he had humanity too, and was a tender-hearted, somewhat melancholy man—'very splenetic, and yet very amorous.'

See Ewald's edition (1893); also Archer's of four plays ('Mermaid Series,' 1906); Dr D. Schmid, *George Farquhar, sein Leben und seine Original-Dramen* (1904); Allardyce Nicoll, *Restoration Drama* (1923).

Farr, WILLIAM, born at Kenley, in Shropshire, 30th November 1807, studied medicine at Paris and London, but devoted himself mainly to medical statistics. In 1839 he received an appointment in the Registrar-general's Office in London, where he eventually became superintendent of the statistical department, a post which he held until 1880. He died in London, 14th April 1883. His chief books are *Tables of Lifetimes, Annuities, and Premiums* (1864); *English Reproduction Table* (1880); and *Net Premiums for Insurance against Fatal Accident* (1880). His *Vital Statistics*, a memorial volume, appeared in 1885.

Farragut, DAVID GLASGOW, the greatest of American seamen, was born of Spanish origin, near Knoxville, Tennessee, 5th July 1801. Entering the navy in 1810, he became a lieutenant in 1825, commander in 1841, and captain in 1855. On the outbreak of the civil war he held by the Union, and in 1862 was given the command of the armament of wooden steamers and mortar-boats fitted out for the capture of New Orleans. The approach to the city was defended by two strong forts, a number of Confederate steamers and an ironclad ram, besides chains stretched across the river, whilst sharpshooters and fire-rafts had been prepared to harass the attacking force. After the forts had been shelled for six days and nights without effect, Farragut decided to force the passage in the darkness, and actually carried through all but three of his vessels, in spite of the terrible raking fire poured in as they passed the opening made in the boom. The Confederate fleet was sunk or burned, and, on the 25th April, the last batteries having been silenced, the city was evacuated, and Farragut's men landed. For many months thereafter he was employed on the Mississippi, until in July 1863 the last fort surrendered, and the entire river was open to navigation. In July 1862 he had been commissioned rear-

admiral, and in 1864 he returned to the Gulf, where on 5th August he fought the battle of Mobile Bay, destroying the enemy's gunboats and a powerful ironclad ram; a few days later the forts surrendered, and the port of Mobile was thenceforth closed to blockade-runners. In December he was made vice-admiral, the grade being created for him by congress, as was also the rank of admiral, to which he was raised in 1866. He died at Portsmouth, New Hampshire, 14th August 1870. There is a colossal bronze statue of Farragut in Washington, and another, of heroic size, in New York. See the Life by his son (1879), and by A. T. Mahan (1893).

Farrant, Richard, musician, was born about 1530, entered the Chapel Royal, became organist of St George's Chapel in 1564, returned to the Chapel Royal in 1569, whence he retired in 1580, and died in 1585. His name is best known in connection with the anthem, 'Lord, for Thy tender mercies' sake,' and a chant based on it, which, however, seem certainly not to be his. He actually did compose a full morning and evening service, and two anthems which have been printed, with parts of other services.

Farrar, Frederic William, D.D., Dean of Canterbury, was born in Bombay, 7th August 1831, and graduated at London University and at Cambridge, where he was fourth classic. Ordained in 1854, he was for many years a master at Harrow, and in 1871–76 head-master of Marlborough College; in 1868 and 1874–75 he was a select preacher before the university of Cambridge, in 1869–73 honorary chaplain to the Queen, and afterwards a chaplain-in-ordinary. He became canon of Westminster and rector of St Margaret's in 1876, and archdeacon in 1883, chaplain to the House of Commons in 1890, and Dean of Canterbury in 1895. His productiveness as an author was equalled only by the remarkable popularity of some of his writings, which include, besides *Eric* (1858) and other stories of school-life, and his earlier works on philology and education, *The Witness of History to Christ* (Hulsean Lectures for 1870); *The Life of Christ* (2 vols. 1874), which passed through twelve editions in as many months; a *Life of St Paul* (2 vols. 1879); *The Early Days of Christianity* (2 vols. 1882); *The History of Interpretation* (Bampton Lectures for 1885); and *The Lives of the Fathers* (1889). *Eternal Hope* (a volume of sermons, 1878) denied the probability of eternal punishment. Other works were *Darkness and Dawn* (1892) and *The Life of Christ in Art* (1894). He was a contributor to a former edition of *Chambers's Encyclopædia*. He died 22d March 1903; see the Life by his son (1904).

Farrer, Lord (Thomas Henry Farrer, 1819–99), was born the son of a London solicitor, and bred at Eton, Balliol, and Lincoln's Inn, and from 1862 till his retirement in 1886 was permanent secretary to the Board of Trade. He was made a baronet in 1883, and a peer in 1893. In *Free Trade versus Fair Trade* (1886), *Studies in Currency*, and other works, he showed himself an uncompromising free trader.

Farrer, Reginald John (1880–1920), a Yorkshireman, educated at Balliol, cultivated Alpine plants at Ingleborough, collected in western China and elsewhere, and wrote some good books of travel —*On the Eaves of the World* (1917) and *The Rainbow Bridge* (1921)—besides gardening books and plays.

Farrier, a shoer of horses, who formerly also treated their diseases. See Horseshoeing, Veterinary Medicine. In every British cavalry regiment there is a farrier quartermaster-sergeant (formerly farrier-major), with three farrier-sergeants and four shoeing-smiths, who attend to the shoeing of the horses and their treatment when sick, subject to the veterinary surgeon. They wear as a badge on the sleeve a horseshoe, in worsted for the shoeing-smiths, and in gold for the farriers, who rank as sergeants and wear Chevrons (q.v.).

Fars, or Farsistan (anciently *Persis*), a province of Persia, bordering on the Persian Gulf, rises from the steep coast in a succession of broad terraces. The coast zone or 'hot country,' the productiveness of which is greatly dependent upon the rainfall, is backed by the 'land of the passes,' behind which comes the 'cold country;' the interior belongs to the Iranian plateau. The mountain chains, lying parallel to the coast, embrace numerous fertile valleys, rich in pasturage and vines and fruit-trees. Amongst the mountains are several lakes, the largest Lake Bakhtegan (q.v.). The rivers are small. The climate varies with the different districts. The principal products of the province are fruits, dates, tobacco, cotton, silk, and excellent wine. Area, about 50,000 sq. m. The population, which is sparse, is estimated at 750,000. The capital of Fars is Shiraz; the port, Bushire, on the Persian Gulf.

Farthing (O.E. *feorðing*, from *feorð*, 'fourth'), an English copper coin equivalent in value to the fourth part of a penny. In accordance with representations made to the government by Dean Swift for the improvement of the coinage, certain pattern farthings were struck in the years 1713–14, known as 'Queen Anne's farthings.' Five distinct varieties are known to exist. The value of the pieces, which are not very rare, has been exaggerated; but one sold in 1907 for £40.

Farthingale, or Fardingale (Old Fr. *vertugalle*, from Span. *vertugada*, 'a hooped petticoat'). See Crinoline.

Farukhabad, a city of the United Provinces of India, near the right bank of the Ganges, 83 miles NW. of Cawnpore. It is a clean and healthy place, with a considerable trade, and a pop. (with Fatehgarh) of 60,000.—The *district* of Farukhabad belongs to the alluvial plain of the Doab, the soil being for the most part high-lying, sandy, and infertile. Area, 1700 sq. m.; pop. 900,000. The most important crops are potatoes, indigo, and sugar-cane. The capital is Fatehgarh. The ruins of Kanauj, the capital of a powerful Hindu kingdom, still exist within the district.

Fasces were bundles of rods usually made of birch, but sometimes of elm, with an axe (*securis*) projecting from the middle of them, which were carried before the chief magistrates of ancient Rome as symbols of their power over life and limb. They were borne by the lictors, at first before the kings, in the time of the republic before consuls and prætors, and afterwards before the emperors. Their number varied, a consul and a proconsul in his province having twelve, a prætor six, but within the city only two. Valerius Publicola introduced a law that within the city the axe should be withdrawn, except in the case of a dictator, who was preceded by twenty-four lictors, bearing as many fasces. Publicola also made the fasces be lowered at the assemblies of the people, as an acknowledgment of their supreme power.

Fascia, in Architecture, a flat space or band between mouldings. See Entablature.

Fasciation is a form of monstrosity not uncommon in plants. The growing apex loses its usual conical shape and becomes greatly extended in one diameter, so as to produce a broad band-shaped growing-point. This may continue to widen until it has reached many times the normal breadth without any proportional increase in thickness, and often becomes thrown into irregular folds, the leaf

arrangement becoming correspondingly confused. Cases of fasciation occur not unfrequently in the ash-tree, the auricula, daisy, and other common plants, and constantly in the cultivated Cockscomb (q.v.). Such growths are with Welsh Gypsies an object of superstitious reverence.

Fascination (Lat. *fascino*, 'I bewitch,' doubtfully akin to Gr. *baskainō*), an interpretation of the fatal influence of some serpents over their destined prey. Kalm and others describe how the rattlesnake fixes a squirrel with its lidless eye, and so far demoralises the victim that it drops into the distended mouth. Le Vaillant describes the convulsions and finally the death of a shrike, paralysed by fear of a serpent at a distance of nearly four feet. Dr Andrew Smith reports that the non-venomous South African tree-snake (*Bucephalus viridis*) gathers quite a circle of victims. Ellis notes the interesting fact that an object pushed between the eye of the snake and a victimised frog broke the spell. In spite of many observations which suggest mesmeric or hypnotic influence, against which there is no strong improbability, most naturalists regard so-called fascination as equivalent to fear. In panic animals may undoubtedly become paralysed or stupid, or lose the usual power of co-ordinating their actions. See Evil Eye, Snakes.

Fascines (from Lat. *fascis*, 'a bundle') are brushwood fagots bound together with wire, yarn, or withes. They are 18 feet long and 9 inches in diameter, used for revetting the steps and steep interior slopes of field-works and for other military purposes, such as roofing magazines, Casemates (q.v.), Blockhouses (q.v.), &c., when timber cannot be procured. A double row covered with earth several feet thick is almost bomb-proof. They also make a very strong stockade, and can be used in bridging operations and road-making. Cut into six-feet lengths, they are often carried by the men of an assaulting column to fill up the ditch of a work or lessen its depth. Five men can make a fascine in an hour.

Fasciola. See Fluke, Trematodes.

Fascismo, a movement organised in Italy by Benito Mussolini, who withdrew from the Socialist party and the editorship of the *Avanti* to press for Italian participation in the Great War by means of his own paper, the *Popolo d'Italia*, published in Milan. In 1920, when many factories were in the hands of the workmen, bands of Fascisti (from *fascio*, 'bundle'), taking the *fasces* as their badge and a black shirt as their distinguishing garb, made melodramatic war upon Socialism, by methods ranging from murder to the administration of castor-oil. Their strength was among the army officers, the captains of industry, and the bourgeoisie, especially in central Italy. They called for a policy of militant imperialism and capitalist enterprise. In October 1922 they seized public buildings in many towns, and moved upon Rome. The army was sympathetic. The king refused to sign a decree establishing a state of siege, and invited Mussolini to form a ministry. His government, mainly Fascista, included members of the nationalist, democrat, and popular (Catholic) parties. A new electoral law assigned two-thirds of the seats in the Chamber to the majority party. Corfu was occupied (see Ionian Islands), and the League of Nations flouted. State enterprises were converted to private ownership; and the crucifix was restored to its place in every school.

Fasher, a province of Dar-fûr (q.v.).

Fashion and **Fashionable,** terms applied to occupations, pursuits, education, and manners, as well as to most of the luxuries and necessaries of modern civilised life, denote an unending series of changes and modifications which are most marked and most apparent in the department of dress. Such variations of costume were unknown to most nations of the ancient world, and among the Romans only influenced the accessories of the toilet. The unchanging East is as unchanging in its dress as in everything else, and the fashions to which savage tribes uncompromisingly adhere remain unaltered for long periods. In some remote districts of European countries peasants still dress in the costume brought two or three hundred years ago by the local nobility from court, and the smock-frock of the English agricultural labourer is a relic of Saxon times. The natural conservatism of man often throws strong light upon long-forgotten social history, and nowhere more than in the survivals in modern costume. Thus, as Sir E. Tylor points out, there is much to be learnt from so quaintly cut a garment as the modern evening dress-coat. 'The cutting away at the waist had once the reasonable purpose of preventing the coat-skirts from getting in the way in riding, while the pair of useless buttons behind the waist are also relics from the times when such buttons really served the purpose of fastening these skirts behind; the curiously cut collar keeps the now misplaced notches made to allow of its being worn turned up or down; the smart facings represent the old ordinary lining; and the sham cuffs now made with a seam round the wrist are survivals from real cuffs, when the sleeve used to be turned back. Thus, it is seen that the present ceremonial dress-coat owes its peculiarities to being descended from the old-fashioned practical coat in which a man rode and worked.' Again, the English clergyman's bands are directly traceable through intermediate stages to the wide collars which everybody wore in Milton's time, the very name of which also survives in our word *bandbox*. And it is said that the modern cylindrical hat is the indirect descendant of the Puritan steeple-crowned hat, carried across the Atlantic by the Pilgrim Fathers, thence again to France, when Benjamin Franklin and the young Republicans were the height of the fashion, and by the French manipulated into the hat which they gave to all the world.

The Romans spread their dress with their civilisation over Europe, and it was gradually modified by the close-fitting garments of the races of the north till the two styles were united in the 5th century; but fashion in its modern sense cannot be said to begin till the 14th century. Then complaints first arise of clothes being cast aside for others of newer shape and cut. It must be remembered that till the 19th century men's clothes were as delicate in colour and as rich in material as women's; Pepys records in his Diary how he had his wife's gowns cut up into waistcoats for himself. The change during the 14th century from close-fitting tunic and hose to long, loose garments trailing on the ground is even more startling than the outcrop of steeple-like headgear which distinguished the ladies of the 15th century.

The sumptuary laws of the 13th, 14th, 15th, 16th, and 17th centuries clearly show that dress was originally a symbol of rank, strictly prescribed for the various classes of society. An early French law complains of each man clothing himself as he pleased, without reference to his rank, so that it was impossible to tell from his dress whether he was a prince, nobleman, citizen, or labourer. In modern days this state of things is fulfilled to the letter, though costume still retains its old significance in the uniforms of the army and navy, of policemen and postmen, in the lawyer's wig and gown, the judge's robe, the bishop's lawn sleeves, and the university student's cap and gown, all of which, as Herbert Spencer remarks, are worn by

people whose office it is to uphold established arrangements in church and state. The railway companies and the Post-office impose a uniform on their employees, the maid-servant (in Britain) wears a cap and apron, and the waiter a black suit, but the only class who at all times voluntarily mark themselves off from other men are the clergy. Political and religious opinions have been at times symbolised by dress, as with the Puritans and Quakers; and instances of such distinguishing marks as the tricolor of France, the white cockade of the Bourbons and the Stuarts, the blue and green of the factions in the circus of ancient Constantinople, the orange and green of Irish political parties, and the blue and buff of English elections might be multiplied indefinitely. Dress attained its highest point of significance in France during the last half of the 18th century, when it marks unmistakably the various stages of the Revolution. Rousseau's *Émile* and *Nouvelle Héloïse* and Goethe's *Werther* brought sentimentality into fashion; women's hair was dressed in *bandeaux d'amour* or *poufs de sentiment;* and Marie Antoinette and the

1 2 3 4 5 6 7

1, Flemish (1341); 2, French (1410); 3, German (1530); 4, Spanish (1580); 5, French (1590); 6, 7, Beginning of 17th century.

ladies of her court sought to return to the simplicity of nature by masquerading in the Trianon attired as shepherdesses and milkmaids. The works of Montesquieu and Voltaire had created an admiration for England, and the courtiers of Versailles dressed themselves like English foxhunting squires, while their wives and daughters got themselves up *à l'Anglaise* in coats with cuffs, collars, and facings, beaver-hats, and cravats. As the political turmoil increased, fashionable attire grew more and more eccentric and multiform, till at last republican institutions triumphed, and the women of France began to clothe themselves as like as possible those of Greece and Rome both in style and scantiness. They discarded costly materials, and shivered through the winter months clad in a few yards of muslin. Men wore a combination of antique and romantic costume invented by the painter David, which was finished off with Hungarian boots. The gorgeous and stately dress of the courts of Louis

8 9 10 11 12

8, Louis XIV. and his Queen (1670); 9, (1740); 10, Prussian court-dress (1780); 11, À la Grecque (1800); 12, (1804).

XIV. and Louis XV. had disappeared with the old régime. At the present time the fashions for women in all civilised countries are set by Paris; for men, though not so exclusively, by London.

One marked feature of the ever-changing kaleidoscope of fashion is its tendency to revolve in cycles. The widely-distended skirts of the 16th century reappear in the 18th and 19th centuries after periods of straight-falling folds; the piles of false hair, artificial flowers, feathers, and jewelry which reached their greatest height on ladies' heads about 1780 had their modified counterpart in the chignon; men's nether garments are by turns skin-tight or loose and full; and the voluminous folds of muslin in which they swathed their necks at the beginning of the 19th century recall in some degree the ruffs of Queen Elizabeth's courtiers. Cycles of alternate luxury and simplicity have also distinguished all ages, though the simplicity of fashion is often more apparent than real. There can be little doubt that fashions change more quickly each decade, a fact due in great measure to increased facilities of communication, while the triumph of

democracy is shown by their universal adoption by all classes. The question cannot but arise whether in this continual variation the most advantageous and artistic costumes for men and women may not at last be found and kept, but the probabilities seem to be against such a conclusion. Lotze in his *Microcosmus* starts the theory that we prolong the consciousness of our personal existence into any foreign body brought into relationship with the surfaces of our own body, so that we feel ourselves grow taller with our high headgear, move with our fluttering laces and ribbons, and derive vigour from the feeling of resistance arising from a tight band or belt. At the same time it is generally allowed that we are more alive to a new sensation than to one which has been long in the field of consciousness, for, from the very fact that it is unusual, our attention is continually directed to it, while a well-known sensation loses its first intensity and the power of directing our thoughts to itself. In order, therefore, that our clothes may yield us the maximum of pleasant feeling which Lotze says we derive from them, they must not be too familiar in shape, colour, and cut—i.e. we must not only have new clothes, but new styles of clothes. But a volume would be required to determine whether this theory satisfactorily accounts for all the changes of fashion.

See Fairholt, *Costume in England* (new ed. 1885); Planché, *Cyclopædia of Costume* (1876–79); Challamel, *History of Fashion in France* (Eng. trans. 1882); Herbert Spencer's *Ceremonial Institutions* (1879); Robida, *Nos Aïeules* (trans. as *Ten Centuries of Toilet*, by Mrs Cashel Hoey, 1892); Georgiana Hill, *A History of English Dress* (1893); and the articles CRINOLINE, HAT, &c.

Fashoda, renamed KODOK, a Shilluk town, on an island in the White Nile, 60 miles below the mouth of the Sobat. Its occupation by the French for a few months in 1898 aroused hostile feeling in Britain.

Fast (a word common to the Teutonic tongues, which Grimm derives from a root signifying primarily to hold, keep, observe, and hence to restrain one's self; Lat. *jejunium*, Gr. *nēsteia*, Heb. *tsom*) is the word used to express a certain self-imposed restraint with respect to the nourishment of the body. The abstinence enforced may be either partial, when the restriction is confined to certain articles of food, or total, when all sustenance is dispensed with for a specified time. The origin of the custom seems to be coeval with man's first experience of the salutary influence which abstinence exercises on the health, and with his more or less instinctive consciousness of the necessity of retaining the body in due subjection to the soul. By degrees, the self-mortification which it implied raised it into a sacrifice offered to the Deity; it became a religious observance, was surrounded with rites and ceremonies, and finally bore the stamp of a divine law. Climate, the habits of a people, and their creed gave it at different periods different characteristics; but it may be pronounced to have been a recognised institution with all the more civilised nations, especially those of Asia, throughout all historic times. We find it in high estimation among the ancient Persians of Iran. It formed a prominent feature in the ceremonies of the Mysteries of Mithras, and found its way, together with these, over Armenia and Asia Minor, to Palestine, and northward to the wilds of Scythia. The ancient Hindus, in accordance with their primeval view—which they held in common with the Parsees—of heaven and hell, salvation and damnation, of the transmigration of the soul, and of the body as the temporary prison of a fallen spirit, carried fasting to an unnatural excess. Egypt seems to have had few or no compulsory general fasts; but it is established beyond doubt that for the initiation into the mysteries of Isis and Osiris temporary abstinence was rigorously enforced. (For Buddhist usages, see BUDDHISM.) That Greece observed and gave a high place to occasional fast-days, such as the third day of the festival of the Eleusinian mysteries, and that, for instance, those who came to consult the oracle of Trophonius had to abstain from food for twenty-four hours, is well known. It need hardly be added that the Romans did not omit so important an element of the festivals and ceremonies which they adopted from their neighbours, though with them the periods of fasting were of less frequent recurrence.

As to the Semitic races, although we find the people of Nineveh undergoing occasional fasts, to which even animals were made to conform, yet the Mosaic law set apart one day only in the whole year for the purpose of fasting. The 10th day of the seventh month (Tishri), called 'the Day of Atonement' (Yom Kippur), or, as the holiest of the whole year, 'the Sabbath of Sabbaths,' was ordained for 'the chastening of the *Nephesh*,' which the traditional law explains as meaning the strictest and most rigorous abstinence from all food or drink, as also from washing, anointing, the putting on of sandals, &c., from the sunset of the ninth to the appearance of three stars on the evening of the tenth day. In process of time, five days of compulsory fasting were added, in commemoration of certain days of humiliation and national misfortune—viz. the 17th of the fourth month (Tamus), as the anniversary of the taking of Jerusalem both by Nebuchadnezzar and Titus; the 3d of the seventh month (Tishri), when Ishmael had killed Gedaliah, the Jewish governor appointed by the Babylonians; the 10th of the tenth month (Tebeth), in remembrance of the siege of Nebuchadnezzar; the 13th of the twelfth month (Adar), the fast of Esther, and the day most rigorously kept next to the great Day of Atonement; and the 9th of the fifth month (Ab), the anniversary of the destruction of the first temple by Nebuchadnezzar and of the second by Titus. The community loved to express their penitence for sin, or their grief on the death of great men, by occasional fastings, which were also considered an efficient means of averting the divine wrath, of insuring victory over an enemy, or of bringing down rain from heaven. Besides, fasting was not unfrequently resorted to by those who wished to free their minds from all hindrances to meditation, as in the forty days of Moses (Exod. xxxiv. 28), or the fast of Daniel. In later times, when, after the destruction of the temple, sacrifices had ceased, fasting, as causing a decrease in the flesh and fat of the individual, was considered to be in some degree a substitute for the animal which had formerly been offered up by the priest. From a means to repentance and inward purification, it became an end and a virtue in itself, an abuse, indeed, neither unknown nor undenounced even in the days of the prophets. Many new fasts were superadded from time to time, but they soon fell into oblivion; and over and above the six already mentioned but few entire days are now observed by the orthodox, and these merely of a local character. Fasting, with the Jews, always implies entire abstinence, and lasts, except on the Day of Atonement and the 9th of Ab—when the sunset of the previous evening is the sign for its commencement—from the break of the day to the appearance of the first three stars. Sackcloth and ashes, the garb of the penitent in ancient times, are no longer worn; but the deepest mourning is visibly expressed by many ceremonies in the Jewish synagogues and homes on the 9th of Ab. Several half-days of fasting have also survived. The individual is bound

to celebrate by fasting the anniversary of the death of his parents, his own wedding-day until the performance of the marriage-ceremony, and the birth of his first-born male child (up to its thirteenth year, when the duty falls upon the latter himself), and on the day preceding the Pesach (Pascha), in commemoration of the sparing of the Israelite first-born in Egypt. The Sabbath causes the postponement of any fast—that of the Day of Atonement and the Fast of Esther excepted—which happens to coincide with it; and children—girls up to their twelfth, boys to their thirteenth year—women with child, and the sick are exempted from the observance.

In the time of Christ, fasting, as we have seen, was held in high estimation. The Mondays and Thursdays—the market-days, on which the judges sat, and the law was read in the synagogues—were especially set aside for this purpose by the Pharisees. The Essenes fasted even more frequently. The Sadducees alone took exception to this rite, and were therefore considered ungodly. Christ himself neither approved nor disapproved of the custom, but, as in all matters of ceremony, allowed his disciples, Jews and Gentiles, to act according or contrary to their old habits. He is distinctly against such a *commandment*, and even excuses those who did not fast; his own abstinence from food for forty days was like that of Moses, entirely an individual act. Roman Catholics maintain that all the words of our Lord, which to Protestants appear to discountenance the obligation of fasting, are directed exclusively against the ostentatious and self-reliant fasts of the Pharisees. They even understand the language which he used in condemning the practice of the Pharisee fasters as containing a direct exhortation to his own disciples—not that they should abstain from fasting, but that they should fast with suitable dispositions. They hold, moreover, that in exempting his disciples from fasting he had regard only to the actual time of his own presence among them. It was incongruous, he said, that the children of the marriage should fast as long as the bridegroom was with them; but, he added, 'the days will come when the bridegroom shall be taken away from them, *and then shall they fast in those days*' (Mark, ii. 20; Matt. ix. 15). Hence they infer that from the time of our Lord's ascension the practice of fasting became obligatory on his disciples, the temporary cause of the exemption hitherto existing having ceased.

During the first centuries of Christianity voluntary fasts were frequent enough; and fasts were considered a befitting preparation for holy acts and feasts, for ordination and baptism. An annual fast generally observed by all from a very early date was that of the forty hours, from Friday afternoon to Sunday morning, during which Christ lay in the sepulchre. But during the first six centuries the difference in the various Christian communities in this matter was very great. The Montanist heretics were especially rigorous in their fasts. Bishops and councils gradually fixed the times and seasons for the whole of Christendom. The forty hours had gradually become forty days, called the *Quadragesima;* and the Council of Orleans in 541 made it binding upon every Christian not to eat any meat during this time, save only on the Sundays. The eighth council at Toledo in the 7th century declared those who ate meat during Lent sinners unworthy to partake in the resurrection. From the 8th century to the 11th, when a gradual reaction set in, the laws of fasting and the punishments awarded to the transgressors became stricter and stricter; interdict and excommunication were among the penalties. By degrees fasts had become so numerous and different in kind that they were divided into—(1) *Jejunium generale* (a fast binding for all); (2) *Consuetudinarium* (local fast, &c.); (3) *Penitentiale* (atonement for all transgressions); (4) *Votivum* (consequent upon a vow); (5) *Voluntare* (for the better carrying out of an undertaking). These, again, were kept as either (1) *Jejunium naturale* (an entire abstinence from food or drink, especially in preparation for the reception of the Eucharist); (2) *Abstinentia* (certain food only being allowed, but several times a day); (3) *Jejunium cum abstinentia* (the same food, which must be taken once a day only); or (4) *Jejunium sine abstinentia* (all kinds of food, but only once a day). The food prohibited on partial fast-days included, during certain periods, not only the flesh of quadrupeds, fowl, and fish, but also the 'lacticinia'—i.e. all that comes from quadruped and bird, as butter, eggs, milk, &c.

Fasts gradually developed in the Roman Church into—(1) Weekly fasts, of which Friday, as the day of the crucifixion, seems to have been early and generally observed. To this was added the Wednesday, as the day on which the death of Christ was resolved upon. At a synod in Spain in the beginning of the 4th century the Saturday was superadded; but this innovation met with great opposition, especially in the East. (2) Vigils, originally night-services observed by the first Christians on the eve of Sundays and festivals, partly in imitation of the Jewish custom of celebrating the entrance of the Sabbath and of festivals on the evening of the previous day, and partly from fear of the danger to which a service in the daytime would have exposed the early converts. Although these night-services became unnecessary in the course of time, they were still continued up to the 4th century, when, owing to the abuses to which they led, they were abolished, or rather transformed into fast-days, kept on the eve of great festivals in honour of Christ, the Virgin, Saints, and Apostles. (3) The great or forty days' fast (Quadragesimal fast), the most important and most rigorously enforced of all. The forty hours of fast, in commemoration of the forty hours during which Christ's body lay in the tomb, gradually expanded to forty days, as mentioned before, in pious allusion to the forty days of Moses, Elijah, Christ, the forty years' sojourn in the desert, or the forty camps—all considered typical; and the fasting became severer the nearer Passion-week itself approached, in which many other signs of mourning and contrition were generally exhibited. (4) The Quatember fasts on the Wednesdays, Fridays, and Saturdays in one week of each season, in imitation of the four Jewish fasts in the fourth, fifth, seventh, and tenth months.—There were still many other fasts, such as those of ordination, &c., but these had only a temporary existence, and do not fall to be treated here. Nor can we enter into the various dispensations granted by the church, or the special pastoral letters generally issued before Quadragesima, nor into the variations in the observance of fasts and fasting in our own days; we can only add that they have in a great measure lost their former severity, and that only partial abstinence is the rule in all cases. More must not be taken than one full meal, and that not before mid-day, nor consisting of flesh meat. Besides this a *collation* of about eight ounces of fruit, vegetables, bread, or small fishes may be taken. The modern meaning of this word was originally due to the slight refreshment in the ancient monastic discipline, taken just before the reading of the 'collations'—i.e. conferences (of Cassian) and such other works. In spite of its diminution of the former severity in the practice of fasting, the

opinion of the church held in former days, that fasting is meritorious and conducive to the salvation of the soul, has undergone no change.

In the Greek Church fasting was and is kept with much greater severity, the non-observance of it being the least venial of sins. The days here extend over almost three-quarters of the year. The principal ones are the Wednesdays and Fridays—with a few exceptions—throughout the whole year; the great Easter fast lasting forty-eight days; that of Christmas, thirty-nine days; that in honour of the Virgin, fourteen days; and that of the Apostles, beginning on Monday after Trinity, and extending to the 29th of June. Besides those smaller fasts of preparation, which correspond to the vigils of the Roman Church, they have many more occasional fasts, which we, however, must omit here.

The Church of England considers fasting a praiseworthy but by no means obligatory custom. Hook, in his *Church Dictionary*, explains the distinction between the Protestant and the Roman Catholic view of fasting as consisting in this, that the Roman Catholic regards the use of fasting as an imperative means of grace, the Protestant only as a useful exercise preparatory for the means of grace. In proof how much the Church of England has left the question of fasting to the conscience and discretion of her members, it may be observed that she has neither defined the mode or degree of fasting, nor anywhere given a positive command to fast. The days named by the English Church as seasons of fasting or abstinence are the forty days of Lent (q.v.), including Ash-Wednesday and Good Friday; the Ember (q.v.) days; the three Rogation (q.v.) days; all the Fridays in the year (unless Christmas Day fall on one); and the eves or vigils of certain festivals.

The sacramental *fast-days* so long observed in Scotland are now fallen into disuse. They were already completely discontinued in Glasgow in 1886, and in Edinburgh in 1887. The Scottish fast-day was instituted as a day for 'fasting, humiliation, and prayer,' and always fell upon some day of the week preceding the yearly or half-yearly *Communion Sunday*, or Sunday set apart in the Presbyterian churches for the dispensation of the Lord's Supper. It was observed exactly as a Sunday, with sermons in the churches and the complete cessation of business.

In the United Kingdom, on occasion of wars and public calamities, the sovereign has from time to time appointed by proclamation a day for a solemn national fast, humiliation, and prayer—as on 21st March 1855 (the Crimean war), and 7th October 1857 (the Indian Mutiny).

A few words remain to be said of the Mohammedan fasts. Islam, as an offspring of Judaism and Christianity, adopted this custom with many others from both churches. During the whole month of Ramadan, in which the Prophet brought the Koran from heaven, eating, drinking, smoking, smelling perfumes, &c. are strictly forbidden from daybreak till sunset; for the intervening nights, however, all these restrictions are removed. There are, besides, many voluntary fasts, expiatory like the 10th of Moharram, corresponding to the Jewish Day of Atonement, or for the averting of the divine wrath in sudden calamities, or as an indemnification for the omission of certain pious acts, as the pilgrimage, &c. See JEWS, MOHAMMEDANISM, MONACHISM, ASCETICISM.

Besides the *Bible*, *Schulchan Aruch*, *Koran*, and the Fathers generally, see Bingham, *Origenes Ecclesiasticæ*, vol. ix. (1708–22); Fabricius, *Bibliogr. Antiquaria*; Muratori, *De Quatuor Temporum Jejuniis*, &c.; Siegel, *Altchristl. Alterthümer*; Walch, *De Jejunio Quadragesimali* (1727); Robert Nelson, *Festivals and Fasts of the Church*; Liesmayr, *Die Entwickelung der Christlichen Fastendisziplin* (1877); and Thurston, *Lent and Holy Week* (1906).

FASTING.—By this term is meant the deprivation of food—the materials by which loss of matter and energy from the body is made good.

Food-stuffs may be divided into (1) water, (2) solid food-stuffs.

When water is withheld death occurs in the course of a few days. For the protoplasm of the tissues to undergo the chemical changes upon which its vitality depends, a certain proportion of water is essential, and when this is not present death ensues through the cessation of these changes.

It is more especially to the deprivation of *solid food* that the term *Fasting* is applied. The physiology of this condition has been most carefully studied in dogs, cats, and other of the lower animals, while one or two observations have also been accomplished in cases of voluntary fasts in man.

To understand the condition, it must be remembered that the energy required in the body is under normal conditions supplied by the various organic food-stuffs, which, entering the body in the condition of large and complex chemical molecules, are oxidised and excreted as simpler bodies, and by their disintegration yield energy (see the article METABOLISM). During fasting it is by the disintegration of the tissues of the body that the necessary energy is yielded. This energy is required not only for the production of mechanical work done by the body, but also for the production of heat, so that the temperature of the body may be maintained. Whenever, therefore, muscular exertion is severe, or when the individual is exposed to cold and has to produce large amounts of heat, then more energy must be forthcoming, and hence tissue waste is enormously increased. Whereas, if complete rest is maintained, and the animal is kept surrounded by air at a temperature approaching that of the body, the waste of tissue-substance is reduced to a minimum. From this it will be apparent that no conclusions of value with regard to the possible duration of life in the fasting state can be drawn from the records of those exposed to cold and hardships after shipwreck. It will be at once apparent that the amount of energy employed in maintaining the temperature of the body must be very much greater in warm-blooded than in cold-blooded animals. Indeed, in the latter class, where the temperature is at most only a few degrees above that of the surrounding atmosphere, waste of tissue for the production of heat is practically in abeyance. The same may also be said of hibernating animals, which may be regarded during their winter sleep as cold-blooded. For this reason, and because during certain periods their movements are by no means active, cold-blooded animals can endure very prolonged periods of inanition.

When we come to consider the physiology of fasting more closely, we find that the amount of waste of the various tissues of the body is by no means equal. The following figures, indicating the percentage loss of various tissues in an animal dying of starvation, are taken from Voit's article in Hermann's *Handbuch der Physiologie*:

Fatty tissue lost	97 per cent.
Muscle	31 "
Blood	27 "
Brain and spinal cord	3 "
Heart	3 "

We thus see that the more essential tissues feed upon the less essential, and that the fats of the body are the great source of nourishment during inanition. As long as a fair amount of fat remains in the body, the muscle can undergo its chemical changes, disintegrating and yielding energy, but always again undergoing a process of reconstruction. Whenever the fat is used up we find that a

rapid disintegration of muscle-substance without reconstruction occurs, and death rapidly ensues. The onset of this condition is indicated by a rise in the excretion of nitrogen in the Urine (q.v.).

In regard to the symptoms observed during starvation little need be said, since in most cases they are due rather to the conditions which have led to or which accompany the fast. The sensation of hunger is a prominent symptom during the earlier days, but appears to diminish. Emaciation is, of course, invariable—the skin feeling harsh and dry from the loss of subcutaneous fat. The temperature falls below the normal, and lassitude and finally torpor supervenes before death, which appears to occur simply from asthenia. See *A Study of Prolonged Fasting*, by Francis Gano Benedict (Washington, D.C., published by the Carnegie Institution of Washington, 1915).

Fast and Loose, the name of a cheating game, also called *Pricking at the Belt*, which appears to have been much practised by the Gypsies in the time of Shakespeare. The following is Brand's description: 'A leathern belt is made up into a number of intricate folds, and placed edgewise upon a table. One of the folds is made to resemble the middle of a girdle, so that whoever shall thrust a skewer into it would think he held it fast to the table; whereas, when he has so done, the person with whom he plays may take hold of both ends, and draw it away.' The game is still practised at fairs, races, and similar meetings under the name of *Prick the Garter;* the original name, in the phrase 'to play *fast and loose*,' has gone into the language to designate the conduct of those whose easy ethics do not forbid them to say one thing and do another. See Book XIII. chap. xxix. of Reginald Scot, *The Discouerie of Witchcraft* (1584).

Fasten's E'en. See SHROVETIDE.

Fasti (Lat. *Dies fasti*), those days among the ancient Romans on which it was lawful to transact legal or public business, in opposition to *nefasti*, on which it was not permitted. But the sacred books, in which the lawful days of the year were marked, were themselves denominated *fasti*, and the term was employed, in an extended sense, to signify various kinds of registers, especially the *Fasti Sacri* or Kalendares, and the *Fasti Annales* or Historici.

The *Fasti Kalendares* or calendars of the year were kept exclusively by the priests for about four centuries and a half after the building of the city. The appearance of the new moon was proclaimed by a pontifex, who at the same time announced to the people the time which would intervene between the Kalends and the Nones. On the Nones the country-people assembled for the purpose of learning from the Rex Sacrorum the various festivals of the month, and the days on which they would fall. In the same way those who intended to go to law learned on what days it would be right (*fas*) to do so. The mystery with which this lore was surrounded, for purposes of power and profit, by the favoured class was dispelled by Cn. Flavius, the scribe of App. Claudius Cæcus, who surreptitiously copied from the pontifical book the requisite information, and published it to the people in the forum. Consequently time-tables (*fasti*) became common, very much resembling modern almanacs. They contained the days and months of the year, the Nones, Ides, lawful and unlawful days, &c., astronomical observations on the rising and setting of the fixed stars, the commencement of the seasons, brief notices concerning the introduction and signification of certain rites, the dedication of temples, the dates of victories, disasters, and the like. In later times the exploits and honours of the imperial family were duly entered in the calendar. The celebrated *Fasti* of Ovid is a sort of poetical year-book or companion to the almanac, as arranged by Julius Cæsar, who remodelled the Roman year.

Several very curious specimens of fasti on stone and marble have been discovered, of which the most remarkable are the *Kalendarium Maffeianum* (so called from its first possessor), upon almost all the days of the year; the *Kalendarium Prænestinum* of Verrius Flaccus, discovered in 1770 at Prænestе, containing the months January to April and December; the *Kalendarium Vaticinum* (March, April, August), *Venusinum* (May, June), *Esquilinum* (May and June), and *Farnesianum* (February and March). These are printed in vol. i. of Mommsen's *Corpus Inscriptionum Latinarum* (Berlin, 1863), in which the Roman calendar for almost the complete year is elucidated.

The *Fasti Annales* or *Historici* were chronicles containing the names of the consuls and other magistrates of the year, and an enumeration of the most remarkable events in the history of Rome, noted down opposite the days on which they occurred. From its application to these chronicles the word fasti came to be used by the poets as synonymous with historical records. Of these, fragments have come down to us, of which the most important are the so-called *Fasti Capitolini*, discovered in the neighbourhood of the ancient forum in the 16th and 19th centuries. See CALENDAR; also Boor, *Die Fasti Censorii* (1873), and Wehrmann, *Die Fasti Prætorii* (1875).

Fastnet Lighthouse, on a rock 4 miles SW. of Cape Clear, with a revolving light 158 feet above high-water. The present tower was built 1899–1904.

Fastolf, SIR JOHN, was born about 1378 at Caistor, near Yarmouth, and 'exercised,' says Caxton, 'the wars in the royaume of France and other countries for forty years enduring.' He distinguished himself at Agincourt (1415), and still more in the 'Battle of the Herrings' (1429), so called because, while convoying supplies to the English besiegers of Orleans, he formed a sort of *laager* of herring-barrels, and with his archers beat off a whole French army. Later in the same year he was less successful against Joan of Arc, and at Patay, according to Monstrelet, whom Shakespeare follows, displayed such cowardice that the Duke of Bedford stripped him of his Garter. This, however, is very questionable; he rather seems to have retained all his honours till in 1440 he came home to Norfolk, and in 1441 he was granted a pension of £20 'for notable and praiseworthy service and good counsel.' His Norfolk life is mirrored faithfully in the *Paston Letters*, where we see him adding to his broad possessions, heaping up riches, building a huge new castle at Caistor—a hard old man, yet not without love of learning and the church, who died 5th November 1459. Anything less like Shakespeare's 'Sir John Falstaff' can hardly be imagined. See Gairdner's *Paston Letters* and Duthie's *Fastolf* (1907).

Fat. See FATS, OBESITY, ADIPOSE TISSUE, OILS.

Fata Morgana, the Italian name for a striking kind of mirage observed in the Strait of Messina. A spectator on the shore sees images of men, houses, ships, &c., sometimes in the water, sometimes in the air, the same object having frequently two images, one inverted. It is so named because supposed to be caused by the fairy (*fata*) Morgana of Arthurian romance. See MIRAGE.

Fate, the Fates, Fatalism, express a conception which has more or less prevailed in all religions. The words are derived from the Latin *Fatum*, which has primarily a passive signification denoting something uttered—a decree or ordinance. The Greeks expressed the same thought by *Eimarmenē*. *Moîra*, again, was the active personification

of the idea—the goddess Fate or Destiny. It constituted in the Greek mythology something like an ultimate monotheistic element—the vague Unity binding together and dominating over the crowd of Olympian deities. With Homer, who in every instance save one speaks of Fate (Moira) in the singular, Fate was not a deity, but a mere personification, the destinies of men being made by him to depend upon the will of the gods; whilst, according to the later Greeks and the Romans, the gods themselves were subject to the control of the *Moirai* or *Parcæ*. Hesiod, however, who is almost contemporary with Homer, speaks of three Fates, whom he calls daughters of Night—Clotho, the spinner of the thread of life; Lachesis, who determines the lot of life; and Atropos, the inevitable. They were usually represented as young women of serious aspect; Clotho with a spindle, Lachesis pointing with a staff to the horoscope of man on a globe, and Atropos with a pair of scales, or sun-dial, or an instrument to cut the thread of life. In the oldest representations of them, however, they appear as matrons, with staffs or sceptres. They had places consecrated to them throughout all Greece, at Corinth, Sparta, Thebes, Olympia, and elsewhere.

With the course of Greek thought the conception of Fate became more spiritualised. In Æschylus it is an inexorable Destiny; in Sophocles and Plato it is more of a free and ordering Will. In the later forms of Greco-Roman speculation, again, it undergoes various modifications. With the Epicureans it seems identical with Chance (*Tuchē*); with the Stoics it is the very opposite of this. In the one case the Absolute is a mere blind fatality; in the other case it is an imminent necessity of reason, governing with iron sway the apparently accidental phenomena of life.

In the two great religions of modern times, Christianity and Mohammedanism, the same conception is found in various forms. In the latter the Highest seems to be conceived as inexorable law, swallowing up every lower law of activity; yet the abject self-subjection to fate generally understood to be implied in the Moslem *Kismet* is by no means inculcated in the Koran (see MOHAMMED). In Christianity and the modern speculation which it has coloured it shows itself less broadly in the well-known doctrines of Predestination and of philosophical Necessity. In the Predestination theory of Augustine, Calvin, and many others, the old fatalistic doctrine is repudiated; the recognition of a free determining element in the divine Will separates their idea of it altogether from that of a mere blind Destiny; but the influence of the mode of thought out of which the old idea sprung appears in the manner in which the divine decrees are sometimes spoken of as inexorably overbearing human freedom. In the doctrine of philosophical necessity promulgated by Leibniz and Edwards, and in a somewhat different form by modern scientific modes of thought, the same idea emerges as inevitable sequence—of an invariable connection linking together all phenomena, material and mental. An immutable law is declared to pervade and harmonise all existence. This is a much higher conception, but is obviously not wholly unrelated to the old pagan doctrine of Fate. See PREDESTINATION, WILL.

Fatehganj ('Victory Market'), the name of two villages and battlefields in Bareilly district, in the United Provinces. (1) EAST FATEHGANJ, 23 miles SE. of Bareilly, was founded by the Nawáb of Oudh to commemorate the British victory over the Rohillas (1774), which gave him possession of a large part of Rohilkhand.—(2) WEST FATEHGANJ, about 35 miles NW. of the former, was the scene of another victory over the Rohillas in 1794. There is a monument over the grave of the Company's troops, and a carved and minareted tomb holds the remains of two Rohilla chieftains.

Fatehgarh, the cantonment and administrative headquarters of Farukhabad district, lies 3 miles E. of the native city of Farukhabad, with which it forms a joint municipality. Government has here an important gun-carriage factory; and there are flourishing settlements of native Christians, established by the American Presbyterian Mission, which was formed in 1838. A British military station since 1802, the place was attacked by Holkar in 1804, and is infamous in the annals of the mutiny of 1857, in the course of which upwards of 200 Europeans—men, women, and children—mostly fugitives brought back after escaping down the Ganges, were sabred or shot, either here or at Cawnpore. Pop., with Farukhabad, 60,000.

Fatehpur, (1) capital of a district in the United Provinces, on the East Indian Railway, 70 miles NW. of Allahabad. It contains two interesting mosques, and has a trade in hides, soap, and grain. Pop. 17,000. The *district* of Fatehpur lies wholly within the Doab (q.v.), and occupies its entire breadth from Jumna to Ganges. Area, 1642 sq. m., more than half of which is highly cultivated; pop. (1911) 676,939, nearly nine-tenths Hindus.—(2) A fortified town of Rajputana, 145 miles NW. of Jaipur; pop. 17,300.

Fatehpur Sikri, a former capital of the Mogul empire, was founded by Akbar in 1570, but soon after abandoned for Agra, 23 miles to the east. The remains of the magnificent architectural works with which he and his son enriched it are enclosed by a high stone wall, about 5 miles in circuit, and include several palaces, a noble mosque, and numerous other splendid ruins. Within the bounds of Akbar's wall are the modern town and the village of Sikri, with insignificant manufactures of carpets and millstones. Pop. 6000.

Fat-hen. See CHENOPODIUM, ORACHE.

Father. See PARENT AND CHILD, FAMILY, INFANT.

Father-lasher, a name applied to two Bullheads (*Cottus scorpius* and *bubalis*) which occur commonly on British coasts. They have a wide European and American distribution, and belong to the Gurnard (q.v.) family (Cottidæ), in the spiny-rayed (Acanthopteri) order of bony fishes. They are both somewhat forbidding little fishes, four or five inches in length, with dark, quaintly mottled skins, and with spines on the head. The head and pectoral fins are large in proportion to the body. The male builds a nest and guards the young. In Scotland the second species is sometimes called the Lucky Proach, while the first species is also known as the Sea Scorpion. Both forms, but

Father-lasher (*Cottus bubalis*).

especially the first, are often left on the shore or among the rocks by the retiring tide.

Fathers of the Church (*Patres Ecclesiastici*), a term which, strictly used, denotes only certain early writers of unimpeachable orthodoxy and eminent sanctity, who have been accepted by the church as duly qualified exponents of her doctrines. The title of 'father' was given in early times to all bishops, confessors, and heads of monasteries (see ABBOT); but the expression 'fathers of the church' has become restricted to this more definite sense, while those writers whose heterodoxy is manifest are called simply *Scriptores Ecclesiastici* ('Church-writers'). The title of 'fathers,' however, is often bestowed on some, such as Origen and Tertullian, the errors in whose writings are overlooked for the sake of the value of their orthodox contents. Historians are generally agreed in excluding from the patristic period the Apostolic Fathers (q.v.), and in dating its commencement from the 2d century; but there is no unanimity regarding the time at which it may be said to have closed. In the Greek Church the period is often brought down to the Council of Florence (1441). Roman Catholic writers include within its limits all writers who were witnesses to the Catholic doctrine of the church during the first twelve centuries of the Christian era, or even down to the Council of Trent; moreover, in 1871–78 Saints Alfonso de Liguori and Francis de Sales, the former of whom died so late as 1787, were raised to the dignity of *Doctores Ecclesiæ*. But there appears no good reason why Anselm and Bernard and those that immediately follow them should be removed from the list of the schoolmen, and the patristic period may conveniently be taken to have closed for the Eastern Church with John of Damascus (756), and for the Western with Gregory the Great (604). Even Roman Catholic theologians acknowledge the higher value and importance of the fathers of the first six centuries. Arranged in the order of their deaths, chief among the ante-Nicene fathers are Justin Martyr, Irenæus, Clement of Alexandria, Tertullian, Origen, Cyprian, and Gregory Thaumaturgus; while the post-Nicene fathers include Eusebius of Cæsarea, Hilary of Poitiers, Athanasius, Basil, Cyril of Jerusalem, Gregory Nazianzen, Gregory of Nyssa, Ambrose, Epiphanius, Chrysostom, Jerome, Augustine, Cyril of Alexandria, Leo the Great, Gregory the Great, and John of Damascus. For all these, see separate articles, as well as for many of the other early writers whom the Latin Church includes in the list. In both divisions of the church four authors are recognised as fathers *per eminentiam*: in the East, Athanasius, Basil, Chrysostom, Gregory Nazianzen; in the West, Ambrose, Jerome, Augustine, Gregory. The study of the life and writings of the fathers is sometimes regarded as constituting a distinct discipline, known as patristics or patrology; but this practically constitutes a study of the church's history during the first six centuries. See CHURCH HISTORY. With respect to the authority of the fathers, the Roman Catholic position is that the teaching of individual fathers is to be accepted or rejected on its merits, and their evidence as witnesses to the tradition of the church, either singly or when several concur, is to receive so much credence as may appear due after the quality and circumstances of the testimony have been considered; but their morally unanimous consent is held to carry decisive authority in matters of faith. Protestant writers, on the other hand, while acknowledging the merits of the patristic writings, and recognising in many important points a *consensus patrum*, dwell upon the admitted fallibility of the authors, and insist upon the sufficiency of Holy Scripture, as containing 'all things necessary to salvation.' See EXEGESIS; also INFALLIBILITY.

Editions of individual fathers are noted under their separate articles. Collective editions are De la Bigne's *Maxima bibliotheca veterum Patrum* (Paris, 1575; improved ed. 27 vols. Leyden, 1677—the Greek writings translated into Latin); Gallandi's *Bibliotheca veterum Patrum* (14 vols. Venice, 1765–81); and Migne's exhaustive *Patrologiæ cursus completus* (387 vols. Paris, 1844–66). This last is continued in Horoy's *Medii ævi bibliotheca patristica, sive Patrologia ab anno 1216 usque ad concil. Tridentinum* (1st series, *Doctores eccl. lat.*, Paris, 1879 *et seq.*). Also the Vienna Academy has been issuing since 1866 a *Corpus scriptorum ecclesiasticorum latinorum*, based on a critical comparison of MSS., to be completed in about 100 volumes. English translations are numerous. Clark's *Ante-Nicene Library* (Edin. 1864–71) is complete in 24 vols., and the *Library of the Fathers* (Lond. 1838–85), edited by Pusey, Keble, Newman, and others, extends to 48 vols. There is a *Select Library of the Nicene and post-Nicene Fathers* (New York), edited by Dr Schaff; and there is a series of *Fathers for English Readers* (S.P.C.K., 11 vols. 1878–84). See Farrar's *Lives of the Fathers* (1889), Bright's *Age of the Fathers* (1903), Swete's *Patristic Study* (1904), and Labriolle's *Littérature Latine Chrétienne* (1922).

Fathom, a measure of six feet, principally used in reference to marine soundings, and in mines. Originally a fathom (O.E. *fæðm*) was taken as the width to which the two outstretched arms extended.

Fatimides, or FATIMITES, an Arab dynasty, descended from Ali and Fatima, daughter of Mohammed, ruled over Egypt and North Africa (969–1171), and later over Syria and Palestine. In religion the Fatimides were Shiites of the Ismailian sect. The Fatimide khalif Hakem was the founder of the Druses (q.v.). Compare also KHALIF, EGYPT, ISMAÎLÎS.

Fats are natural oils which occur in plants and animals. They are all *esters* of the triatomic alcohol glycerol, $C_3H_5(OH)_3$, formed by the replacement of the hydrogen of the hydroxyls by the radicles of the fatty acids.

The most abundant fatty acids of the body are—

Saturated	Palmitic Acid	$C_{15}H_{31}COOH$
	Stearic Acid	$C_{17}H_{35}COOH$
Unsaturated	Oleic Acid	$C_{17}H_{33}COOH$

The unsaturated acids are more readily oxidised than the saturated.

The fats of these acids are—

Palmitin	$C_{51}H_{98}O_6$
Stearin	$C_{57}H_{110}O_6$
Olein	$C_{57}H_{104}O_6$

In addition to these, small quantities of the neutral fats of butyric, caproic, caprylic, capric, and myristic acids occur in milk and butter. They are oily bodies; some solid, others fluid, at the ordinary temperature. They are insoluble in water, soluble in hot alcohol, in ether, chloroform, &c. Under the action of caustic alkalies or superheated steam they are decomposed into their fatty acid and glycerin. The fat of different animals differs in its characters according to the relative proportion of these various fats which it contains. Thus, the fat of the dog, which contains a large proportion of olein, melts at a comparatively low temperature, while the fat of the sheep, on the other hand, which is particularly rich in stearin, has a much higher melting-point.

Whatever be the nature of the fat, it occurs in the animal body inside the living units or cells in the form of small globules. Fats appear to be an almost invariable constituent of all living protoplasm; but in certain tissues they accumulate in very large amounts. This is especially the case in the cells of loose fibrous tissue, where the deposition of fat is frequently so great as to form regular

masses or lobules. Under the skin, in the abdomen, in the orbits, round the heart, and in various other places these masses are well marked.

The quantity of fat in the human body varies considerably at different periods of life. In the earlier stages of fœtal existence we find scarcely any fat; in new-born children there is usually a considerable quantity of this substance deposited under the skin, and the organism continues rich in fat till the age of puberty, when a marked diminution of the substance occurs. It again increases about middle life, and then occasionally occurs in great excess; for example, three or four inches of fat are not unfrequently found under the skin of the abdomen in corpulent persons.

It has now been clearly shown that an animal takes up and stores in its body any fat which may be administered in the food, and that it may thus for the time being have the chemical nature of its fat materially altered. After a time, however, the living protoplasm of the body seems to be able to convert the foreign fat so stored into the proper fat of the animal.

That carbohydrates—such as sugar and starch—are also sources of fat is a matter of popular belief. Various researches have clearly demonstrated that this belief is correct. By feeding young growing pigs on a diet of known composition, and afterwards killing them and analysing their bodies, it was shown that the fat found was in such amounts that it could have been derived only from the carbohydrates of the food.

The physiological value of the fats is due partly to their physical and partly to their chemical characters. The uses of the fat deposited beneath the skin are, first, to protect the body from external shocks by a uniform diffusion of pressure through the whole adipose tissue; and, secondly, to keep up the heat of the body, by materially checking, through its very slight conducting power, the loss of free heat by radiation. This use of the fat is most clearly seen in some of the lower animals (the seal, whale, &c.), which are exposed to very low temperatures.

The chief chemical use of fat is as a store of potential energy for the body (see FASTING). On account of the large amount of carbon and the small amount of oxygen contained in the molecule, it is peculiarly valuable in this respect. Measuring the potential energy, as is usually done in calories, 1 gramme of fat yields 9·3 calories, while in the body 1 gramme of protein and 1 gramme of carbohydrate each yield 4·1 calories. See also OILS, OBESITY, ADIPOSE TISSUE.

Fatty Acids. See OILS.

Fatty Degeneration. See HEART, LIVER.

Fatuity. See IDIOCY, INSANITY.

Faucher, LÉON, a French publicist and statesman, was born at Limoges, 8th September 1803. He studied at first philology and archæology, but about the period of the July revolution (1830) betook himself to journalism and political economy. From 1830 to 1842 he was successively editor of the *Temps*, the *Constitutionnel*, and the *Courrier Français*. In 1843 he began to write for the *Revue des Deux Mondes* a series of articles on the industrial condition of England, collected in two volumes in 1845 under the title of *Études sur l'Angleterre*. After the revolution of 1848 he sat in the Constituent and Legislative Assemblies for the department of Maine. When Louis Napoleon was chosen president, Faucher became first minister of Public Works, and subsequently minister of the Interior; but, when the president proposed to appeal to universal suffrage, Faucher gave in his resignation, and withdrew from political life. He died at Marseilles, 14th December 1854. Several of his most valuable contributions to politics are printed in *Économistes et Publicistes Contemporains*, and in the *Bibliothèque des Sciences Morales et Politiques*.

Faucit, HELEN. See MARTIN, LADY.

Fault, or DISLOCATION, a term used in Geology to characterise certain displacements common among rocks. Rocks have been fractured and displaced, or shifted along the line of breakage. Such faults may occur with or without distortion of the fractured rock-masses. Sometimes the fissure is smooth and close. In other cases the rocks are jumbled and shattered along the line of dislocation, and the fissure (sometimes several yards in width) is often filled with a breccia of blocks and debris forming what is termed *fault-rock*. The opposite walls of a fault are not infrequently smoothed, polished, and marked with rectilinear striæ, which are called Slickensides (q.v.), and similar markings frequently occur on the faces of the joints that invariably abound in rocks in the neighbourhood of faults. Dislocations are rarely quite vertical, their inclination from the vertical being called their *hade*. The diagram shows one of the simplest kinds of fault. The amount of vertical displacement of the beds is the *amount* of the throw, and is measured by protracting a line across the fault, from the truncated end of some particular bed, *a*, until it is reached by a perpendicular, AB, dropped from the other end of the selected stratum. All normal faults hade in the direction of downthrow, so that when a miner meets a dislocation, he has only to look at the hade to ascertain at once whether he must seek for

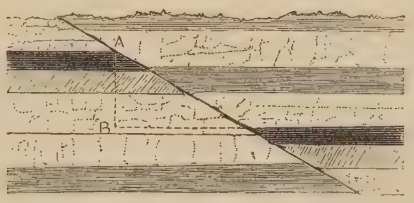


Diagram of Dislocated Strata.

the continuation of the displaced seam at a higher or lower level. Thus, if he happened to work the coal-seam, *a*, shown in the diagram, up to the dislocation at A, he would see from the hade of the fault that the missing seam must be sought for at a lower level, and he would describe the fault as a downthrow or downcast; whereas, if he reached the fault from the lower level, he would call it an upthrow or upcast. There is another class of faults in which the hade is not in the direction of downthrow: these are termed *reversed* faults. They rarely occur in strata which are not highly folded and plicated, but in regions where the rocks give every evidence of great lateral crushing and squeezing, as in true mountains of elevation, they are of common occurrence. Remarkable faults of this kind have been discovered in the north-west of Scotland. The inclination from the vertical of some of these faults is very great; in fact some approach horizontality, so that the strata on the high side overlie the rocks on the lower side of the fault, like successive strata in a conformable series. One set of rocks belonging to a low horizon has been pushed horizontally over the surface of another set pertaining to a higher horizon for distances of 10 and even 20 miles. The amount of vertical displacement produced by normal faults may vary from an inch or two up to many thousand feet. Thus, the great fault between the Highlands and Lowlands of Scotland has a downthrow of not less

than 8000 feet, while the similar dislocation between the Lowlands and Southern Uplands of the same country amounts in places to 15,000 feet.

Fauna, a term employed to designate animals collectively, or those of a particular region, or of a particular geological period. Thus, we speak of the fauna of Great Britain, the recent fauna, the fossil fauna, the fauna of the Eocene period or formation, &c. The term bears the same relation to the animal kingdom that *Flora* does to the vegetable. Its derivation is from the mythological fauns, regarded as the patrons of wild animals. In the fauna of any region are included only those animals which are indigenous to it, and not those which have been introduced.

Fauns. Faunus, grandson of Saturn, was an ancient Italian king, who instructed his subjects in agriculture and the management of flocks, and was afterwards worshipped as the god of fields and of shepherds. The festival of the *Faunalia*, held on the 5th December, referred to the protection he exercised over agriculture and cattle. *Fauna* was his female complement. He was also worshipped as a prophetic divinity. As deity of the woods and of flocks and herds, he corresponds to the Greek Pan, and hence with his name became associated the attributes of the latter. The idea also arose of a plurality of Fauns, like the Greek Satyrs, who were represented with short horns, pointed ears, tails, and goats' feet, and to whom all terrifying sounds and appearances were ascribed. Readers of Hawthorne's *Marble Faun* (or *Transformation*) will remember the artistic use there made of the conception.

Fauntleroy, Henry, forger, was born in 1785, and at fifteen entered the London banking-house of Marsh, Sibbald & Co. His father had been one of the original founders, and on his death in 1807 the son became a partner, and ere long almost its sole manager. In 1824 it was discovered that the signatures of two trustees for a sum of £1000 had been forged four years before for the purpose of selling the stock, while Fauntleroy had been paying the dividends regularly ever since. Other and much larger transactions of the same nature were discovered, and Fauntleroy was put on trial (30th October) with seven separate indictments against him, the one on which the attorney-general most relied being a forged deed in his sister-in-law's name for a transfer of £5480. A paper in Fauntleroy's handwriting was produced in which he confessed to having forged powers of attorney in order to save the credit of the house. The prisoner was condemned to death. The case excited great interest, and many influential persons exerted themselves to procure a commutation of the penalty, but without success. Fauntleroy was hanged, 30th November 1824, in the presence of a vast multitude of spectators. See Griffith's *Chronicles of Newgate* (1884).

Faure, François Félix, President of the French Republic, was born in Paris, 30th January 1841, was for a time a tanner in Touraine, but became a wealthy ship-owner in Havre, and an authority on all questions concerning shipping, commerce, and the colonies. During the Franco-German war he commanded a body of volunteers, and gained the ribbon of the Legion of Honour. He entered the Assembly in 1881, served as Colonial and Commercial Minister in the cabinets of Gambetta, Jules Favre, and Tirard, and as minister of marine in that of Dupuy. A moderate republican, he was elected president of the republic on the resignation of Casimir-Périer in 1895. He died 16th February 1899.

Fauré, Gabriel Urbain, organist and composer, born 13th May 1845 at Pamiers, Ariège, was organist in various Paris churches, and director of the Conservatoire. He died 4th November 1924.

Fauriel, Claude Charles (1772–1844), was born at St Étienne, served in the army and was secretary to Fouché, but soon devoted himself entirely to letters. He put in circulation, says Renan, a greater number of ideas than any contemporary writer. After the July revolution he became a professor in the Paris Faculté des Lettres, and was elected to the Academy of Inscriptions in 1836. His earliest works were translations. In 1836 he published his chief work, *Histoire de la Gaule Méridionale* (4 vols.); the year after, an edition of the Provençal rhymed chronicle on the crusade against the Albigenses. A very important essay was *Sur l'Origine de l'Épopée du Moyen Âge* (1833). His *Histoire de la Poésie Provençale* (3 vols. 1846), which claimed for the Provençals the greater portion of the romances of chivalry, and his *Dante et les Origines de la Littérature Italienne* (1854) are based on his lectures. See Sainte-Beuve's *Portraits Contemporains.*

Faust, Dr, a famous dealer in the black art, whose legendary story, a product of the Reformation period, has filled a great place in literature. The historical person who bore the name of Faust lived in the first half of the 16th century, and can be traced in the testimonies of contemporaries from 1507 down to about 1540. He was born at Knittlingen in Württemberg, or, according to others, at Roda, near Weimar. His parents were poor, but the bequest of a rich uncle enabled him to study medicine and magic at Cracow. From a letter of the Abbot Trithemius of Spanheim, written August 20, 1507, we find an account of him first at Gelnhausen the year before, then at Würtzburg, next at Kreuznach, under the name of Georgius Sabellicus *Faustus junior.* He is described as a vagabond, boastful and pretentious, giving himself out as skilled in necromancy, astrology, magic, chiromancy, agromancy, pyromancy, and hydromancy, able to restore by his own genius the works of Aristotle and Plato if they were lost, and reproduce as often as required all the miracles of Christ. At Kreuznach he was employed to teach by Franz von Sickingen, but was soon obliged to flee for his abominable debaucheries. In 1509 one Johann Faust was pursuing his studies at Heidelberg, where he took the degree of bachelor of theology, and may be the same as the vagabond scholar whom Tritheim denounced. Mutianus Rufus, in a letter to Henri Urbain in 1513, speaks with contempt of one Georgius Faustus at Erfurt, whose follies—as those of a stranger—are of no consequence. Here he seems to have made long and frequent sojourns, if the chronicle first published by Motschmann may be accepted as contemporary evidence; and, moreover, the main elements in his story appear to be already formed. In 1516 we find him at Maulbronn, next in 1525 (traditionally) at Leipzig; in 1528, as Dr George Faust of Heidelberg, he was expelled from Ingolstadt. The physician Philip Begardi, in his *Index Sanitatis* (1539), speaks of him as having been for some years known as a rogue and a vagabond who gave himself out as *philosophus philosophorum*, and was highly renowned among his dupes for his great skill, not alone in medicine, but also in chiromancy, necromancy, physiognomy, crystallomancy, and the like other arts. Begardi had not himself seen him, but had many accounts of him. A somewhat ambiguous sentence at the end of the passage about Faust has been interpreted as conveying the fact that he was just dead, and certainly after 1539 we have no positive proofs of his existence, while we

know that he was dead by 1544. The Protestant theologian Johann Gast, in the second volume of his *Convivialium Sermonum Liber* (1544), speaks of having supped with Faust at Basel, where he was attended by a dog and a horse that were evidently demons, and further describes his deplorable end, how the devil strangled him, and how his dead body lay constantly on its face on the bier, although as often as five times turned upwards.

Conrad Gesner of Zurich, in a letter written in 1561, mentions him as a wandering scholar of marvellous powers, long since dead. Next Manlius, a pupil of Melanchthon, tells us in his *Locorum Communium Collectanea* (1562) that his master knew Faust, who was a native of Kundling in his own country, and described him as 'turpissima bestia, et cloaca multorum diabolorum.' He described further how he had studied magic at Cracow, worked many vain wonders throughout Germany, and was at last carried off by the devil some years before. Joannes Wierus, a pupil of Cornelius Agrippa, in his *De Præstigiis Dæmonum* (1583), speaks of Faust as having been born at Kundling and educated at Cracow, and as having travelled over all Germany, and been imprisoned for his misdeeds in a town in Holland. He tells two stories of him which harmonise with the tradition. According to Widman, Luther in his conversations spoke freely of Faust and his familiar in illustration of the craft and wickedness of the devil, and of the necessity of avoiding all perilous dealings with him. Faust he condemned as the typical infidel and impious man, as well as the mere profligate and the vagabond. Here we see the beginnings of the religious colour which was later to become one of the main characteristics of the story. Count Froben Christoph von Zimmern in his *Chronik* twice alludes to Faust, confirming the account that he died in an inn during the night at the hands of his familiar when his hour had come. One of the last notices of Faust before the publication of the *Volksbuch*, which was to fix the form of the legend for all time, is that of Augustin Lercheimer of Steinfelden, a Protestant theologian, and, like Manlius, a pupil of Melanchthon. In his *Christliche Bedenken und Erinnerung von Zauberei* (1585) we find frequent notices of Faust, and in the minuteness of his details we see the legend full-grown. Again, in two among the seventeen tracts composing the *Theatrum de Veneficis* (1586) there is distinct mention of Faust. Martin Delrio, in his *Disquisitionum magicarum Libri sex* (1624), and Philip Camerarius, in his *Operæ Horarum Subcisivarum* (1658), testify further to his story.

The first literary version of the Faust story was the Volksbuch, published by Johann Spies at Frankfurt in 1587, under the title *Historia von Dr Johann Fausten, dem Weitbeschreiten Zauberer und Schwartzkünstler, &c.*, of which but five copies are in existence—one in the British Museum. At the close of the dedication Spies explains that he has printed the book for a warning to all Christians, and tells how he had received his version of the legend from a friend at Spires, evidently a Protestant theologian from the Scripture texts with which it is scattered. The 'preface to the Christian reader' is an admirable sermon upon the damnable consequences of magic and commerce with the devil. The book is divided into sixty-eight chapters, unequally arranged in three parts and a conclusion. The first part recounts, in seventeen chapters, the birth of Faust at Rod near Weimar, his early studies and bold speculations, his meeting with the devil in a wood near Wittenberg, and his three several disputations in his own dwelling with the fiend, who gives his name as Mephistophiles, when the compact is concluded by which Faust signs away his soul in blood drawn from a vein in his left hand, in return for the services of Mephistophiles for twenty-four years. The fiend now supplies him with the means wherewith Faust and his *famulus* Wagner are able to live in the greatest luxury. Ere long Faust wishes to marry, but is not allowed, as marriage is an institution of God, and therefore hateful to the devil. Then follow the answers of Mephistophiles to Faust's questions about hell and its ten governments, the form and figure of the fallen angels, the power of the devil, the division of hell called Gehenna, its creation, and the tortures peculiar to it.

The second part contains fifteen chapters relating to the rest of Faust's questions about astronomy and astrology, the causes of winter and summer, the creation of the firmament; after which follow the false answers of the fiend about the creation of the world and the birth of man, and the account of Faust's earliest adventures, including a visit to hell and an account of its hierarchy, a journey to the stars, riding upon Mephistophiles in the form of a horse with the wings of a dromedary, and next to many distant countries and famous cities, as Paris, Naples, Venice, and Rome. Here he torments and bewilders the pope with his strange enchantments, remaining three days invisible in the papal palace, seeing in the pope and his attendants countless sins like his own—shamelessness, audacity, pride, presumption, gluttony, drunkenness, luxury, adultery, and impieties of all kinds. At Constantinople he lives royally in the sultan's palace in the form of Mohammed, returning to Wittenberg after a year and a half's absence.

The third part, in twenty-eight chapters, narrates the conclusion of Faust's adventures, and especially the mighty deeds done by his necromancy at the courts of divers potentates. At Innsbruck he calls up the shades of Alexander the Great and his wife for the delectation of the Emperor Charles V., and afterwards plays many tricks upon his knights—planting a stag's horns on the head of one, devouring a peasant's load of hay together with the horse and wagon, and producing fresh apples and grapes in January; and at carnival time he revels with a company of students, drawing forth wine from a table, and raising Helen of Troy from the shades to gratify their eyes with the sight of her beauty. The story tells further of his debaucheries, and of the seven diabolical succubæ whom he made his concubines; and lastly of his liaison in the last year of his term with the famous Helen of Troy, who bore him a son whom he named Faustus junior. As the end approached he was filled with profound melancholy, seeing hell yawning before his eyes and its unutterable torments, from which there was for him no possible escape, while the wicked spirit now began to torment him with cruelly ironical raillery. On the night on which his twenty-four years expired he was in company with a group of students in a tavern of the village of Rimlich, near Wittenberg, and to them he made a long address expressing his deep penitence, after which he remained alone in his chamber. At midnight a fearful storm arose; horrible hisses as of a thousand serpents were heard, and for a little the agonising cries of Faust with a hollow and suffocated sound; but soon all was still. In the morning the floor of the room was found stained with blood, his brains were spattered upon the walls, and his body was found outside, lying near a dunghill, the head and every member hanging half torn off. Helen and her child had disappeared, and the famulus Wagner succeeded as heir to his master's property. The history ends with an edifying conclusion.

This Volksbuch, which we have seen is not a product of the imagination, at once became popu-

lar, as many as four impressions being printed before the close of the following year. A second and corrected edition was published by Spies himself in 1588. In the same year a Low German rendering was published, and a close though somewhat shortened English translation before 1589, the earliest copies not being dated. See the reprint in W. J. Thoms's *Early English Prose Romances* (new ed. 1906). Danish, Dutch, Flemish, and French versions were also made—the last not till 1598. A Berlin edition of 1590 added six new chapters, of which one relates to the Leipzig tradition of Faust's adventures in Auerbach's cellar. A version of the book in rhyme, executed by Tübingen students, appeared there in 1588 (printed in vol. xi. of Scheible's *Kloster*, 1849). At Hamburg in 1599 was issued the second form of the popular book, the enlarged version of Widman (printed in vol. ii. of Scheible's *Kloster*, 1846). Many additional stories and details are here inserted, and each chapter concludes with an edifying discourse, called a *reminder* (*Erinnerung*), which reveals a violently Protestant bias, extorting everywhere a moral against Rome. A later version of Widman is that by the Nuremberg physician, Johann Nicol. Pfitzer (1674; new ed. by A. v. Keller, Stuttgart, 1880), which is chiefly interesting as containing the prototype of Goethe's *Gretchen* in the citizen's daughter whom Faust wishes to marry, which the devil will not permit him to do. Yet another version was issued at Frankfurt about the beginning of the 18th century, by 'One with Christian Intentions,' in an abridged and modernised form, which was the basis of many widely diffused chapbook impressions (see 'Des Christlich Meynenden Geschichte Faust's,' in vol. ii. of Scheible's *Kloster*, from an edition dated 1728). The life of Christopher Wagner (Scheible's *Kloster*, vol. iii. 1846) was issued in 1593, and originated in the same year an imitation, rather than a translation, in English. It closely follows the form of Faust; Wagner is attended by an ape-shaped attendant devil named Auerban, has similar adventures to his master's, and in the end shares the same fate.

Independent poetic versions of the Faust story also began early to appear. Of these, the earliest, and still the greatest but one, was Marlowe's *Tragical History of the life and death of Doctor Faustus.* English itinerant players traversed Germany in the beginning of the 17th century, and may have carried with them Marlowe's magnificent tragedy, but the popularity of the theme was so great that it may well have inspired the native imagination also, and given rise to the numberless marionettes in which the story was continuously represented down to the present century. These were seldom printed, and usually largely extemporised, keeping at the same time more or less closely to the theme. See the excellent Ulm piece and others in vol. v. of Scheible's *Kloster* (1847); also the marionette versions edited by W. Hamm (1850; Eng. trans. by T. C. H. Hedderwick, 1887), O. Schade (1856), K. Engel (1874), Bielschowsky (1882), Kralik and Winter (1885), and Mentzel (1900).

Lessing had projected two versions of the story, one close to the original legend, the other with the supernatural element eliminated; but of these only some fine fragments now exist. Klinger worked the subject into a romance, *Fausts Leben, Thaten, und Höllenfahrt* (1791; translated into English by George Borrow in 1826); and Klingemann published in 1815 his absurd tragedy, 'the hero of which,' says Carlyle, 'is not the old Faust driven desperate by the uncertainty of human knowledge, but plain John Faust, the printer, driven desperate by an ambitious temper and a total deficiency of cash.' Heine's ballet, *Der Doctor Faust, ein Tanzpoem*, appeared in 1851, and N. Lenau's really poetical epico-dramatic *Faust* in 1836. The *Faust* made known to the English public by Henry Irving was a free adaptation of Goethe's Part I. by W. G. Wills (1885). Librettos were written by Bernard for Spohr (1814), Gandonnière for Berlioz (1846), and by Barbier and Carré for Gounod (1859).

Of artistic representations of Faust all the world knows the fine engraving by Rembrandt finished by Van Vliet (1630). Next came those by Christoph von Sichem (1677). The most famous illustrations to Goethe's *Faust* have been those of Cornelius, Retzsch, Seibertz, Kaulbach, and Kreling. The first of the two ancient mural paintings in Auerbach's cellar at Leipzig represents Faust sitting at the head of the table during a revel; the second, as being by magical art carried out into the street sitting astride a wine-cask. Since Goethe's time many fresh paintings have been added to the two venerable studies.

But it is time to come to the greatest genius who has ever experienced the spell of this ancient legend. 'The marionette fable of *Faust*,' Goethe says, 'murmured with many voices in my soul. I too had wandered into every department of knowledge, and had returned early enough satisfied with the vanity of science. And life, too, I had tried under various aspects, and always came back sorrowing and unsatisfied.' Goethe had thought out his *Faust* as early as 1774, but did not publish the first part of his greatest work till 1808, the second till 1831. In his hands it has become a splendid masterpiece, the most really original, moreover, of all his works, although, indeed, in the details of the plot he has invented nothing. It will remain a magnificent dramatic realisation of the elemental struggle between the higher and the lower natures in man. Impossible as it is to compare the English with the German *Faust*, it is still true that Marlowe's conception of the character has the stronger grasp of the actual. His Faust is always a man, real and living; Goethe's is often idealised and subtilised to the point of being a shadow, or rather a symbol.

See Sommer, in Part 42 of Ersch u. Grüber's *Encyklopädie* (1845); Düntzer, *Die Sage vom Doctor Faustus* (1846); Ristelhuber, *Faust dans l'Histoire et dans la Légende* (1863), to be read with caution; Dr Ernest Faligan's admirable *Histoire de la Légende de Faust* (1888), with its excellent 'Index bibliographique;' Kiesewetter, *Faust in der Geschichte und Tradition* (1893); and Rudolf Frank, *Wie der Faust Entstand* (1912). A complete bibliography of Faust literature is Karl Engel's *Zusammenstellung der Faustschriften* (1885).

Faust, JOHANN, printer. See FUST.

Faustina, mother and daughter, wives of two of the noblest among the Roman emperors. The elder, Annia Galeria, usually spoken of as *Faustina Senior*, was the wife of Antoninus Pius, and died 141 A.D.; the younger, known as *Faustina Junior*, was married to his successor, Marcus Aurelius Antoninus, and died at a village near Mount Taurus in 175 A.D. Both, unless maligned by partisan historians, were notorious for the profligacy of their lives, yet after their deaths their memories were marked with signal honours by their forgiving husbands. Institutions for the relief of poor girls were founded by both emperors, and were called '*puellæ alimentariæ Faustinæ.*'

Favara, a town of Sicily, 4 miles SE. of Girgenti, with sulphur-mines and marble-quarries. Pop. 25,000.

Favart, CHARLES SIMON, a French dramatist, was born at Paris, 13th November 1710, and first became known by his *La Chercheuse d'Esprit*, performed in 1741. In 1745 he became director of the *Opéra Comique*, where he and his wife (a singer and actress, who had a share in the composition of several of her husband's plays) made the first

attempt to harmonise the costume of the actors and actresses with their impersonations. This excited the jealousy of the other theatres, and the *Opéra Comique* was closed in the first year of its existence. After spending some time in Flanders, with a troupe of comedians, in the army under Marshal Saxe, Favart returned to Paris and continued to write operas. He died 12th May 1792. His most celebrated pieces are *Le Coq du Village*, *Bastien et Bastienne*, *Ninette à la Cour*, *Les Trois Sultanes*, and *L'Anglais à Bordeaux*. An edition of his works in ten volumes was published at Paris in 1810; *Les Mémoires et la Correspondance de Favart*, giving delightful glimpses of the literary and theatrical world of the 18th century, was published at Paris in 1809 by his grandson.—*Madame Favart* is the subject and the title of a popular comic opera (1878) by Offenbach.

Faversham, an ancient municipal borough and river-port of Kent, 52 miles by rail ESE. of London, and 10 WNW. of Canterbury, chiefly consists of four streets forming an irregular cross. It has a valuable oyster-fishery, and sends much agricultural produce to London. The creek on which it is situated admits vessels of 200 tons. In the vicinity are important powder-mills. Pop. (1851) 4595; (1921) 10,870. Under the name of Favresfield it was a seat of the Saxon kings, where Athelstan in 930 held a Witenagemot. It has scanty remains of a Clugniac abbey founded (1147) by King Stephen, whose tomb is pointed out in the parish church. This is a fine cruciform building, Early English in style, with a spire 148 feet high. Near it is the house of 'Arden of Feversham,' whose murder by his wife in 1551 forms the theme of an anonymous tragedy (1592; edited by A. H. Bullen, 1888; Thorndike, 1910; Farmer, 1911). A grammar-school, founded in 1527, was rebuilt outside the town in 1879. In 1688 James II. was seized at Faversham, attempting to flee to France.

Favre, Jules Claude Gabriel, a French advocate and statesman, was born at Lyons, 21st March 1809. He studied for the bar at Paris, and took an active part in the July revolution of 1830. As the defender of the *Mutuellistes* at Lyons in 1831, and in 1835 of those who had been impeached in April, he displayed a spirit of the most ardent and uncompromising republicanism; and in the February revolution of 1848 he wrote the notorious circular for which Ledru-Rollin's administration was so severely reproached, investing the commissioners of the republic with dictatorial authority in the provinces. On being elected deputy to the Constituent Assembly for the department of the Loire, Favre became a member of the Committee of Foreign Affairs, and advocated the prosecution of Louis Blanc. After the election of the 10th December he showed himself a persistent antagonist of Louis Napoleon, and after the flight of Ledru-Rollin became the virtual leader of the Mountain. The *coup d'état* closed his political career at this time, and compelled him to return to his profession. In 1858 he defended Orsini, on his trial for a conspiracy to murder; this procured his election as member of the Legislature for Paris, and he became one of the leaders of the republican party against Napoleon III. In September 1870, after the downfall of the empire, he was appointed minister of Foreign Affairs, and carried on negotiations, though fruitlessly, with Bismarck. But in January 1871, when settling the terms of the capitulation of the capital, he committed the very serious blunders of omitting Bourbaki's army from the armistice and allowing the National Guards of Paris, contrary to Bismarck's advice, to retain their arms, thus facilitating the outbreak of the Commune. He resigned office in July 1871, and resumed practice at the bar. Favre died at Versailles on 20th January 1880. He was greatest in political repartee, and though long accustomed to public strife, his language was noted for its Attic elegance. See Maritain, *Jules Favre, Mélanges Politiques* (1882); Reclus, *Jules Favre* (1912).

Favus (Lat., 'a honeycomb'), a disease of the skin, chiefly of the hairy scalp, characterised by yellowish dry incrustations of more or less roundish form, and often cup-shaped, composed of the Sporules and Mycelia (q.v.) of a vegetable growth belonging to the order of Fungi (q.v.), with usually an unpleasant mousy odour. The discs of favus are produced with great rapidity, and spread rapidly, if not attended to at the first, over the whole scalp, destroying the bulbs of the hair, which becomes very short and thin, and then falls out altogether. Favus is a disgusting and unsightly, but hardly a dangerous disorder; it is, beyond doubt, contagious, but only spreads where cleanliness is greatly neglected, and is therefore almost unknown among the better classes. It is far more common among children than among adults, often affecting those in delicate health, and seems to be more frequent in Scotland than in England, and more frequent also on the Continent than in either England or Scotland. It seems to be gradually diminishing in frequency. On the general surface of the body it is easily cured; but on the hairy scalp its eradication is a matter of great difficulty. The treatment consists in careful removal of the crusts and scrupulous cleanliness, pulling out the hairs from affected parts by the roots, or removal of all the hairs by applications of the X-rays. Thereafter an ointment of copper sulphate 10 per cent. in lard, of resorcin, &c., is perseveringly rubbed in daily. Favus, if allowed to run its course unchecked, is almost always followed by permanent baldness of the parts affected; unlike Ringworm (q.v.), which is a minor disease of the same order.

The Favus fungus, *Achorion Schœnleinii*, is nearly allied to the fungus which is so destructive to vines, and has by some botanists been placed in the same genus, Oidium.

Fawcett, Henry, was born at Salisbury, 26th August 1833, son of the mayor of the city, a decided Liberal. He went in 1852 to Cambridge, where in 1856 he graduated as seventh wrangler, and was elected to a fellowship at Trinity Hall, and commenced to read for the bar. In September 1858, when they were shooting, shots from his father's gun entered both Fawcett's eyes, totally blinding him. He was a candidate for parliament at Southwark in November 1860, and was defeated at Cambridge in 1863 by the Conservative candidate. His *Manual of Political Economy* (often re-edited) led to his election to the chair of Political Economy at Cambridge in 1863, a post which he held until his death. Other writings are *The Economic Position of the British Labourer* and *Protection and Free Trade*. In 1864 he stood for Brighton, but was defeated; but in 1865 he was elected, and again in 1868. His independence of party ties was often misconstrued as half-hearted Liberalism. His so-called 'Tea-room' party virtually ensured the passing of Disraeli's Household Suffrage Bill of 1867. He urged forward measures for the abolition of religious tests at the universities, the extension of the Factory Acts to agricultural children, the promotion of compulsory education, the preservation of commons and open spaces, and the better government of India. He strongly opposed in 1873 Gladstone's Irish University Bill; and he introduced a bill for the abolition of tests in Trinity College, Dublin. In 1874 Fawcett lost his seat for Brighton, but was elected for Hackney. He joined cordially with his party in opposing Beaconsfield's policy

on the Eastern question; and continuing his work for India, was popularly known as 'the member for Hindustan.' He opposed legislative restrictions upon the industry of women, and was a warm supporter of their claims to representation. In 1880 Fawcett was again elected for Hackney, and Gladstone made him Postmaster-general. He introduced the parcel post, postal orders, and sixpenny telegrams. He died 6th November 1884. See Lives by Sir Leslie Stephen (1885), W. Holt (1915).

His wife, MILLICENT GARRETT, was born at Aldeburgh, 11th June 1847. After her marriage (1867) she interested herself in the women's suffrage movement and the education of women. She was created G.B.E. in 1925. Her principal works are *Political Economy for Beginners* (1870); *Essays and Lectures* (jointly with her husband, 1872); *Tales in Political Economy* (1875); *Some Eminent Women of our Time* (1889); *Life of Queen Victoria* (1895); *Life of Sir William Molesworth* (1901); *What I Remember* (1924). She wrote on WOMEN'S RIGHTS for this work.

Fawkes, GUY, conspirator, was born in York of Protestant parentage in 1570. Becoming a zealous Catholic before he was of age, he served in the Spanish army in the Netherlands from 1593 until 1604, when he crossed to England at Catesby's invitation. For his share in the Gunpowder Plot (q.v.) he was hanged 31st January 1606.

Fáy, ANDRÁS (1786–1864), a Hungarian poet and author, born at Kohany, was educated for the legal profession, but abandoned it for literature, writing fables, plays, romances, and tales. The fables show richness of invention, simplicity of design, and truth of character. Of the novels the most interesting are *The House of the Beltekis* (1832) and *Doctor Javor* (1855), both humorous. From 1825 to 1840 Fáy was one of the chief leaders of the Liberal opposition. He was the founder of the first savings-bank at Pest, and one of the founders of the Hungarian national theatre.

Fayal, one of the Azores (q.v.). The island (area, 69 sq. m.; pop. 25,000) is fertile, has a mountain 3000 feet in height, and on its south-east coast a bay with good anchorage, on which stands the town of Horta.

Faye, HERVÉ AUGUSTE ÉTIENNE (1814–1902), French astronomer, born at Saint-Benoît-du-Sault, became in 1873 professor at the École Polytechnique, and in 1878 director of the Paris Observatory. In 1843 he discovered Faye's comet; and in 1872 propounded the sun-spot theory of the weather, restated in *Tempêtes ou Tornados* (1897).

Fayetteville, capital of Cumberland county, North Carolina, at the head of navigation on the Cape Fear River, 53 miles S. of Raleigh, has cotton-mills, and exports naval stores, &c.; pop. 9000.

Fayûm, a province of Upper Egypt (pop. in 1917, 517,617), consisting in a nearly circular depression or oasis, about 30 miles in diameter, sunk beneath the level of the Libyan desert (and of the sea), about 80 miles by rail SSW. of Cairo and 15 miles west of the Nile, with which it is connected by a narrow, perhaps artificial, pass through the encircling hills, through which flows the ancient canal, now called the Bahr Yûsuf (after its restorer, Saladin), which, in the absence of the springs common to other oases, irrigates the Fayûm and makes it one of the most fertile provinces of Egypt. The construction of the dam at Assuan considerably added to its cultivable area, and three crops can be raised in a year and a half. The Fayûm abounds in fruit, especially figs and grapes; from its rose-gardens is distilled the Egyptian *attâr* of roses; and its well-irrigated fields produce heavy crops of cereals, rice, cotton, flax, and hemp. In 1902 discoveries were made of fossil animals, and evidence has been found that the oasis was inhabited by a neolithic race. It has always been renowned for its fertility, and the irrigation in Pharaonic times was regulated by a system of canals, embankments, and sluices connected with a reservoir, Lake Mœris (q.v.). Traces of the ancient irrigation works may still be seen, and the obelisk of Ebgig and the colossi of Amenemhat III. at Biahmu were connected with them; the latter standing on the pier or quay of the port of the ancient capital, Crocodilopolis (see MEDÎNET-EL-FAYÛM). The pyramid of Usertesen II. at Illahun, and the brick pyramid of Amenemhat III. at Hawara, probably mark the ends of the channel (Mewer) connecting the reservoir with the Bahr Yûsuf. Both kings belonged to the XIIth dynasty, or about 2500 B.C., and the famous 'Labyrinth,' or palace of Amenemhat III., which was reckoned as one of the 'wonders of the world,' may still be traced in the vestiges of numerous chambers about Hawara. Large quantities of papyri of the Ptolemaic and Roman periods found here testify to the prosperity of the oasis, and Coptic manuscripts have also been unearthed. See PAPYRUS. The modern capital is Medînet-el-Fayûm.

See Brown, *The Fayûm and Lake Mœris* (1893); Beadnell, *Topography and Geology of the Fayûm Province* (1905); Willcocks, *The Assouân Reservoir and Lake Mœris* (1904); Flinders Petrie, *Hawara, Biahmu, and Arsinoë* (1889) and *Illahun, Kahun and Gurob* (1890 and 1891); Grenfell, Hunt, and Hogarth, *Fayûm Towns and Papyri* (1900); Crum, *Coptic Manuscripts from the Fayûm* (1893).

Fazy, JEAN JAMES, Swiss journ list and publicist, was born at Geneva, 12th May 1796. His early life was spent in Paris, where he acted as a political journalist in the ranks of the Liberal opposition. Returning to Geneva in 1833, he founded the *Revue de Genève*, and became the leading spirit in the radical movement which resulted in the new constitution of 1846. From this latter year until 1861 he was the real ruler of Geneva, and it is due to his influence that the city has of late years been enriched with numerous fine public buildings. Fazy died on 5th November 1878. He wrote a *History of Geneva* (2 vols. 1838–40), and a *Treatise on Constitutional Legislation* (1874).

Feal and Divot (words both meaning turf), in the law of Scotland, are usually conjoined with the word Fuel, as 'Fuel, Feal and Divot,' to denote the rural servitudes which give right to the proprietor of the dominant tenement to dig and win peat and turf from the servient tenement for fuel, or for building fences, or thatching houses, or similar purposes. They involve also a right of access to the peat-ground, and a right of using the ground to dry the cut turf.

Fear. See FORCE AND FEAR.

Fear, CAPE, the most southerly point of North Carolina, forms the southern extremity of Smith's Island, at the mouth of the Cape Fear River. It has a lighthouse, with a light 110 feet above the sea.—Cape Fear River, formed by the Deep and Haw rivers, runs south-east, and enters the Atlantic after a course of 250 miles, more than half of which is navigable for steamboats; it is tne largest river whose course is entirely within the state.

Feasts. See FESTIVALS.

Feather-grass (*Stipa*), a genus of grasses remarkable for the long awns which give a peculiar and very graceful appearance to the species, mostly natives of warm temperate climates, and including Esparto (q.v.). *S. pennata*, *S. capillata*, and *S. elegantissima* are favourite ornaments of gardens. When gathered before the seeds

are ripe, its feathery awns remain attached, so that the tufts retain their beauty throughout winter. The feathery awns not only assist in the diffusion of the seed, which is carried by the wind to great distances, but in a very interesting manner help to fix it in the soil. Being very hygroscopic, the awn lengthens or shortens with each change of moisture, and each lengthening thus tends to push the sharp pointed grain a little into the earth, its return being prevented by barbed hairs. The awns are hence sometimes used to make rough hygrometers.

Feather River, California, a feeder of the Sacramento, rises in two forks in the Sierra Nevada, and has a southerly course of about 250 miles. It is navigable for steamboats to Marysville, and large quantities of gold have been found on its banks.

Feathers, modified outgrowths of integument, characteristic of birds, and belonging to the same series of skin-structures as the scales of reptiles and the hairs of mammals. There are no transitions known between scales, feathers, and hairs, and each has its characteristic mode of development; but it seems probable that a feather corresponds to a part, at least, of a scale. Feathers must have been very early acquisitions of birds, since the most ancient form we know of—Archæopteryx from Jurassic strata—already possessed them. See HAIR, SCALES.

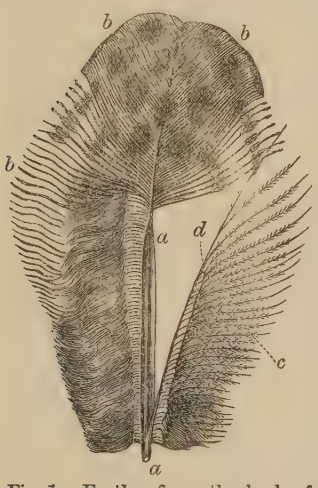


Fig. 1.—Feather from the back of *Argus giganteus*:
a, shaft (rachis); *b*, barbs forming the vexillum, removed from one side of both shaft and undershaft; *c*, barbules on the barbs; *d*, aftershaft (after Nitzsch).

Structure. — An ordinary feather exhibits two principal parts—axis and barbs. The axis is divided into a bare, hollow, inferior portion—the quill, and a barb-bearing, solid, upper part—the shaft. At its base the quill is partly imbedded in a small sac of the skin, and shows at the very end a small aperture for the entrance of the nutritive vascular pulp. The barbs or small plates, which together form the vane, are linked together by pointed lateral barbules, which may be again interlocked by minute hooklets. Each barb with its barbules is thus itself like a little feather. In the ostrich family the barbs, though possessing barbules, are free, and the familiar loose plume results. In a great many birds the quill bears a second shaft, rising at the base of the vane. This is usually small, but in the cassowaries and a few other birds main shaft and 'aftershaft' are almost equal, and the feather is thus distinctly double.

Relation to the Skin.—Only in a few birds—e.g. the ostrich tribe and the penguins—do the feathers occur all over the surface; usually they are restricted to 'feather-tracts' between which the skin is bare or at most downy. Each feather is imbedded in a sac, readily obvious on a plucked bird, and with this sac are associated muscle fibres, more or less abundant, serving to erect the feather. Unlike hairs, feathers have no sebaceous glands associated with them; they are, however, anointed by the secretion of the 'preen-gland' on the tail.

Kinds of Feathers.—The most conspicuous feathers clothing a bird are such as have been above described—'contour feathers,' or *pennæ*. Among these, however, there are down-feathers or plumes, in which the barbs remain soft and free from one another. These are the first feathers, for a time abundant on young birds, but gradually for the most part ousted and replaced by the ordinary forms. Besides these are still simpler and smaller feathers with a long shaft and a rudimentary brush of barbs—the 'filoplumes.' In addition to these common forms there are numerous peculiar modifications of restricted occurrence. Thus, in herons and some other birds small down-feathers occur, 'the summits of which break off into a fine dust or powder as fast as they are formed,' and give rise on certain parts of the skin to 'powder-down patches.' In many aquatic birds an almost fur-like down is very common, the minute component feathers having only a slight development of shaft. In great contrast are a few strong quills on the cassowary's wing, where the long shaft is quite destitute of barbs.

Development.—The cells of the under-skin or dermis multiply and push out the epidermis into a papilla. As the papilla elongates into a cone, its base sinks and becomes surrounded by a moat-like depression, the feather-follicle or sac. The core of the cone, consisting of dermis, is a nutritive pulp; the sheath of the cone, consisting of epidermis, forms the feather. But here as elsewhere the epidermis has two layers—an outer or horny, an inner or Malpighian stratum (see SKIN). The inner layer forms the real feather; the outer layer is only a protective sheath which is eventually shed. 'The cells of the Malpighian layer multiply rapidly, giving rise to a series of radial folds along a central axis, which extend inwards towards the pulp, and are externally bounded by the horny layer. These folds then become cornified and separated from the surrounding cells, and by a gradual drying of the central pulp-substance give rise to a tuft of horny rays, which are, however, at first bound together by the enclosing outer layer.' After hatching, the sheath is shed and the barbs set free; the undivided lower part remains as the quill; the barbs develop barbules; the result is an embryonic down-feather.

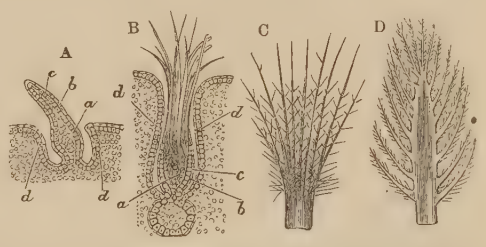


Fig. 2.—The Development of a Feather (from Wiedersheim and Parker, mainly after Studer):
A, an early stage of the feather papilla and follicle; B, the papilla breaking up into a tuft of barbs; C, the quill and primary rays or barbs, with indications of barbules; D, the thickening of one of the rays to form the stem of the vane. *a*, pulp of dermis; *b*, outer or horny layer of epidermis; *c*, inner or Malpighian layer of epidermis; *d*, feather-follicle.

The more permanent feathers have an essentially similar history. From the base of the first follicle a second is formed; the growing papilla within the latter ousts the embryonic feather and replaces it; one of the rays formed as above described 'becomes rapidly thickened, and forms the main axis or

stem, to which the barbs are attached on each side.' The result is an ordinary penna or contour-feather.

Growth and Shedding.—When in process of formation, feathers are of course genuinely alive; the vascular nutrient core of dermis keeps up the supply. They grow with great rapidity, and in some birds attain a length of more than two feet. When fully formed, however, the pulp dries and shrivels, and the feathers become virtually dead from tip to base. They usually last only one year, being replaced by a fresh growth, which generally occurs at the end of the reproductive period. This process of moulting is in a general way equivalent to the 'skin-casting' of reptiles and the shedding of hair in mammals, but its physiology is not yet understood. Involving no little expenditure of vital energy, generally occurring after the already severe strain of reproduction, brooding, and parental care, moulting is frequently associated with mortality, but when successfully accomplished is obviously of great advantage in repairing the injuries of the past and in equipping the birds afresh for migratory flight or the ordinary business of life (see BIRD).

Colour.—Feathers excel hairs and scales in the richness and variety of their colouring. This is usually most prominent in the male birds, but is emphasised in many cases only when sexual maturity is attained. Very often the bright colouring is acquired along with other decorations in a spring moult before the breeding period. The colour is due to the presence of pigment, but is greatly enhanced by physical peculiarities, such as markings on the barbs and the occurrence of air-spaces (see PIGMENT).

In regard to the general physiology of feathers but little can be said. Their utility as a clothing for the skin and as organs of flight is evident enough, but the conditions determining the historic and individual development of these most highly-evolved skin-structures are quite obscure. It is noteworthy, however, that this climax of integumentary outgrowth occurs in animals living a very active life, with the highest body-temperature, and with peculiarly thin skin almost devoid of the usual glands.

Industrial Uses.—Feathers are still largely used as Quills (q.v.) for writing, for holding the sable hairs of artists' brushes, and for toothpicks. Much more important is their use for stuffing beds, quilts, and cushions, when dried and cleaned; the feathers and down of the Eider-duck (q.v.) being most highly esteemed, and after them those of geese, swans, and poultry. The feathers of most kinds of birds are used for personal ornament, often after being washed, bleached, dyed, curled, or made up. Ostrich (q.v.) feathers are the most notable for ornamental purposes, and it is for its feathers alone that it is reared. Other feathers for various kinds of ornament are those of the American ostrich or rhea, adjutant, bird of paradise, humming-bird, albatross, grebe, and penguin (see the articles on these various birds). An Act of 1921 forbade importation of plumage of any bird except the African ostrich, the eider duck, and birds ordinarily used for food, with special arrangements for feathers wanted for scientific purposes.

See BIRD, FLIGHT, SKIN. Nitzsch, *Pterylography*, trans. by Sclater, Ray Soc. (1867); Wiedersheim and Parker, *Comparative Anatomy of Vertebrates* (Lond. 1886); Huxley, 'Tegumentary Organs,' Todd's *Cyclop.*, vol. v. (1859); T. Studer (Development), *Zeitschr. wiss. Zool.*, vol. XXX.

Feather-stars. See CRINOIDEA.

Featherstone, an urban district in the West Riding of Yorkshire, 2½ miles S. by W. of Pontefract. In a riot here arising out of a coal strike (1893) the military were called out, and two men were killed and six wounded—the subject of a royal commission. Pop. 15,000.

Febris Diaria. See EPHEMERA.

Febronianism, a system asserting the independence of national churches, propounded (1763) by Hontheim (q.v.), under the pseudonym 'Febronius.'

February, the second month of the year, contains in ordinary years 28 days, but in leap-year it has an intercalary day. On the 15th was held the *Lupercalia* (q.v.) or *Februa*. See CALENDAR, MONTH.

Fécamp, a manufacturing town and seaport in the French department of Seine-Inférieure, is situated in a narrow valley, flanked on either side by steep cliffs, at the mouth of a little stream, 28 miles NNE. of Havre by rail. The great Benedictine abbey church (*c.* 1220) in the Early Pointed style, rich in painted glass, monuments, and carved woodwork, was burnt in 1892, and rebuilt and consecrated in 1895. At Fécamp the benedictine liqueur, formerly made by the monks, is still produced in large quantities in a factory. The new harbour, opened in 1892, is frequented by colliers from Newcastle and Sunderland, by Baltic timberships, and by fishing-vessels. Fécamp's industries include fish salting and smoking, tanning, corn and oil milling, net-making, and cotton-spinning. Population, 17,000.

Fechner, GUSTAV THEODOR, one of the founders of psychophysics, the science of the relations between the mental and the physical sides of man's nature, was born at Gross-Särchen in Lower Lusatia, 19th April 1801. After studying physics at Leipzig, he became professor of the sciences comprehended under that name in the same university in 1834, his labours being principally devoted to galvanism, electro-chemistry, and the theory of colour. Five years later, however, in consequence of a disease of the eyes, he abandoned these branches for that of philosophy and psychophysics. His most important book on this subject is *Elemente der Psychophysik* (2 vols. 1860), whilst on galvanism he wrote *Massbestimmungen über die galvanische Kette* (1831), and brought out an enlarged translation of Biot's *Handbook of Experimental Physics* (5 vols. 1828–29). Besides these he wrote some books on belief and on the soul, and under the pen-name of Dr Mises published a number of smaller miscellaneous works, including a volume of *Humorous Essays* (1824) and another of *Poems* (1842). In *Mind* for 1876 will be found a paper on Fechner's psycho-physical law by James Ward. Fechner died 18th November 1887.

Fechter, CHARLES ALBERT, an actor of eminence, was born in London, 23d October 1824, his father being a Frenchman of German extraction, his mother an Englishwoman. When only three or four years old he went with his parents to France, and was there educated as a sculptor. His predilections were, however, in favour of the stage; and, making his *début* in 1840, he soon became a popular actor. In 1860 he appeared in London with great success in an English version of *Ruy Blas*, and next year astonished Londoners by his powerful impersonations of Hamlet and of Othello, departing widely from stage traditions. Subsequently Fechter became the lessee of the Lyceum Theatre, playing the chief part in most of the pieces produced. In 1869 and 1872 Fechter paid visits to the United States, where he thenceforward remained. He was not successful as a manager in Boston. He died at his farm near Quakertown, Pennsylvania, 5th August 1879.

Fecundation. See FERTILISATION.

Federalists, a political party formed in the United States in 1788, whose members claimed to

be the defenders of the constitution and of the federal government, in opposition to the Republicans or Democrats (q.v.), whom they dubbed Anti-federalists. Washington, John Adams, Hamilton, Jay, and Marshall were leaders. Its fate was sealed by the holding of the Hartford Convention (q.v.), and by 1820 it had disappeared.

Federated Malay States. See MALAY STATES.

Federations and Unions.—Federation, in modern political terminology, denotes that form of political organisation in which a number of units of government, while retaining for certain purposes their separate identity, for other purposes are merged in a larger whole, whose personality is a new entity different from the mere sum of the several units put together. It differs from a unitary form of government in that the functions of government are divided between the central government and the states or provinces of which the whole is made up, in such a manner that the distribution of powers is not dependent on the will of either the central or the provincial governments. In a unitary state it is often necessary or desirable, for reasons of practical convenience, for the central legislature to accord to inferior bodies legislative authority; but in that case the power which conferred can take away, and there is no real federal element. The contrast is well illustrated by the case of the Union of South Africa, which contains in its constitution certain federal elements, and which was drafted by men who originally had proposed to bring about nothing more than a federal union. While under the terms of that constitution the provinces have a certain sphere of action, their legislation is subject to the paramount authority of the Union Parliament, and that parliament can, under certain not very difficult conditions, actually abolish the whole provincial constitutions. On the other hand, a federation differs from a mere alliance in that an alliance gives no more than a sum of parts, while federation creates a new organic unity. In entering upon an alliance a state diminishes in no degree its sovereignty, though it may agree to limit its exercise in certain ways, as, for instance, did Great Britain, France, and Russia in agreeing in 1914 to make no separate peace with their opponents, or as did the powers who agreed in 1919 to form the League of Nations; but in entering a federation a state parts irrevocably with a portion of her sovereignty, and, unless she stipulates for the right to withdraw, is bound to remain a member of the federal whole, as the northern states of the United States showed in the war of secession.

For the rise of a federation two conditions are necessary: in the first place, there must be communities of an organised type, which, through reasons of proximity, race, language, religion, common interests, or other such ground, are anxious for some closer union among themselves; and, in the second place, that anxiety must not be strong enough to lead to willingness to unite in the fullest sense. History shows that federation is normally formed between communities which have, prior to the agreement to federate, either been united in alliance, or have formed part of a territory under one rule, or have fulfilled both conditions. This fact points to the conclusion that federation is a natural step towards national unity, and in fact this view is borne out by the experience of the modern federations. It is clear that the nationality of the United States is a very different thing now from what it was in 1787; that Swiss nationality has greatly developed since 1848; Germany has thrown off much of its particularism since 1871; and while local feeling is still strong in Canada, it is infinitely less so than in 1867, when the people of the several provinces regarded one another as little better than strangers. At the same time it is clear that the growth of national feeling is not in these cases at all likely to lead to the adoption of a unitary form of government; with lessened fear of the federal government, there has come an increased readiness to extend its functions, but the value of provincial or state autonomy remains unimpaired. Federalism, in fact, shows itself as definitely adapted to reconcile within a whole deep-seated differences, such as those between Protestant and Catholic Germany, between French and British Canada, between the several elements of nationality in Switzerland, and the very varied elements which make up the population of the United States of America. On the other hand, where there is real national unity there is no possibility for enduring federalism, a fact which explains the breakdown of the suggestions that the new kingdom of Italy should take the form of federalism.

Federalism cannot, however, endure unless the national sentiment is strong enough to resist the tendency to particularism inevitable when a portion of sovereignty is retained by the states, and unless there is either no state which is so strong as to be able to seek supremacy over the whole; or, if one state has the strength to do so, that state is animated by sufficient federal spirit to refrain from such action. Federalism has often appeared in the course of history, but it has not normally shown the power to develop into a real organic unity. Thus the elements of federalism present in the two Athenian confederations were soon extinguished by the eagerness of Athens to found an empire, and the equal anxiety of the other states to assert their independence the moment they were free from immediate danger. The Achæan league, which maintained its existence from 280 to 146 B.C. with varying fortune, was prevented from regenerating Greece, partly no doubt by external interference, but in the main by the indifference of the constituent cities to anything save their own immediate interest. Similarly, in the latter part of the 18th century, the memoirs of Lord Malmesbury reveal the impotence to which the Dutch were reduced by the jealousy of the central authorities displayed by the several members of the federation; and in the 19th century the same thing can be seen in the records of the federations of South and Central America.

The immediate cause of the formation of a federation has, in the great majority of cases, been the need of protection against a common enemy. This was clearly so in the case of the Achæan league, framed to meet the Macedonian efforts to control Greece, of the United States of Holland, of Switzerland, of the United States of America, and the South American federations, and even of Germany. In the case of Canada, also, there is evidence that the possibility of friction with the United States was present to the minds of the framers of the Dominion. Even in the case of the Commonwealth of Australia considerations of defence had some influence in inspiring the movement to closer union, but that motive had probably far less weight than other arguments more directly commercial in character. Indeed, the tardiness with which the Commonwealth came into being is one of the clearest proofs of the long-continued freedom of its inhabitants from anxiety on the score of external aggression.

As the essence of a federation is the creation of a new entity with defined powers which is to subsist alongside of the former political units, while the latter are to lose certain of their former authorities, it is practically essential that the agreement

creating the federation should be in writing. This is certainly the case with all the federations existing at the present day, but it is uncertain whether it was the case with the constitution of the Achæan league, though it is possible that in some instances at least when a new city was admitted to that league the terms of admission were duly recorded. The form of these instruments varies in the different cases, but in all they embody what are in effect the terms of treaties made among the contracting parties; even in the case of the constitutions of Canada and the Commonwealth, while the instruments themselves are acts of the Imperial Parliament, the terms contained represent the results of the agreements of the representatives of the several provinces and states. But, of course, it is possible for provision to be made in the constitution, as is made in those of the United States and Canada, for the erection of new states or provinces out of territories which have never enjoyed an independent political existence in any form.

Not only must the constitution be written, but it must also be rigid, and must in some manner be superior to the organisation which it creates. It is, indeed, conceivable that a constitution might be framed for a federation which should be absolutely rigid, and which should never admit of change, but no such constitution has yet been recorded. Without exception, all modern federations provide for the alteration of the constitution in a special manner which removes it from the ordinary legislative competence of either the central or the aggregate of the provincial legislatures. Further, the constitution must provide for a division of the authority between the central and the provincial governments, and probably it must provide some means by which these authorities may be kept within the bounds assigned to them by the terms of the constitution. But within these limits there is room for the greatest possible variations in the nature of federal governments, according to the different degrees of freedom allowed to the members of the federations as against the central government.

Of the individual federations, the Achæan league deserves special mention as the first recorded federation of considerable duration and importance. Unfortunately we know little of the terms of its constitution. There was, however, an assembly, composed of the whole body of citizens of the league who cared to attend, which decided the issues of war and peace, provided means for carrying on war, determined questions as to admission of new members of the league, and elected the federal executive, consisting of a strategus and a body of demiurgi; the federal principle was recognised in the fact that the voting was by cities, not by numbers of citizens. There seems, also, to have been a federal council, and Polybius records that the unity of the members of the league extended to the use of the same coins, weights and measures, and judges, a remark which suggests some form of federal judicature. It is, however, uncertain whether the individual states were secured against encroachment by the central power, even *de jure*, and *de facto* it is clear that the constitution was by no means strictly observed, even in the best days of the league.

The true federal character of the Achæan league, however, showed itself in the effort which it made to secure that in political matters the whole league should act as one unit, and that no separate negotiations with other states should be allowed. This principle is expressly laid down in the constitutions of the United States and Germany; and, in the case of Canada and Australia, while the power of making treaties rests formally with the government of the United Kingdom, all matters affecting treaties are reserved to the central governments. In the case of Switzerland, however, the cantons may, in exceptional cases, conclude treaties with foreign countries regarding matters of vicinage, public economy, and police, although foreign policy and the general treaty power rest with the federal government; and in Germany the states may, with the consent of the federation, conclude agreements with foreign powers on matters regulated by state legislation. But, though in the United States the control of foreign affairs rests with the federal government, there is no provision in the constitution which secures to that government the ability to enforce directly the performance of their obligations by the states of the Union; and, in point of fact, difficulties have arisen through the absence of such a power; in Germany also the federation's powers seem to be limited; the constitution of Canada, and that of the Commonwealth, therefore, accord the power to provide by legislation for the carrying out of the treaty obligations binding on the Dominion and the Commonwealth.

In the modern federations great stress is laid on the creation of a common nationality, and the conferring upon the citizens or subjects in each of the component parts of the federation of the full rights of citizenship in that part. This is common to all the great federations, and its stands in striking contrast with the provisions of the constitution of the Union of South Africa, which do not even provide for freedom of migration throughout the Union. Unfortunately we do not know how far in the Achæan league mutual rights of citizenship were accorded by the several cities; but tradition ascribes to the old Latin federation, before its absorption by Rome, the rule that full commercial rights and rights of intermarriage were possessed by the citizens of the several towns comprised in the league.

In the Achæan legislature the federal principle received recognition in the fact that the voting was by cities, not individuals; and in modern federations this principle is also regarded, but it is modified by the rule that legislatures should be bicameral. Thus, in the upper house the representation is now federal—i.e. each state has a definite representation—while in the lower chamber the representation is by population. In the more perfect form of federation, as in Switzerland, the United States of America, Australia, and in a modified form in the Union of South Africa, the number of representatives of the states in the upper house is the same, despite the differences of size and importance between the states. In the case of Canada, as of Germany, the numbers are determined by other considerations; the aim, in the first case, being to secure the equality of Ontario and Quebec, and in the latter to safeguard without unduly emphasising the importance of Prussia. Australia and Germany have full provisions to solve the case of deadlocks between the representatives of the people and of the states.

In the distribution of powers between the federal and provincial legislatures great variety exists, but Canada is singular in adopting, in deliberate differentiation to the practice in the United States, the rule that the federal legislature should possess whatever legislative authority was not expressly given to the provinces, the normal rule being that the federal legislature has only the authority which is expressly given to it. The importance of the distinction may be over-estimated, for, in the case of Germany and the United States, at least, judicial interpretation has extended widely the powers of the central legislature. As a rule the federal and state legislatures have concurrent authority over a large number of subjects, federal legislation prevailing over state legislation. Broadly speaking, the subjects ascribed to the central authority

include nationality, foreign affairs and treaties, colonial affairs, the army and navy, customs duties and internal free trade, posts and telegraphs, weights and measures, the currency, patents and copyright, bankruptcy, and the mercantile marine, all being matters of obvious national importance. But even in regard to these matters there are divergences: the control of the Swiss and United States armed forces is, in effect, divided between the central and the provincial authorities; and it is only in the case of Germany, Canada, and Australia that the full control of military matters rests with the central government alone. Similarly, Switzerland alone has full powers over all railways, though in each case some authority is conferred on the federation in respect of these important adjuncts of military operations, and in Germany the federation is required to assume ownership of the railways serving for general traffic and to manage them on a uniform system.

In no case have the state or provincial authorities any direct control over federal legislation, and, conversely, the federal authorities in Switzerland, the United States, Australia, and with one exception in Germany, cannot directly affect state legislation. Canada, however, permits the executive government of the federation to disallow any provincial act within a year of its passing, and the same power in an extended form is accorded in the unitary constitution of South Africa.

In the executive government the federal principle is disregarded entirely in practice, at least, in the United States; in Germany the ministers are required to keep the Reichsrat, which represents the states, in touch with federal affairs; and in Canada and Australia it presents itself in the form of the convention, that a cabinet should represent all the provinces and states. In Switzerland each of the seven members of the Federal Council must be chosen from a different canton; moreover, the members of the council are elected by the Federal Assembly, but hold office for a fixed term of three years, thus occupying a position half-way between the purely parliamentary executives of the British federations and the elective presidency of the United States.

The necessary conflict of authorities, which is part of the nature of a federation, requires as its logical complement a judiciary to settle the limits of power on either side. Such a judiciary has been created in the Supreme Court of the United States, which forms an essential part of the constitution. Similar services have been rendered for Canada, not so much by the supreme court of that dominion as by the judicial committee of the Privy Council, and for the Commonwealth by the high court, whose existence is provided for in the constitution, and from which, save by its leave, no appeal lies to the judicial committee on matters affecting the constitutional rights of the Commonwealth, and the states or of the states *inter se*. But in the case of Germany and Switzerland, while the federal courts have the right and duty of pronouncing invalid provisions of state or cantonal law, they are debarred from questioning the validity of a federal law, though they may determine the extent of its application. There is, however, in each case a special reason for this lack of power; a Swiss federal law may be annulled by the use of the referendum on the demand of 30,000 citizens or eight cantons, while in Germany the composition of the federal council gives some measure of security against the passing of any law which really threatens state interests. The German supreme court is empowered to decide constitutional controversies between states, or the federation and a state, and the Commonwealth high court has a similar authority.

Practically essential, in view of the rigidity of the constitution in a federation and the rule of law, is the power to amend the constitution. This right is, indeed, denied to Canada, but the deficiency is made good by the power of the Imperial Parliament, which is exercised in accordance with the expressed will of the people of Canada, ascertained in such manner as seems in each case appropriate. In Australia change requires the assent of a majority of the people and a majority of states, but the reference to the people may take place even if the proposed change has been approved by one house of Parliament alone. In Switzerland any change must be approved by a majority of the citizens and of cantons, and a power of initiative is given to not less than 50,000 voters. In the United States, in practice, revision is effected by majorities of two-thirds in either house of Congress, and ratification by three-quarters at least of the states; and, in recent years, the procedure seems to have become more easy to work. In the German federation a constitutional change may be effected by simple law passed in the Reichstag by a two-thirds majority of those present, who must be at least two-thirds of the legal total of members, but the interests of the states are secured to some extent by the right of the Reichsrat to demand an appeal to the people. On the other hand, the alteration of their own constitutions is a privilege of the states or provinces, subject only to a limited degree of control; thus, in the United States, the federation can only recognise a republican constitution; in Germany a state constitution must be republican, the government must be responsible to the legislature, and there must be universal, equal, direct, and secret suffrage on the principles of proportional representation; in Switzerland a constitution must not contravene the federal constitution, must be republican, must have been accepted by the people, and be open to revision when demanded by a majority of the people; and, in Canada, the federal government can disallow any law altering the provincial constitution, just as it can disallow any other law. The duty of maintaining these constitutions against internal tumult rests primarily with the local governments, but the federal authority is in each case bound by law or practice to intervene where its aid is applied for, at least if it considers that there is real need for its services.

No provision is made in the Swiss constitution for the expansion of the number of the members of the federation, but such provision is made in the case of the United States, Germany, Australia, and Canada.

The fundamental distinction between these true federations and the constitution of the Union of South Africa, which, in many respects, has a federal aspect, is due to the fact that the authority of the Union Parliament is ultimately paramount. The Senate is, indeed, as regards 32 of its 40 members, representative of the old colonial legislatures, and therefore to some extent may be deemed to stand for provincial rights; but parliament may, after the expiry of ten years, alter its constitution, and the provisions for a joint session in the case of deadlocks secure that the will of the lower house, which is based on population, alone shall prevail. There is, again, a definite allocation of a legislative sphere to the provinces, but the Union Parliament has paramount legislative authority on the same subjects, which is totally contrary to a federal system. Again, the central government cannot merely veto any provincial act; no such act can become law without their assent. Further, the executive government of the province can be influenced largely through the administrator, who is a servant of the central government, and who takes an active share in administration, while the

provincial finances are ultimately under the control of the administrator and the auditor, who is also a servant of the central government. Finally, the parliament can abolish the provincial legislatures by a simple act, subject only to the requirement that such an act must be reserved for the signification of the king's pleasure. Nor are these theoretic powers; the short history of the Union has sufficed to show that the central government are determined not to allow the provincial rights to approximate to those of federal states. The relation between Great Britain and Northern Ireland under the Government of Ireland Act, 1920, is more truly federal. The Imperial Parliament, it is true, retains power to legislate for Northern Ireland on any topic and to alter its constitution, while the bills of the Irish legislature may be refused assent at the discretion of the Imperial Government. But it is clearly intended in practice not to interfere, except in the case of the utmost necessity, with the free exercise of the legislative and executive functions of the Irish Parliament and Government, whose powers are very far-reaching. The constitution accorded to India in 1919 is preparatory to the evolution of a true federation, which is demanded by the racial and linguistic divisions of India, but in itself it is lacking in essential federal characteristics.

The merit of federation lies in the fact that it is often the highest form of political unity of which a community may be capable, especially in cases where there are divergencies of race or religion among the inhabitants, and that in large countries government by semi-sovereign authorities tends to attract to public life abler men than would be attracted by the performance of functions merely delegated. Its demerits are essentially the outcome of its qualities. The division of powers tends to weaken both the central and the state or provincial authority, and to afford the possibility of the obstruction of reforms through legal difficulties. The same defect appears in the tendency of federations towards conservatism, which has evoked many complaints in the United States, and which has induced the Labour party in Australia to advocate the reduction of state powers with a possible adoption of a unitary constitution. Nor, of course, is federalism a success in any country where respect for law is not strongly developed; hence the comparative failure of the system, except in the case of Germany, Switzerland, the United States, and the British federations of Canada and Australia.

Fee; Fee-simple and **Fee-tail.** The term fee is derived from *feudum*, a feudal holding; but in English law it has now no reference to tenure; fee means an estate of inheritance in land. The person who has the fee is entitled not only to the annual profits, but also to the corpus of the land; he may sell or otherwise dispose of it, and he may commit acts of waste, which impair its permanent value. If he dies owner in fee, the land will go to his heirs or to the person entitled under his will (in legal phrase, the devisee). If a man holds 'to him and his heirs,' he is owner in fee-simple; he has the largest estate known to the law. But a fee-simple may be made *determinable*, as if land be given 'to A and his heirs, lords of the manor of Dale;' in this case, if A or any of his heirs ceases to be lord of that manor, the estate, and all interests derived from the owner of the estate, will come to an end. A fee-simple may also be made *conditional*, to vest only on the happening of an event. In early times, if land was given 'to A and the heirs of his body,' or 'to A, if he shall have an heir of his body,' the judges held that the fee was conditional; as soon as the condition was fulfilled (as soon, that is, as a child was born to A), the donee became owner in fee-simple, with full power to alienate the estate. In 1285 the lords and great men of the kingdom procured an act, commonly known as the statute *De Donis Conditionalibus*, whereby it was provided that in such cases the land should descend to the heirs of the body, according to the form of the gift. The statute therefore restricted the right of alienation, and limited the succession to a particular class of heirs. An estate given with words limiting it to heirs of the body was therefore called a fee-tail (*taillé*, 'cut down or limited'). The strict rules of the statute remained in force until means were devised for breaking entails. See ENTAIL. It is to be observed that, when heirs are mentioned in conveying an estate, the heirs themselves take nothing directly; thus, an estate given to A and his heirs means simply an estate of inheritance given to A. If land be granted to A and his heirs in trust for B and his heirs, the legal fee is in A the trustee, and the equitable fee in B the beneficial owner. An estate in fee might always be given by will without the addition of the word 'heirs'; and now, by the Conveyancing Act, 1881, it is no longer necessary to use the word 'heirs' in any deed, it being sufficient that the conveyance is 'in fee simple.' In Scotland the term *fee* is used as a correlative to *liferent*, to signify the ownership of land or money. In some cases the fee is vested in a person whose beneficial interest does not extend beyond his life; his 'fiduciary fee' corresponds to the 'legal fee' of English law.

Feeble-mindedness. See IDIOCY.

Feeling. See EMOTION, PSYCHOLOGY, TOUCH.

Fees. Neither a barrister nor an advocate can take legal proceedings against his client for the recovery of his fees, even under a special contract. It is clearly established that 'the relation of counsel and client renders the parties mutually incapable of making any legal contract of hiring and service concerning advocacy in litigation' (13 *Common Bench Reports*, N.S., p. 677). There is nothing, however, to prevent an advocate recovering fees earned by him, by the exercise of his professional knowledge where the relation of counsel and client did not exist between the contracting parties—e.g. by acting as arbitrator or returning officer. There is some, but not strong, authority for the proposition that an express promise to pay fees might be enforced by a barrister against a solicitor who had actually received them from the client. On the other hand, a solicitor is entitled under his general retainer to employ and pay counsel; and fees so paid can be recovered by the solicitor from his client, or from an unsuccessful adversary. No action lies to recover back fees given to a barrister to argue a cause which he did not attend. Special pleaders, equity draftsmen, and conveyancers who have taken out certificates to practise under the bar, and are not therefore counsel, may recover their reasonable charges for business done by them. Barristers' and advocates' fees are paid before being earned. This rule, by removing from members of the bar all pecuniary interest in the issue of suits, has done much to maintain its independence and integrity.

In the United States the two branches of the legal profession are not separated as in England. A barrister is entitled to recover his fees, and is liable to be sued for professional incompetency or negligence. Nor is there anything illegal or improper in an American counsel agreeing to let the payment of a fee by a poor client depend on the issue of his action.

In France an action by a barrister for his fees is maintainable, but in most of the French bars such a proceeding is rigorously discountenanced, and in Paris it would lead to disbarment. The fees of French advocates are now usually paid in

advance, and any bargain between an advocate and his client which made the amount depend upon the issue of an action would be regarded as most dishonourable.

The theory that an advocate's services ought to be given gratuitously arose at Rome. To defend his client was one of the duties incumbent upon a patron, and it was all the more readily and faithfully discharged when forensic eloquence was perceived to be an avenue to political power. The Cincian law (204 B.C.), in which the receipt of pecuniary reward by an advocate was simply prohibited, gave expression to the prevalent public feeling upon the subject at this time. The Cincian law was first systematically evaded, and was then practically repealed by a decree of the Emperor Claudius, which limited the maximum fee which an advocate might receive to 10 sestertia (about £78). The old Roman idea that the gifts of eloquence and persuasion should not be sold has made itself felt in the restrictions imposed by law or custom upon an advocate's power to bargain for fees or to secure their payment.

By the common law of England, a physician could not recover his fees by an action at law; but this rule was repealed in 1849.

The members of the inferior branches of both professions, such as solicitors, apothecaries, and dentists, have never been prevented by any rule of law from taking legal proceedings for the recovery of their charges.

Fehrbellin, a town of Prussia, with 2000 inhabitants, 40 miles NW. of Berlin by rail. Here on 28th June 1675 the Swedes under Wrangel were disastrously defeated by the Great Elector. A tower (1875–79) marks the battlefield.

Feisul. See FAISAL.

Feith, RHIJNVIS, a Dutch poet, was born 7th February 1753, at Zwolle, in Overyssel. He studied law at Leyden and settled in 1772 at his native place, of which he became mayor in 1780, and where he died on 8th February 1824. Feith tried almost all kinds of poetry. In 1792 appeared *Het Graf* ('The Tomb'), a didactic though sentimental poem; in 1802, *De Ouderdom* ('Old Age'); in 1796–1810, four vols. of lyrical pieces marked by a high enthusiasm and warmth of feeling. Of his tragedies the best known are *Thirza* (1784), *Johanna Gray* (1791), and *Ines de Castro* (1793). Of Feith's prose works the most important are his *Brieven* ('Letters on Different Subjects,' 6 vols. Amst. 1784–94), which by their polished style and refined criticism did much to improve the literary taste of Holland. His complete works (1824) fill 11 vols.

Felaniche, or FELANITX, a well-built town of the island of Majorca, is situated in a mountain-girdled valley, which produces wine. Boots, shoes, baskets, water-jars, and brandy are made, and wine is exported. Pop. 12,000.

Félegyháza, a town of Hungary, 80 miles SE. of Budapest by rail, with trade in grain, fruit, wine, tobacco, and cattle; pop. 37,000.

Félibre (from *sèt félibre de la lèi*, perhaps 'seven doctors of the law'). See MISTRAL, PROVENÇAL.

Felidæ, a family of carnivores in the digitigrade or æluroid section, corresponding to the genus Felis of Linnæus, and to what we commonly call the cat tribe. They include the most carnivorous of Carnivora, excelling the less specialised forms, just as falcons and eagles are in a similar direction more perfect than many other less predacious birds. Their chief characteristics of habit and structure may be taken together, being obviously complementary.

Conspicuous for their muscular development, they express this most characteristically in the sudden leaps and bounds to which they trust after stalking their prey with all the cunning of true hunters. They crawl stealthily on noiseless, velvety paws, or patiently lurk for passing victims; at the fit moment occurs a sudden, almost explosive, output of reserved energy, a great bound, a yell inspiring terror, a blow or two with the powerful fore-limbs, and the sharp canines and sharper retractile claws begin their murderous work on the struggling prey. With the exception of the lion, the Felidæ are more or less arboreal, and make good climbers.

Characteristic Features of the Felidæ:
a, tiger's head; *b*, portion of tongue; *c*, right fore-paw, showing claws; *d*, claw, showing tendons. For dentition, see article CARNIVORA.

The body is rather long, and very lithe and graceful; the limbs are rather short, except in cheetahs and lynxes; the tail varies from a long appendage to a mere stump. They are the most digitigrade of carnivores—i.e. they walk on the tips of their (five) fingers and (four) toes. Under a glove of velvet they have claws of iron—strong, much curved, very sharp, and retractile; withdrawn by special muscles and ligaments into sheaths when not in use, and their points even turned upwards, so that they are not blunted by unnecessary friction, and do not interfere with the movements of the animal by hooking objects which are in the way. The collar-bones or clavicles, though unattached to shoulder or sternum, are better developed than in other carnivores.

The Felidæ never bury or store their dead prey, but often drag it off to some place of shelter, and in so doing exhibit enormous strength. The leaps a lion can take with a mouthful half as big as itself are herculean marvels. Besides the strength of grip, the powers of rending and mastication are equally well developed. Thus, we find a skull which tends to be short, broad, and rounded, with large posterior ridges for the fixing of muscles, and with a wide cheek (zygomatic) arch in which lie the relatively enormous muscles working the jaws. The latter form powerful short levers, and the articulation is such that only an up and down, and no rotatory, motion is possible.

The teeth are well adapted for their work, the chief features in the dentition being the large size, strength, and sharpness of the canines, and the two specially adapted cutting teeth ('carnassials' or 'sectorials')—viz. the last premolar above and the single molar below, which are both compressed into sharp blades. The front teeth are relatively small, and so, but more markedly, is the molar on the upper jaw. The numerical relations of the teeth may be summed up in the formula $\frac{3131}{3121} = 30$. The well-known character of the tongue, most conveniently exemplified in the cat,

is also to be associated, as far as utility is concerned, with the carnivorous diet. It is thickly covered with sharp, recurved, horny papillæ, strong enough to rasp off the skin and draw blood from the hand, and obviously useful in clearing the flesh off the bones of victims. As is usual in carnivorous animals, the cæcum of the intestine is small and simple. The food varies widely, from the large ruminants attacked by lions and tigers to the mice for which cats hunt. Some of the large forms are said to develop a special partiality for human flesh; some of the smaller do not disdain to eat big insects. In attack the Felidæ often exhibit a wise discretion in seeking to avoid a fair fight with large animals.

Many members of the family have exceedingly beautiful fur, soft and glossy in texture, generally striped and spotted according to the varied pigmenting of the hairs. The markings in some may be regarded as protective; thus, the stripes of the tiger 'assimilate,' according to Wallace, 'with the vertical stems of the bamboo,' and the spots of the leopard are suited to the interrupted light of the jungle. It seems also true, as Eimer has emphasised, that the markings illustrate definite rhythms of development, and exhibit an orderly progression both in the individual and in a series of related forms. They are in fact, here as elsewhere, external indices to constitutional changes. The colour-differences between the sexes are seldom marked, though they are distinct in the Ocelot (*Felis pardalis*) and a few other forms. The male lion, stronger and larger than the female, is distinguished by his mane, which appears to have protective as well as decorative value. The male Canadian Lynx (*F. canadensis*) also excels his mate in the development of a ruff round the neck. The Felidæ are very cleanly, taking pains to keep their fur in order, and are free from unpleasant smells. They have, however, a notorious dislike to water.

As one would expect from their habits, the senses of Felidæ are highly developed. Keen scent; quick sight, especially for near objects, and well suited for night-work; acute hearing, and great power of localising sounds; and a delicate tactile sensibility in the strong hairs of the moustache or whiskers, are characteristic. The eyes are large, and possess marked powers of accommodation to different quantities of light; the pupillary opening is rapidly altered, contracting in bright light to a narrow slit, though in some forms into the usual circular shape. The animals generally hunt at night, and then their eyes seem to 'burn brightly.' The ears are of moderate size, usually pointed, and mobile.

The intelligence of the family is certainly highly developed, and many of the members can be readily tamed when young, though a deeply ingrained wildness keeps the domesticated cat or tamed individuals of other species from exhibiting the marvellous educational results familiar in dogs. They are not social animals, never hunting in troops, and even the males and females usually live apart except at the breeding season. In spite of the individualism and ferocity of the Felidæ, maternal care and affection are exhibited in a high degree. Not only will a lioness robbed of her cubs risk her life to rescue them, but the habitual care is tender and lavish.

The wild Felidæ seem to be less prolific than the Canidæ, two or three at a birth being an average number. There are usually eight teats, lying on the breast and the abdomen.

While the above are the chief characteristics of Felidæ, it is necessary also to notice that the family is separated from the adjacent civets (Viverridæ) and hyænas (Hyænidæ) by technical details such as the reduction of molars to one above and one below in each jaw, the presence of only two inferior premolars, the division of the bony auditory prominence or tympanic bulla into two chambers, the number (thirteen) of dorsal vertebræ, and so on.

The Felidæ are almost world-wide in distribution, absent only from the Australian region, Madagascar, and the Antilles. They are especially abundant in warmer climates. In the Old World, Lion (*Felis leo*), Tiger (*F. tigris*), Leopard or Panther (*F. pardus*), Ounce (*F. uncia*), Wild Cat (*F. catus*) are well-known species; while in the New World may be noted the Puma (*F. concolor*), the Jaguar (*F. onca*), and the Ocelot (*F. pardalis*). The Lynx (*F. lyncus*) is probably common to both hemispheres. The Cheetah or Hunting Leopard is sometimes placed in a separate genus, Cynælurus.

Numerous Felidæ occur in Tertiary strata, many quite like species now alive, others with more numerous and less carnivorous teeth, others again (e.g. Smilodon, Machærodus, and especially Eusmilus) with much greater development of upper canines than in modern forms. Through extinct American genera like Nimravus, Professor Cope traces back the modern Felidæ to a race of primitive unspecialised cats. So far as natural selection means the destructive elimination of one animal by another, the Felidæ must rank high as agents in the process, and it is at least certain that their abundant presence must exert an often wholesome restraining influence on many more prolific animals. See CARNIVORA, CAT, CHEETAH, JAGUAR, LEOPARD, LION, LYNX, OCELOT, OUNCE, PUMA, TIGER, &c.

Felix, ANTONIUS, or CLAUDIUS, a Roman procurator of Judæa in the time of the apostle Paul, was a freedman of the Emperor Claudius I. and was brother of his favourite Pallas. The circumstances under which he received his appointment are related differently by Tacitus and Josephus. The latter tells us that he cleared the country of robbers, and vigorously suppressed the chaotic seditions of the Jews; but his cruelty, lust, and greed were unbounded. His wife was Drusilla, a beautiful but renegade Jewess, whom he had induced to abandon her first husband. According to Tacitus, she was a granddaughter of Antony and Cleopatra. We read in Acts (xxiv. 25) that Felix trembled as Paul reasoned of 'righteousness, temperance, and judgment to come.' He was recalled to Rome, 62 A.D., on account of the accusations preferred against him by the influential Jews of Cæsarea, and narrowly escaped the sentence of death.

Felix I.–IV., POPES. FELIX I. succeeded Dionysius in the see of Rome in 269. Little is known of his history, for though he has been put amongst the martyrs there is no early evidence as to the manner of his death.—Felix II. was the first antipope (see ANTIPOPE), being consecrated when Liberius was banished (356) for refusing to condemn Athanasius. When Liberius was restored in the following year, Felix was constrained to retire from the city. Most ancient authorities treat him as an unauthorised interloper; but he was ultimately regarded as a saint and martyr (on what evidence does not appear).—FELIX III. ascended the pontifical throne in 483 as the successor of Simplicius. He was a native of Rome, and of the family from which afterwards sprung Pope Gregory the Great. Immediately after his accession Felix repudiated the Henoticon or Decree of Union between the Eastern Church and the Monophysites proclaimed by the Emperor Zeno, and proceeded to excommunicate Acacius, patriarch of Constantinople, because he refused to do the same, thus originating the first disruption between the churches

of the East and West, a breach which on this occasion lasted thirty-four years. Felix died 24th February 492, and was succeeded by Gelasius.—Felix IV., a native of Benevento, succeeded John I. in 526. He was appointed by Theodoric, and failed to meet with the approval of the clergy and the people. He died in 530. His successor was Boniface II.—Felix V. (antipope). See Amadeus (VIII. of Savoy).

Felix, St, with his sister and fellow-sufferer Regula, the patron saint of the city of Zurich and its cathedral. Early in the 3d century he preached Christ there, and was beheaded on the site of the great cathedral. His day is the 11th September.

Felixians, a Spanish sect of the later part of the 8th century, so called from Felix, Bishop of Urgel. See Adoptianism.

Felixstowe, a coast-village of Suffolk, 9½ miles SE. of Ipswich. It is named from a priory (1105) dedicated to St Felix, a Burgundian, who from 631 to 647 was first bishop of Dunwich. With a fine beach for bathing, a pier, good golf-links, and many Roman remains near by, the place has rapidly become a popular seaside resort. Pop. of urban district (which includes Walton, to the west), 12,000.

Fell (Norw. *fjeld*, Swed. *fjäll*), the name given in Scandinavia to the bare plateaus which occur in its mountainous regions; they are destitute of vegetation, and generally lie above the snow-line. The word enters as a component into the names of innumerable mountains, owing to the fact that in their formation they have taken on the shape of a fell. Fell is also used in the north of England and south of Scotland to designate a barren hill, and indicates Scandinavian settlements.

Fell, John, Dean of Christ Church and Bishop of Oxford, was born 23d June 1625, his father, Dr Samuel Fell (1584–1649), being also Dean of Christ Church, of which the boy became a student at the age of eleven. He volunteered for the king, and with Wallis and two others contrived to maintain Church of England services during the Commonwealth; at the Restoration he was rewarded by being made Canon and four months later Dean of Christ Church, royal chaplain, and D.D. He governed the college strictly, restored its buildings, reformed its discipline, and himself attended divine service four times a day. He was liberal of his money to public purposes and the necessities of poor scholars, and did much to promote learning and the advancement of knowledge. In 1676 he became Bishop of Oxford, without, however, giving up his deanery. He rebuilt the episcopal palace at Cuddesdon, and died in 1686. His works no longer concern the world, but his name lives in the well-known proverb: 'I do not like thee, Doctor Fell, the reason why I cannot tell,' usually said to be a paraphrase made by Tom Brown, when a student at Christ Church, from Martial's 'Non amo te, Sabidi,' but more likely to be rather his paraphrase of the following version of Martial in Thomas Forde's *Virtus Rediviva* (1661): 'I love thee not, Nel! but why, I can't tell.'

Felláh (pl. Fellâhîn), an Arabic word meaning 'tiller' of the soil, specially applied to the agricultural or labouring population of Egypt by the Turks, in a contemptuous sense, as 'yokels,' or 'boors' They form the great bulk of the population, and are descendants of the ancient Egyptians, intermingled with Syrians, Arabs, and other races which have been converted to Islam. In their physical conformation and features they differ among themselves, those of the northern provinces of the Mediterranean being of whiter hue, while at Aswan they are almost black. They are described as of middle stature, with large skull, facial angle almost 90 degrees, oval face, arched eyebrows, deep dark eyes, large, well-formed mouth, with rather thick lips, thin beard, short nose, large chest, small belly, arched back, and small hands and feet. Their dress generally consists of a blue or brown cotton smock and linen drawers. On their shaven head they wear the *tarbûsh*, or only a thin cotton cap, but the better-off wind a poor turban round it. The women are singularly graceful and slender, with beautiful skin (despite their tattooing) and often lovely features, and especially magnificent eyes; their dress is a single cotton smock, which they pull up over the mouth before men, and few wear the regular face-veil. They are often married at eleven years, become mothers at twelve, and grandmothers at twenty-four. The children are pot-bellied, dirty, and fly-bitten, but grow up straight, strong, and healthy. Their villages are mere groups of mud-hovels. The food of the Fellâhîn consists almost entirely of vegetables, chiefly millet bread and beans, which they eat in a crude state. Even rice is too dear for them, and animal food seldom attainable. Their drink is limited to the water of the Nile and coffee, and the only luxury which they enjoy is the green tobacco of the country; yet on this diet they are robust and healthy, and capable of extraordinary labour and endurance. In their social position they are inferior to the Bedouin, who, although they will marry the daughters of the Fellâhîn, will not give to them their own in marriage. They exhibit the moral qualities of the ancient Egyptians—are intelligent, docile, pliable, cheerful, and sober on the one hand, and quarrelsome, satirical, licentious, and of unbending obstinacy on the other; and they inherit the traditional hatred of their ancestors to the payment of taxes, which were formerly too often extorted by the bastinado. Their condition has improved; and though they have been slow to understand and exercise the political rights accorded to them, many of them played their part in the movement for Egyptian independence.

Felling, an urban district of Durham, forming an eastern coal-mining and manufacturing suburb of Gateshead; pop. 26,000.

Fellowes, Edmund Horace, born in London 11th November 1870, studied at Winchester and Oriel, became a minor canon of Bristol and of St George's, Windsor. He has done much to make old English music accessible.

Fellows, Sir Charles, English archæologist, was born at Nottingham in 1799. Working in the western peninsula of Asia Minor and along the course of the Xanthus, he discovered (1838) the ruins of the city of Xanthus, formerly the capital of Lycia, and those of the ancient Tlos. Having made drawings of some of the fine remains of architecture and sculpture which he found in these cities, and copies of some of the inscriptions, Fellows returned to England, and published *A Journal written during an Excursion in Asia Minor* (1839). In the course of another visit to Lycia in 1839 he discovered the ruins of no less than thirteen cities, each of which contained works of art, and which he described in *An Account of Discoveries in Lycia* (1841). Under the auspices of the British Museum, Fellows went out to Lycia twice, in 1841–44, for the purpose of selecting works of art, and marbles and casts, from the cities he had discovered. Knighted in 1845, he died at Nottingham, 8th November 1860. Besides his *Journals*, he wrote *The Xanthian Marbles* (1843), *An Account of the Ionic Trophy Monument excavated at Xanthus* (1848), and *Coins of Ancient Lycia before the Reign of Alexander; with an Essay on the Lycian Monuments in the British Museum* (1855).

Fellowship, in a college, is a foundation which usually entitles the holder to be a member of the college, to share in its revenues and government, and, in Oxford and Cambridge, to have rooms in college, with other privileges. Celibacy was usually insisted on in old days, and life fellowships were usual. Commonly now fellowships are for a term of years, or while the fellow continues to perform specified work. In some universities, such as those of Scotland, the fellowship is a university prize for one or more years, bestowed after examination on graduates. See UNIVERSITY, OXFORD, CAMBRIDGE.

Felo de se. See SUICIDE.

Felon and **Felony.** The Old Fr. *felon* was derived from a Low Lat. *felo, fello,* 'a traitor,' a word of unknown origin, possibly a derivative of Lat. *fel,* 'gall,' and so connected with Gr. *cholē,* Eng. *gall.* Its original signification was supposed to be a vassal who failed in his fidelity or allegiance to his superior, thus committing an offence by which he forfeited his fee or feud. From this it came to signify traitorous or rebellious, and was gradually generalised till it reached its modern meaning. In English text-books felony is usually defined as a crime which works a forfeiture of land or goods. Treason itself, says Coke, was comprised under the name of felony, and all capital offences; also such offences as suicide, manslaughter, and larceny, 'as they submit the committers of them to forfeitures.' At the present day it is not possible to draw any logical and consistent distinction between those crimes which are called felonies and those which are called misdemeanours. Sir J. F. Stephen, in his *History of the Criminal Law,* pointed out that the distinction is obsolete; and, if parliament should ever find time to recast the criminal law in general principles, the term will probably disappear. The general principles of American law are the same as those of English law. In Scots law the term felony has not now any special significance. See COMPOUNDING OF FELONY and FORFEITURE.

Felsite, a pale-coloured, compact, sparingly porphyritic rock composed essentially of 'felsite matter,' which appears to be an intimate admixture of orthoclase and quartz. Most felsites are devitrified rhyolites or pitchstones.

Felspar (Ger. *Feldspath,* 'field-spar'), a general term in mineralogy for the most important rock-forming group of minerals. The felspars are usually divided into two series—in one of which the minerals crystallise in monoclinic forms, and in the other in triclinic forms. They are all anhydrous silicates of alumina, containing either potash, soda, or lime alone, or two of those bases together. Thus they are often spoken of as potash-, soda-, lime-, soda-lime-felspars, &c. They have a hardness between 6 and 7—that is to say, they can just be scratched with a good penknife. Their specific gravity is about 2·6. The most important felspars are shown in the following table:

		Silica percentage.
MONOCLINIC....	Orthoclase (potash-felspar).....	64·7
TRICLINIC....	Microcline (potash-felspar).....	64·7
	Albite (soda-felspar)	68·8
	Oligoclase (soda-lime-felspar)....	65—62
	Andesine (soda-lime-felspar)	62—56
	Labradorite (lime-soda-felspar)..	56—49
	Anorthite (lime-felspar).....	43·3

Orthoclase (Gr. *orthos,* 'straight,' *klasis,* 'a fracture') is so called because the two cleavage-planes of the mineral are at right angles to each other. As a rock-former, it occurs most frequently in the form of imperfect crystals or irregular crystalline aggregates. In porphyritic rocks, and especially in drusy cavities in such rocks as granite, it often appears in tolerably well-developed crystals. It is an essential constituent of granite, syenite, orthoclase-porphyry, and quartz-porphyry. The compact ground-mass of the two last-mentioned rocks is largely composed of micro-crypto-crystalline orthoclase. Orthoclase occurs also as an accessory ingredient in most plagioclase rocks, and is present in many of the crystalline schists, especially the gneissose rocks. A clear glassy variety of orthoclase called *sanidine* is a common constituent of many igneous rocks of Tertiary and Recent date, such as liparite, phonolite, trachyte, &c. Orthoclase, as a rule, is readily acted upon by the weather—the potash and some of the silica being removed in solution, while a fine-grained clay or Kaolin is left behind. Ordinary orthoclase is either gray, white, or flesh-coloured, and these tints of the felspar generally determine the colour of the rock in which it occurs. Thus we have *gray* granites and *red* or *pink* granites.

Microcline has the same composition as orthoclase, and its cleavage-angles differ so very slightly from a right angle that it might well be looked upon as simply another form of orthoclase. It is frequently associated with the latter in plutonic and schistose rocks.

The other triclinic felspars are grouped together as *Plagioclase* (Gr. *plagios,* 'oblique,' and *klasis,* 'a fracture;' in reference to the cleavage-planes, which are not at right angles to each other), and are among the most important rock-formers. According to Tschermak, they form a series of which anorthite and albite are the extremes, while the others are isomorphous mixtures of these two types in various proportions. The plagioclase felspars often assume a tabular aspect when growth has been confined almost entirely to two parallel faces. At other times the crystals, owing to extension in the direction of the principal axis, acquire a long prismatic form. As rock-formers they occur either as well-developed crystals, or as narrow lath-shaped microlites, or sometimes as a crypto-crystalline matrix or ground-mass, through which other rock-forming minerals are disseminated. On fresh unweathered faces of an igneous rock the crystals frequently appear as clear glassy strips or rods, in which may often be detected by the eye or by a lens a fine parallel striation, formed by the union of many twins, sometimes thirty or more appearing in one and the same crystal. This structure is never seen in orthoclase. This repeated twin-lamellation has been developed artificially in untwinned plagioclase by subjecting the mineral to a high temperature, and the same molecular change has been superinduced by pressure. Plagioclase is an essential constituent of many igneous rocks, and it is likewise met with in many crystalline schists, in which it is the product of hypogene metamorphic action. *Albite* is a common constituent of some crystalline schistose rocks. It is found in igneous rocks in perthitic intergrowths, and as a 'juvenile' mineral after basic plagioclase. *Oligoclase* occurs both in the older and younger eruptive rocks, and also in many crystalline schistose rocks. *Andesine* is met with rarely in crystalline schists, but is a common constituent of some eruptive rocks, such as andesite. *Labradorite* is an essential constituent of such rocks as gabbro, basalt, &c. It occurs also in metamorphic rocks, sometimes in large crystalline masses. It often shows fine chatoyant reflections, receives a fine polish, and is occasionally employed in jewelry. *Anorthite* is not common as a rock-former. It occurs in some igneous rocks of low silica percentage, and also in certain metamorphosed limestones.

The felspars which occur in rocks that contain much free silica (quartz) are generally orthoclase and microcline, but with these are frequently asso-

ciated the sodium-rich plagioclases, albite and oligoclase. The chief habitats of the basic plagioclase felspars are basic igneous rocks.

Common felspar or orthoclase, under the name of *Petunse* or *Petuntze*, is employed by the Chinese (along with some of the quartz associated with it) in the manufacture of porcelain. It is used with other materials as a flux, and alone to form an enamel or glassy covering, without which the porcelain would absorb moisture and grease. *Kaolin* (Chinese) is the name given to the fine clay which results from the decomposition of felspar by weathering or, as in Cornish granites, by pneumatolysis. *Adularia* is a transparent variety of orthoclase, often showing pearly opalescent reflection, and sometimes a play of colours. The finest specimens of this variety are cut as ornamental stones, and known as *moonstones;* they show a shimmering play of white light often tinged with blue. Another kind, found among rolled stones in Ceylon, and remarkable for the reflection of a pearly light, has occasionally been confounded with Cat's-eye (q.v.). *Sunstone*, or *aventurine felspar*, is somewhat similar to the variety of quartz called *Aventurine* in the play of light which it exhibits—a property which seems to be due to disseminated crystals or plates of hematite or göthite. The aventurine effect is found in a number of felspars, but is most common in oligoclase. *Amazon-stone* is a bright verdigris-green microcline, fine specimens of which come from Pike's Peak, Colorado. *Peristerite* is a whitish adularia-like albite.

Felstone, a rock-term now disused. It comprised a number of rocks composed chiefly of felspar, sometimes orthoclase, and sometimes plagioclase. These rocks are now referred to quartz-porphyry and porphyrite.

Felt, a fabric formed without weaving, by taking advantage of the natural tendency of the fibres of wool and certain kinds of hair to interlace with and cling to each other. When one of these fibres is examined by the microscope, it is found to be minutely notched or jagged, the barbs pointing to the tip of the hair. Some fibres of this kind, however, such as human hair and horse-hair, are too nearly smooth or too rigid for felting purposes. Among the most suitable fibres are those of the sheep, goat, ox, hare, rabbit, musquash, and beaver. Some of these are used chiefly for felt hats (see HAT). Felted cloth is made principally from wool, but less valuable substances are mixed with it.

The making of felted fabrics is a very ancient art in some parts of Asia, and to this day the thick *nămăds* or *nammads* of Persia and Turkestan are remarkable not only for their durability, but for their beautiful ornamentation, produced by a felted inlay of coloured wools.

The first successful mechanical process for the manufacture of felt was invented by Mr J. R. Williams, an American, in the decade 1820–30, Mr Wells, also an American, being associated with him. Williams took out a patent for the process, or for a modification of it, in England in 1840, and about this time a large factory was erected by some capitalists at Leeds to manufacture felt cloth under the patent. The company speedily attained great prosperity, but in the full tide of its success the mill was destroyed by fire. Williams, whose whole property was in the concern, which was not insured, soon afterwards died of grief.

Felton, CORNELIUS CONWAY, president of Harvard College, was born in West Newbury, Massachusetts, in 1807, and studied at Harvard, where, after filling several minor posts, he became in 1834 Eliot professor of Greek, and in 1860 president. He died 26th February 1862. He published translations of modern European works, and editions of Greek classics; his chief work, however, was his posthumous *Greece, Ancient and Modern* (2 vols. Boston, 1867), mostly made up of lectures delivered before the Lowell Institute.

Felton, JOHN (*c.* 1595–1628), the assassin of the Duke of Buckingham (q.v.).

Feltre (ancient *Feltria*), a town of Northern Italy, 19 miles SW. of Belluno; pop. 7000.

Feltre, VITTORINO DA, is the name by which a great Italian educationist (1378–1446) is known, though Ramboldi was his family name. Born at Feltre, he lectured at Padua and Venice; and as tutor to the children of the Marchese Gion Francesco Gonzaga of Mantua, conducted a school in which they and other noble boys studied on a footing of strict equality with poor youths. He was a forerunner of Pestalozzi, and his school became a model for imitation. Rosmini wrote a Life of him (1881), and, in English, Woodward (1897).

Felucca. See SAIL.

Feme Coverte. See HUSBAND AND WIFE.

Femern, a flat and fertile island of Sleswick-Holstein; area, 70 sq. m.; pop. 10,000.

Femgerichte. See VEHMGERICHTE.

Feminism. See WOMEN'S RIGHTS.

Femoral Artery. See ARTERIES.

Fences, in Agriculture, serve in general the threefold purpose of inclosing animals on pasture-grounds, of protecting land from straying animals, and of affording shelter from cold winds. In countries where wood or stones are scarce, and more especially where the land has been long settled, hedges formed of various kinds of plants are common. These, when grown upon good soil, and when well kept and managed, give a clothed and picturesque appearance to the landscape. The hawthorn or white-thorn is the favourite hedge-plant in Britain. See HEDGES.

Stone walls, when well constructed, form the best fences. The form and mode of building varies with the nature and quality of the stones. In Aberdeenshire the walls or dykes surrounding the fields are constructed of granite boulders that are found strewn over the surface of the country. The Silurian of the southern counties of Scotland supplies durable but irregularly shaped whinstone, which forms a lasting but rough fence.

In new countries, where wood is abundant, the fences are all of this material. The snake-fence, named from its zigzag form, is made by merely laying trees above each other, in such a manner that their ends overlap and cross, and require no additional fixing. As wood becomes more valuable, it is made into posts and rails. The posts are driven into the ground from two to three yards apart, and from four to five rails are nailed across, according to the purpose which the fence is meant to serve. The stob and rafter fence is made by driving the posts in the ground at a distance of from three to four inches apart, and binding the whole by a rafter or rail nailed across the top. This is one of the strongest of wooden fences, but requires more material than the other. In America split rails, roughly sharpened at either end, and let into wide openings cut into the posts, are in common use.

Iron or wire fencing is the form most frequently adopted at the present time. Vast stretches of waste land in Britain, as well as pastures in Australia, have been inclosed by means of wire-fencing. Strong wires are stretched on straining-posts firmly secured in the ground 200 yards apart. Intermediate or lighter posts—standards for support, or hangers in the hollows to keep down the wires, as the case may be—are put in at from two to three

yards' distance. After the wires are fully stretched they are fixed to the smaller posts; when of wood, by means of staples, or threaded through, when of iron. Barbed wire is now extensively used in fencing cattle, both in Britain and elsewhere. The only danger of serious injury from the use of barbed wire is when an animal runs close to and in the line of the fence; a horse can thus saw the skin and flesh through, and lay the shoulder-joint open in a few seconds. Various forms of fencing can now be obtained ready made, in which the several wires, at convenient distances apart, are fixed together by strong cross-wires welded to them, or by thin wooden or iron uprights. The fence is held by strong posts driven into the ground at intervals of five or six yards. This type is easily erected, and may be easily taken down and re-erected elsewhere.

In Scotland the landlord is held bound to put the fences on the farm in due repair on the entry of the tenant, independently of any stipulation in the lease; whilst both in England and Scotland the tenant must maintain the fences and leave them, with the exception of ordinary tear and wear, in the state in which they were given over to him. A tenant who erects a temporary fence (e.g. a wire-fence), can, unless he makes a special agreement to the contrary, remove the same as a temporary fitting, provided the ground on which it stood is left in the original natural condition.

Fencing may be generally described as the scientific handling of a sword or bayonet in attack or defence, though the term is usually limited to the use of the rapier. It is taught in every gymnasium, and in the British army every officer on joining is put through a course of gymnastics of which it forms a part. Non-commissioned officers are taught at the Aldershot Gymnasium, and then appointed instructors throughout the army.

FENCING WITH THE RAPIER OR FOIL is admitted to be the best exercise that can be taken. Every muscle of the body is brought into play by it, and hand and eye are trained to act in unison. No description can pretend to teach it. Even an instructor who is not thoroughly capable does more harm than good in attempting to teach fencing, as bad habits are acquired which it is most difficult to unlearn; and, unless every movement is accurately and properly made, there is no science and very little interest in its practice.

The foil in practice used as a substitute for the rapier should have a tapering blade about 32 inches long, and square in section, with a gutta-percha button on the point, and a weighted pommel to the hilt, so as to balance it properly. Masks of wire netting are absolutely essential to protect the face, and leather gloves, jackets, and aprons should also be worn.

Except in Spain, where one straight cut at the head is allowed, the only attack with the rapier or foil is by *thrust* and *longe* (or *lunge*)—i.e. straightening the elbow so as to bring the sword and arm into line, and then striding forward about 18 inches with the right foot. The defence is by slight movements of the sword hand, which cause the *faible* (upper half) of the assailant's blade to glide along the *forte* (lower half) of the defender's foil, and outside it, so as to pass clear of his body, while his point is always kept towards the front, ready to *ripost* (longe after parrying) without an instant's delay. The proper positions and movements when *on guard*, *engaged*, *longeing*, *parrying*, *advancing*, and *retreating* must be most carefully learned from an instructor, and assiduously practised, as well as the various *attacks*. A reproduction (fig. 1) of the diagram given by Captain Chapman in his excellent little book, *Foil Practice*, shows the four lines of attack and the nine parries usually taught. It will be sufficient to mention that a *counter parry* describes a circle

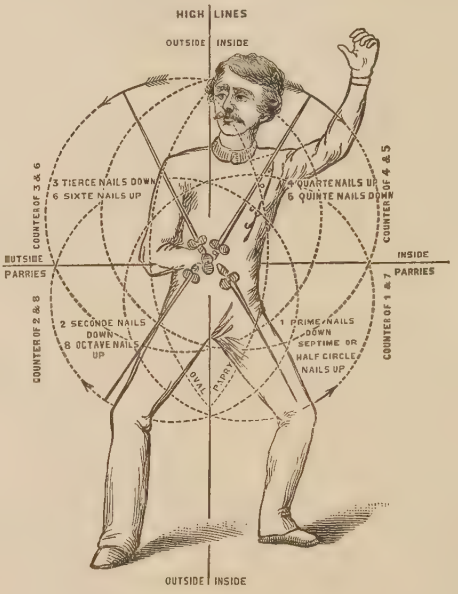


Fig. 1.

under or over the adversary's foil before throwing it off, and to add the following explanation of terms used in fencing. When the nails are uppermost the sword hand is said to be in *supination*, when under, in *pronation*. The thrusts, like the parries are called quarte (or carte), tierce, &c. The *flanconade* is an attack made by the assailant *binding* his blade round the adversary's and longeing at his body under his arm. An attack may be a combination of any of the following movements preceding a longe: *disengage*, when swords are crossed, changing from one line of attack to another by passing under the adversary's sword; *cut over*, the same change by whipping over his sword; *one*, *two*, a double disengagement; *double*, both blades horizontal, and circling round parallel to one another; and *beat*, a side-blow of one blade on the other. If a second thrust is made after longeing, and without springing up to guard again, it is called a *reprise;* and, if made to take advantage of a wide parry not followed by a ripost, a *remise*. *Time thrusts*, like cross-counters in boxing, parry a thrust by a thrust.

The system of fencing compiled by Mr Archibald Maclaren, of the Oxford Gymnasium, is that used in the British army, and differs from others in teaching only four parries—viz. quarte, tierce, seconde, and semicircle. All are formed in the usual manner, except the last, which, by raising the hand slightly and elevating the blade as high as the face, guards both the upper and lower openings on the inner or left side, carrying the adversary's blade over the right shoulder, and leaving him completely exposed to the return thrust. In Spain and Italy the left hand is used as an auxiliary in parrying, and in Italy is aided by a dagger, or a cloak.

THE BROAD-SWORD EXERCISE differs from fencing with the foil, in that the weapon employed is intended to cut as well as thrust. For practice a stout, straight stick is used ('single-stick'), with buffalo-hide or basket handle to protect the knuckles.

The position and movements of the combatant are very similar to those for fencing with the foil, but the position *on guard*, the start of a formal

fight, has nails down, while in fencing the corresponding position has nails up. There are seven cuts, with seven corresponding guards, and three thrusts, as shown on the accompanying diagram, which represents a target placed opposite a pupil, with its centre in a line with the centre of his breast.

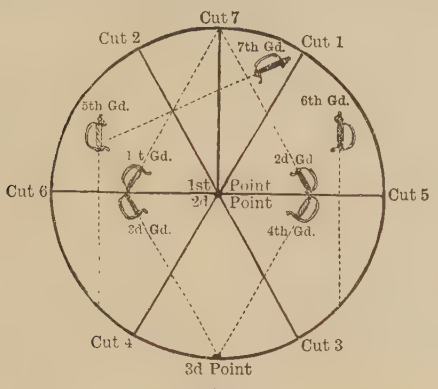


Fig. 2.

The cuts cross the whole circle through the centre along the *thick* lines. Nos. 1, 3, and 5 are inside cuts, and may be directed against any part of the left side, and inside of the right leg; 2, 4, and 6 are outside cuts, attacking the right side, and right leg on the outside. No. 7 is a vertical cut, aimed at the head. The dotted lines show the several guards. The points or thrusts are shown by the black dots. The 'parry' consists in bringing the wrist nearly to the right shoulder; whence, as centre, a circular sweep of the sword is made from left to right.

Cavalry Sword Exercise differs from the foregoing, which is not suitable for horsemen. It has four cuts on each side, two at a mounted, and two at a dismounted adversary. Each cut has a corresponding point and guard.

The Bayonet Exercise taught in the British army has been assimilated to Maclaren's system of fencing. The guards are formed in as nearly as possible the same manner, except that, of course, the rifle is held in both hands, one at the grip, and one in front of the back-sight. The latter remains almost stationary, while the movements of the other form the parries. A most effective thrust, called the *throw*, has been introduced. When making it, the forward hand quits the rifle, which is thrown forward to the full extent of the other arm.

As to the relative values of the sword, rapier, and bayonet, the first, requiring for each cut two motions, one up and the other down, cannot but be much slower in its action than either of the other two; while the last, from its weight, is exhausting and clumsy. The second, on the other hand, has none of these objections, and in skilled hands is by far the most deadly weapon.

See Captain Chapman's *Foil Practice;* Maclaren's *System of Fencing* (1864); Captain A. Hutton's *Cold Steel* (1889); the Manuals of Sword and Bayonet Exercise published by the War Office; and *Fencing, Boxing, and Wrestling* in the 'Badminton' series, by Grove, Pollock, Armstrong, and Prévost (1889).

Fen Country. See Bedford Level.

Fénelon, François de Salignac de la Mothe, was born August 6, 1651, in the château de Fénelon, province of Périgord, now included in the department of the Dordogne, of a family which has given many celebrities both to the church and to the state in France. His education was conducted at home up to his twelfth year, when he was transferred to Cahors, and afterwards to the Plessis College in Paris. In his twentieth year he entered the newly-founded seminary of St Sulpice, where he received holy orders in 1675. Unlike too many ecclesiastics of his own rank at that period, he gave his whole heart to his sacred calling, being for some time employed in the parochial duties of the parish of St Sulpice; and in the year 1678 he was named director of an institution recently founded in Paris for the reception of female converts to the Roman Catholic faith. During his tenure of this office he wrote his first work, *De l'Éducation des Filles;* and the success with which he discharged his duties towards the young converts led to his appointment as head of a mission, which, on the revocation of the Edict of Nantes in 1685, was sent to preach among the Protestant population of Saintonge and Poitou. In 1689 he was named by Louis XIV. to the highly confidential post of preceptor of his grandson, the young Duke of Burgundy. In the discharge of this delicate trust he sought to impress on his pupil's mind the great principles of truth and justice upon which the prince's responsibilities are founded, and to show the hollowness and futility of all earthly glory, power, and happiness which do not rest upon this foundation. To this wise design of the preceptor we are indebted for many works still popular in educational use; for the *Fables*, for the *Dialogues of the Dead*, for the *History of the Ancient Philosophers*, and for the germ at least of the *Télémaque*. As an acknowledgment of these great merits, he was presented by the king in 1694 to the abbey of St Valery, and in the following year to the archbishopric of Cambrai.

It is to this period of Fénelon's life that the history of the unhappy controversy about Quietism (q.v.) belongs. Two separate schools of Quietism are to be distinguished. In one of these the common mystic principle of the absorption of the soul in the love and contemplation of God led to the conclusion that the soul, in this state of absorption, suffered no contamination from the material actions of the outer man, and that no acts of virtue, not even of prayer, were any longer required (see Molinos). The other school, while it maintained the theory of passive contemplation and love, yet repudiated the dangerous and immoral consequences which were deduced therefrom. It was exclusively the latter and less objectionable form of Quietism the professors of which for a time claimed, although not the patronage, yet at least the indulgent consideration of Fénelon. He formed in the year 1687 the acquaintance of the celebrated Madame Guyon (q.v.). Fully convinced of the unfairness of much of the outcry which was raised against her, and which made her responsible for all the principles of the grosser Quietism of Molinos, his generous mind was perhaps attracted to her cause by the very injustice of her opponents. He advised her to submit her works to the judgment of Bossuet, who was then in the zenith of his fame, and with whom Fénelon was in the most friendly relations. In the condemnation of the book of Madame Guyon by this prelate Fénelon acquiesced; but, as she made a formal submission to the church, he refused to join in any condemnation of herself personally. Nevertheless, when a commission was appointed to examine the whole affair, he signed their report. It was not thought enough to publish a condemnation of her several works, but Bossuet prepared a special exposition of the true doctrine of the church on these questions. To this work Fénelon refused to give his approval, and even composed his own *Explication des Maximes des Saints sur la Vie intérieure* in explanation and defence of certain at least of Madame

Guyon's doctrines; he cheerfully agreeing to the stipulation of the Archbishop of Paris that the *Maximes* should be kept back from publication until the completion of the rival treatise of Bossuet, *Instruction sur les États d'Oraison*. An unfortunate violation of this engagement, committed without the knowledge, and in the absence of Fénelon, was the last of a long train of causes which led to the painful and unedifying rupture between these two great prelates. Fénelon's book was received with much clamour, that of Bossuet was universally approved; and in the controversy that ensued all the displeasure of the court, which Fénelon had provoked by covert strictures in his works of fiction, was brought to bear against him. He was ordered to submit his book to the judgment of an ecclesiastical tribunal, of which Bossuet was a member. He refused to accept Bossuet as judge; and in the end he appealed to the judgment of the holy see. Bossuet published a succession of pamphlets; several of the bishops who had espoused the side of Bossuet issued pastorals in the same sense; and Fénelon defended himself vigorously against them all.

The last blow against the ancient friendship of the great rivals was struck by Bossuet in his celebrated *Relation sur le Quiétisme*. Fénelon was wounded to the heart; but his most masterly defence was written, printed, and published within little more than a fortnight from the appearance of Bossuet's *Relation*. From this point the controversy assumed a more personal and therefore a more acrimonious character; and it was maintained on both sides till the long-delayed decision of the pope brought it to a close, March 12, 1699, by a brief, in the usual form, condemning the *Maximes des Saints*, and marking with especial censure twenty-three propositions extracted from it. The conduct of Fénelon under this blow constitutes, in the eyes of his fellow-churchmen, one of his highest titles to glory. He not only accepted, without hesitation, the decision of Rome, but he took the very earliest occasion to publish from his own pulpit the brief of his condemnation. The jealousy with which the political principles of Fénelon were already regarded was heightened about this time into open hostility by the appearance of his *Télémaque* (see TELEMACHUS), printed from a copy surreptitiously obtained by his servant, which the king regarded as but a masked satire upon his own court. Louis's anger knew no bounds. Fénelon was strictly restrained within his diocese; and measures were taken to give the condemnation of his book every character of publicity. From this date Fénelon lived exclusively for his flock. He founded at Cambrai a seminary for his archdiocese, which he made his own especial charge. He was assiduous in preaching and in the discharge of the other duties of his office; and the fame of his benevolence, charity, and enlightened liberality is attested by the order issued by the Allies in the campaign of 1709 to spare the palace and the stores of the Archbishop of Cambrai. The only later controversy in which he appears is the revival of the Jansenistic dispute, in which Fénelon engaged earnestly on the side of orthodoxy. He died January 7, 1715, and was buried in his cathedral of Cambrai (q.v.).

The works of Fénelon are very voluminous, and embrace every variety of subjects—theology, philosophy, history, literature ancient and modern, and oratory, especially the eloquence of the pulpit. His correspondence is very extensive and most interesting. Of his mature discourses two only have reached us in a finished state. They are of the very highest order of sacred eloquence. His work on the temporal power of the medieval popes presents that doctrine in its most amiable form; and even his spiritual writings are not unfrequently read by Christians of all denominations.

See Bausset's edition of the Works (22 vols. 1821–24), also the Abbé Gosselin's (10 vols. 1848–52), to which is prefixed Bausset's *Histoire de Fénelon* (1808; new ed. 1862); Mme. Duclaux, *The French Ideal* (1911); Paul Janet's *Fénelon* (1892; trans. 1913); uncritical Lives by Mrs Lear (1876) and E. K. Sanders (1901); and the Life by Viscount St Cyres (1901). Douen, in *L'Intolérance de Fénelon* (1872), endeavoured to establish by documents that both in his management of the institute for the converts and in his measures in Poitou, Fénelon frankly accepted the policy of persecution, and was guilty of inexcusable severity and even cruelty.

Fenestella, or FENESTRELLA, a genus of Polyzoa, resembling the recent 'lace coral,' very common in Palæozoic rocks, from the Lower Silurian to the Permian.

Fenians, or FENIAN SOCIETY, was a popular name for the Irish Republican Brotherhood, a political association of Irish or Irish-Americans for the overthrow of the British authority in Ireland, and the establishment of a republic. The words *Fiann, Fianna* are used of the ancient Irish militia of the kings Conn of the Hundred Battles, his son Art, his son Cormac MacArt (who began to reign at Tara in 213 or in 227 A.D.), and Cormac's son Cairbre, who in the battle of Gabhra destroyed the power of the militia, now mutinous and inclined to side with Connaught against the high-kings of Ireland. Dr Douglas Hyde, in his *Literary History of Ireland* (1899), calls the tales illustrating the enmity that arose between the high-kings and their militia the 'Fenian Cycle' of romances; it might also be called the Ossianic cycle, since Ossian is said to have written many of these tales. The word *Fenian* has, however, nothing to do with the name of Finn MacCúmhail, though by 'Finnian' Moore no doubt meant 'followers of Finn MacCool.' In the earlier English translations of Keating's Irish history the word is not used, but 'Irish militia.' Miss Brooke, translating some Ossianic fragments, is the first to use the English form Fenian (1796). John O'Mahony, brilliant Irish scholar and head-centre of the I.R.B., christened the 'men of '68' Fenians. The I.R.B.—of which the Clan-na-Gael was the American branch—was in Ireland the mainspring of Home Rule, the Land League, and Nationalism.

The modern Fenian movement adopting the name of this ancient military association had its first seat in America, where the Irish population had largely increased since the famine of 1846–47. Many of the emigrants being driven from their homes by arbitrary ejectment, or from inability to pay rent, carried with them a sense of wrong; others had been sympathisers if not participators in the insurrection of 1848; and almost all were deeply imbued with general political and social discontent. The most openly active seat of the organisation was in the western states, especially Chicago; but the movement was directed from New York, and possessed ramifications in almost every city of the Union. It was conducted by a senate, and consisted of 'circles,' each directed by a centre. The duty of the centres was to enrol members, who bound themselves, generally by oath, 'to be faithful to the Irish Republic as at present virtually established;' to instruct and practise them in military exercises; to raise funds for the purposes of the association, especially for the purchase of arms and munitions of war; and to extend the organisation by every means at their disposal. Agents were sent into Ireland, and to the chief seats of the Irish population in England; and, opportunely, the termination of the civil war in America set free a large number of men with

military training and experience. In this, unlike almost all similar movements, pains had been taken to exclude the Catholic clergy, by whom the Fenian confederation had from the first been steadily resisted, from all knowledge of its character and objects, as well as of the names or number of its members in the several localities.

By degrees the movement acquired solidity, and the British government ascertained that Fenianism, however corrupt in some of its sources, and however wild and extravagant in its aims, was nevertheless a reality with which it had become necessary to grapple. The Habeas Corpus Act having been summarily suspended, all the known leaders in Dublin and in the provincial districts of Ireland (most of them Irish-Americans) were at once placed under arrest. The 'Head Centre,' James Stephens, was one of those arrested. The chief journal of the conspiracy, *The Irish People*, edited by O'Donovan Rossa, was suppressed and seized; additional troops were moved into Ireland, and other measures of repression were vigorously carried out. Many of the prisoners, convicted of treason, were sentenced to penal servitude. By these energetic measures public tranquillity was maintained in Ireland, but the embers of discontent continued to smoulder among the poorer peasantry and the working population of the towns; and a certain prestige was given to the fallen cause by Stephens' escape from prison. His return and that of other exiles to America renewed the agitation in that country. In the early summer of 1866 a raid was attempted into Canada, which proved an utter failure; and it was followed in the spring of 1867 by an utterly abortive attempt at insurrection at home, beginning with the seizure of the castle and military stores at Chester. The attempt was defeated by the treachery of one of the conspirators. A partial insurrection, however, took place in the county of Kerry; and a few weeks later a more extensive movement was attempted in the counties of Dublin, Louth, Tipperary, Limerick, and Cork. But most of the parties dispersed or were made prisoners after a single night's campaign. The rest betook themselves to the mountains, and after a few days of exposure and hardship were either captured or dispersed. The leaders were tried at a special commission held in the spring of the year 1867, some being convicted, but none executed; and tranquillity for a time seemed to be restored in Ireland. In September 1867 an attack was made, in open day, on a police-van in Manchester; the officer in charge was killed, and the prisoners, who were suspected Fenians, were released. A few weeks later a still more daring attempt was made to blow down Clerkenwell Prison wall, with the same object.

In 1871 the United States government frustrated another Fenian raid on Canada by the apprehension of its leaders and the seizure of its arms. Later developments of the Fenian spirit appeared (1883–85) in the *Skirmishing Fund*, raised to promote the free use of dynamite for the destruction of English public buildings and English commerce, and in the extreme party of the *Clan-na-Gael;* and some of the 'invincibles' who were to 'make history' by removing tyrants, as in the Phœnix Park assassination (1882), had been Fenians. Some also of those who were leaders in the Home Rule and Land League agitations had formerly been members of the Irish Republican Brotherhood.

See the history of IRELAND in this work; J. Rutherford's *Fenian Conspiracy* (1877); J. O'Leary's *Recollections of Fenians and Fenianism* (1896).

Fennec (*Canis cerdo, famelicus, chama*), little African foxes, of elegant habit and active, courageous disposition. The ears are remarkably large. Fennecs are found apparently throughout Africa, and are sometimes hunted. In diet they show an interesting though not unique fondness for sweet vegetable food, such as dates. Quite distinct is the decidedly larger African Fox (*Otocyon megalotis*). See FOX.

Fennel (*Fœniculum*), a genus of umbelliferous plants, allied to Dill (q.v.), but distinguished by the cylindrical, strongly-ribbed fruit. The flowers are yellow. All the species are aromatic, and have much-divided leaves with thread-like segments. The best known is the Common Fennel (*F. vulgare*), a native of the south of Europe and of some parts of England. It is a biennial, 3 or 4 feet high, and is cultivated in gardens, chiefly for the sake of its leaves, which are boiled, and served up with mackerel, with salmon, and occasionally with other kinds of fish, or are employed to form a sauce for them.—Sweet Fennel, Italian Fennel, or Cretan Fennel (*F. dulce*), is a plant of much humbler growth, an annual, much cultivated in the south of Europe, but too tender for the climate of Britain. The greatly dilated bases of the petioles are less aromatic than those of Common Fennel, and when blanched form a very agreeable salad and potherb. The fruit (seed) is longer and paler than that of Common Fennel, has a more agreeable odour and flavour, is a favourite aromatic condiment of the Italians, and is used in medicine as a carminative and aromatic stimulant. *Oil of Fennel*, an aromatic, stimulant, and carminative essential oil, is also made from it.—Cape Fennel (*F. capense*), found in the interior of the Cape of Good Hope, has a thick, aromatic, esculent root.—The Panmuhooree of India (*F. panmorium*) is a species cultivated for its sweet, warm, and aromatic fruit, which is much used as a carminative, and in curries.—The Giant Fennel of the south of Europe is a plant of a different genus (Ferula), and abounds in a fetid juice; it is indeed closely allied to asafœtida. It forms a favourite food of buffaloes in Apulia, where it particularly abounds. The dry, dead stem is full of a white pith, which is used in Sicily as tinder.

Fennel (*Fœniculum vulgare*): *a*, a flower.

Fens. See BEDFORD LEVEL.

Fenugreek (*Trigonella*), a genus of Leguminosæ, allied to clover and melilot. The Common Fenugreek (*T. fœnum Græcum*) is a native of the south of Europe, and of some parts of Asia; it is much cultivated in India as a fodder-plant, and derives its name since classic times (*Fœnum Græcum*, 'Greek hay,' of which the English name is a corruption) from its use as fodder in Greece. On account of its strong smell it must, however, be mixed with other plants. The seeds also have a strong, peculiar smell, and an oily, bitter taste; the flour made from them is used for emollient poultices, but only in veterinary practice. The

seeds of Fenugreek were formerly held in great esteem in medicine, and are still largely consumed by women in the East, especially in Egypt. An Indian species (*T. incisum*) is used as fodder, and the legumes of another (*T. esculenta*) are esteemed as food.

Fenwick, Sir John, was born about 1645, and, after serving in the army, in 1688 entered parliament as Tory member for Northumberland. He afterwards entered ardently into the conspiracy known as the Assassination Plot (see Assassination), and in 1696, being committed to the Tower, made an artful confession involving several Whig leaders in the Jacobite intrigues. Since the only witness against him had been spirited out of the country, the Whig party, furious at these charges, secured the passing of a bill of attainder against Fenwick, under which he was beheaded, 28th January 1697.

Feodosia, or Theodosia. See Kaffa.

Feoffment (*infeudare*), the oldest and for a long period the only method for the conveyance of land known in England. Feoffment consisted in the formal conveyance of the land from the feoffor to the feoffee, the former stating distinctly the measure of the estate conferred, whether it was in Fee (q.v.), in tail, or for life. Where no mention of the duration of the estate was made, the gift was presumed to be for life. This conveyance of the land, in order to be complete, required to be accompanied by Livery of Seisin, which was of two kinds—viz. in deed and in law. In the former case, the parties being actually upon the land, the feoffor, by delivery of a twig or a turf, testified his conveyance of the land. In livery in law, the parties being in sight of the land, the feoffor referring to the land gave possession to the feoffee 'in name of seisin.' This mode of feoffment was ineffectual unless the feoffee entered into possession during the life of the feoffor. Livery in deed might be effected by attorney; but livery in law only by the parties themselves. When the practice of embodying the transaction in a deed was introduced it became customary, but not essential, to indorse on the deed the fact that livery of seisin had been made. By the statute of Frauds, passed in 1678, it was declared that no estate created by livery of seisin, unless accompanied by writing, signed by the party or his agent, should be of any effect, except as an estate at will. A feoffment is now void unless accompanied by deed. The law formerly gave so great an effect to a feoffment that a party could in some cases convey a greater estate than he had; the parties wronged by his act being disseised of their estates unless they could recover them by entry on the land or by action. But a feoffment now has no tortious operation. Feoffment was the form adopted for conveying the legal estate in land to trustees or 'feoffees to uses' (see Uses). It must be observed that the practice of feoffment above described, which has existed in England from time immemorial, differed materially from the old form of investiture in use in strictly feudal times, and from that which still prevails in Scotland. In England the transaction was simply a conveyance by the actual holder of the land to a new tenant, testified by certain ceremonies, but requiring no confirmation by the lord to complete it. In Scotland no transfer of heritage is complete without the formal confirmation of the superior; acceptance by the superior, and the performance of the pecuniary services attendant on that acceptance, are still preserved. See the articles Infeftment and Feudal System.

Feræ Naturæ (Lat., 'of a wild nature') is the term given by Roman law to those animals which are wild or not domesticated, including game animals—deer, hares, pheasants, &c. See Game-laws.

Ferdausi. See Firdausi.

Ferdinand the Catholic, V. of Castile, II. of Aragon and Sicily, and III. of Naples, was born at Sos in Aragon, 10th March 1452, the son of John II. of Navarre and Aragon. By his father he was formally associated in the government of Aragon in 1466, and appointed king of Sicily in 1468; in 1469 he married, at Valladolid, Isabella, sister of Henry IV. of Castile. On Henry's death in 1474 most of the nobles refused to acknowledge the legitimacy of his daughter Juana ('La Beltraneja'), and proclaimed Isabella and her husband Ferdinand joint-sovereigns, who, in 1479, emerged victorious from the civil war that ensued. In that year also Ferdinand became king of Aragon on the death of his father, and the two kingdoms of Aragon and Castile were united in the persons of Ferdinand and Isabella; the latter, however, as long as she lived, maintained control and authority in Castilian affairs. The reign that followed is one of the greatest in the history of Spain, which was in a few years advanced to the first rank among the nations by the military, administrative, and diplomatic skill of its sovereigns, and of the distinguished body of ministers and generals that surrounded them.

Ferdinand's political talents found plenty of scope in the distracted condition of affairs which met him on his accession—the kingdom split into factions, feuds raging between the great houses, and robbery and outrage rife in every quarter of the country. The effectual suppression of the banditti he accomplished by reorganising the *santa hermandad*, or 'holy brotherhood,' a kind of militia-police, composed of the citizens and the country-people. Moreover, a principal aim of Ferdinand and Isabella was to break the power of the feudal aristocracy, and good use was made of the *hermandad* in carrying out this design. The establishment of the Inquisition in 1478–80, although primarily and mainly intended to further 'religious' ends, likewise helped to lessen the nobles' influence; and Ferdinand also strengthened his power by vesting in himself and his successors the grand-mastership of the military orders of Calatrava, Alcantara, and Santiago. In all his schemes he was ably seconded by his queen and by the celebrated Cardinal Ximenes.

The year 1492 was the most brilliant in his reign. It opened with the fall of Granada, which marked the end of the long struggle with the Moors; and in August Columbus set sail from Palos. Although the free exercise of their religion was guaranteed to the Moors, an edict for the expulsion of the Jews from the conquered kingdom was immediately signed; and, a few years after, the privileges secured to the Moors were treacherously withdrawn, baptism or exile being offered as alternatives. By these two barbarous and unwise acts the most industrious and civilised inhabitants of the Peninsula were driven from it. The discovery of America, however, for a time gave Spain almost unchallenged supremacy along both shores of the Atlantic, and Ferdinand turned his attention to European affairs. From France he recovered by treaty the counties of Rousillon and Cerdagne (now the Pyrénées Orientales), which his father had mortgaged to Louis XI.; in 1495 he formed the Holy League, with the pope, the emperor, and the states of Milan and Venice (Henry VII. of England was persuaded to enter the league nearly sixteen months later), under which Gonsalvo de Cordova drove the French out of Naples; and in 1500–1 the French king was induced to join him in

the conquest and partition of Naples, only to be overreached by the Catholic king, and compelled to yield up the kingdom to him entirely three years later.

In 1504 Isabella died, and Ferdinand at once had his insane daughter Juana proclaimed queen of Castile, and himself regent; but Juana's husband, the Archduke Philip of Austria, threatening an appeal to arms, the king threw up the regency, and in 1505 married Germaine de Foix, a niece of Louis XII. of France. Philip died in September 1506, only three months after his landing in Castile; whereupon Ferdinand resumed the administration, which he retained till his death, although his position was greatly changed after Isabella's death, and he was compelled to reverse all his former policy—make an alliance with France, and buy off French claims on Naples—besides being frequently in great straits for money, so that he was for some time unable to send the second portion of the dowry required to secure the marriage of his daughter Catharine with Henry, Prince of Wales. Nevertheless, he took part in the famous league of Cambrai formed against Venice in 1508, conquered Oran in Africa in 1509, and in 1512 seized a favourable opportunity to make himself master of the long-coveted kingdom of Navarre—thus becoming monarch of Spain from the Pyrenees to the Rock of Gibraltar. He died at Madrigalejo, 23d January 1516, and was succeeded by his grandson, best known in history as the Emperor Charles V. Ferdinand's ability, both as a general and as a statesman, has been variously estimated; but at least his skill and shrewdness as a negotiator were unsurpassed in an age of cunning and unscrupulous diplomatists. A characteristic anecdote relates that, on hearing of a complaint made by Louis XII. that he had cheated him once, he promptly answered: 'He lied, the drunkard! I cheated him three times.' Yet to Ferdinand and Isabella Spain owes her unity and greatness as a nation, and under them the foundations were laid of the unrivalled and imperial influence which, in the brilliant reign of their successor, she exercised over Europe. See Prescott's *History of the Reign of Ferdinand and Isabella* (3 vols. Boston, 1838).

Ferdinand I., German emperor from 1556 to 1564, was born at Alcala in Spain in 1503. He was the son of Philip I., and brother of Charles V., whom he succeeded in the empire in 1556, having been previously elected king of the Romans (1531). Already, in 1521, Ferdinand had married Anna, daughter of Ladislaus, king of Bohemia and Hungary; and when her brother Louis fell in 1526 in battle with the Turks, leaving no issue, he claimed the crown in right of his wife. This involved him in a long and bloody struggle with a rival, John Zápolya, who laid claim to Hungary, and who, as well as his son Sigismund, was supported by Soliman, sultan of the Turks. Ferdinand at last gained the upper hand, bought off the Turks by a yearly tribute, and finally secured Hungary and Bohemia to the House of Austria. When he was elected emperor the concessions he had made to the Protestants caused the pope, Paul IV., to refuse to acknowledge him. That pope dying, his successor, Pius IV., was more complaisant; but the electors resolved that for the future the consent of the pope should not be asked; and this was carried out. Ferdinand made several attempts to reconcile his Protestant and Catholic subjects, and urged, though fruitlessly, the reformation of abuses on the Council of Trent. He died in 1564, leaving the reputation of a prudent and enlightened ruler, and was succeeded by his son Maximilian II. See Bucholtz, *Geschichte der Regierung Ferdinands I.* (9 vols. Vienna, 1831–38).

Ferdinand II., German emperor from 1619 to 1637, was born at Gratz, 9th July 1578. He was grandson of Ferdinand I., his father being Charles, Archduke of Carinthia and Styria, the younger brother of Maximilian. His mother, Maria of Bavaria, early inspired him with hatred against the Protestants, and he was educated by the Jesuits at Ingolstadt, along with Maximilian of Bavaria. It is said that at Loretto he took a solemn oath before the altar of the Mother of God to reinstate Catholicism as the sole religion of his dominions at any cost. As soon as he succeeded to the government of his own duchy of Styria, he set about putting down Protestantism by force. He attempted the same in Bohemia and Hungary, of which countries he had been elected king during the lifetime of his cousin, the childless emperor Matthias; but though at first unsuccessful, and even in danger of losing his dominions, he ultimately managed, with the aid of the Catholic League and of the Elector John George I. of Saxony, to subdue them. Bohemia lost all its privileges, and by merciless hanging, confiscation of property, and the banishment of innumerable families, was reduced to obedience, while by the introduction of the Jesuits, and rigorous persecution of Protestants, he re-established Catholicism. His measures were less entirely successful in Hungary. Meanwhile Ferdinand had been elected emperor of Germany (1619). The war that had already been begun was now transferred to a wider area, and took the character of a religious war—the famous 'Thirty Years' War' (q.v.). The two imperial generals, Tilly and Wallenstein, were opposed by a confederacy of the Protestant states of Lower Saxony, with Christian IV. of Denmark at their head; but the confederates were defeated by Tilly at the battle of Lutter, in Brunswick, and forced to conclude peace at Lübeck in 1629. Confident in the ascendency which he had acquired, Ferdinand in the same year issued an edict of restitution for the whole of Germany, taking away from the Protestants nearly all the rights they had acquired by a century of struggles; and the troops of Wallenstein and of the League were immediately set to work to carry out this edict in several places. But his further success was soon arrested by the dismissal of Wallenstein, on which the diet of the empire at Ratisbon had insisted, by the opposition of Richelieu, and by the arrival upon the troubled scene of the great Protestant hero, Gustavus Adolphus of Sweden. After the murder of Wallenstein, at which the jealous Ferdinand connived to his eternal disgrace, the imperial commander, Gallas, by the victory of Nordlingen (1634) detached Saxony from the Swedish alliance; but the ability of the Swedish generals, for whom Austria had none that were a match, and the open part that France now took in the contest, brought back the balance of victory so far to the Protestant arms, that ere the wretched Ferdinand died, February 15, 1637, he had lost all hope of ever attaining the object he had pursued with such unreasoning and relentless constancy. His reign is one of the most disastrous in history; for Germany owes him nothing but bloodshed, misery, and desolation. See Hurter, *Geschichte Ferdinands II.* (11 vols. Schaffh. 1850–64).

Ferdinand III., German emperor from 1637 to 1657, was the son of Ferdinand II., and was born at Gratz, 11th July 1608. He was not so much under Jesuitical and Spanish influences as his father. Having accompanied the armies in their campaigns after the death of Wallenstein, he had witnessed the miseries of war, and was inclined for peace; but the conflicting interests of the individual belligerents hindered any unity of view, and made it necessary to proceed with the struggle. Thus was this miserable war protracted, ever

extending in circuit, and increasing in devastation from the growing licentiousness of the soldiery. At last, in 1643, a congress met at Münster to arrange terms of peace, which was concluded in 1648, and is known as the Peace of Westphalia. At the diet of the empire (1653–54), the last presided over by an emperor in person, Ferdinand effected important alterations in the administration of justice. He died 2d April 1657, shortly after concluding an alliance with Poland against Sweden, and was succeeded in the German empire by his son Leopold I.

Ferdinand I., emperor of Austria from 1835 to 1848, was born at Vienna, 19th April 1793, and died at Prague, 29th June 1875. See AUSTRIA.

Ferdinand I., king of the Two Sicilies, was the third son of Charles III. of Spain, and was born 12th January 1751. When his father ascended the Spanish throne in 1759 Ferdinand, though a minor, succeeded him on the Neapolitan throne, under a regency, as Ferdinand IV. After his marriage, in 1768, with Maria Caroline, daughter of the Empress Maria Theresa, he fell completely under her influence, and lost all his former popularity. The queen and her favourite minister Acton (q.v.) ruled the kingdom. Ferdinand joined the coalition of England and Austria against France in 1793, and in 1798 occupied Rome, but soon fled panic-stricken before the French to Sicily on board Nelson's fleet. The French thereupon entered Naples, and set up the short-lived Parthenopean Republic, but were soon obliged to abandon the city and make room for the return of Ferdinand, who contrived to establish his power under the shadow of Nelson's ships. At length, however, in 1801 Ferdinand was forced to enter into a treaty with the First Consul. A subsequent violation of this treaty compelled him in 1806 again to take refuge in Sicily, under the protection of the English. A French army marched into Naples, and took possession of the kingdom, which Napoleon bestowed first on his brother Joseph, and afterwards on Murat. Ferdinand was reinstated by the Congress of Vienna, and entered Naples, after Murat's flight, in June 1815, and in the December of next year united his two states into one, and assumed the title of king of the Two Sicilies. His queen had already died in 1814. He had sworn before his recall to grant a constitution, and a popular movement in 1820 compelled him to renew his pledge, but with the help of an Austrian army the year after he shamefully broke his word and established a rigorous reign of despotism. He died January 4, 1825, and was succeeded by his son Francis I. (died 1830). See Cordy Jeaffreson, *The Queen of Naples and Lord Nelson* (1889); Giglioli, *Naples in 1799* (1903).

Ferdinand II., king of the Two Sicilies, grandson of the preceding, son of Francis I. by his second wife, Isabella Maria of Spain, was born at Palermo, 12th January 1810. He succeeded his father in 1830, and after a brief period of promise soon showed himself as corrupt and worthless a king as his predecessors. His first wife, a daughter of Victor Emmanuel I., dying in 1836, he married Maria Theresa, daughter of the Archduke Charles of Austria, and consequently gave himself more and more up to Austrian counsels, which saw danger for the whole peninsula in liberal measures. Henceforward Naples became the scene of incessant conspiracy, insurrection, bloodshed, and political prosecutions. Ferdinand yielded to the storm of 1848, and granted a constitution to both parts of his dominions, but the Sicilians mistrusted, and with reason, the king's pledges, and declared that he and his family had forfeited the Sicilian crown. Ferdinand followed the constitution so far as to call the promised national parliament together, but quickly dismissed it, impatient of any interference with his authority. He subdued the revolt in Sicily by the inhuman bombardment of its chief cities that earned him the epithet of 'Bomba,' which will live in history to his eternal dishonour. He now completely set aside the new constitution, while all who had taken any part in state reforms were subjected to those cruel persecutions which the Letters of Mr Gladstone in 1851 held up to the execration of the world. Bomba died 22d May 1859, and was succeeded by his son Francis II. (1836–94), the weak and cowardly 'Bombino,' whose reign of cruelty quickly fell before the victorious enthusiasm of Garibaldi and the triumphant progress of Italian unity. See Nisco, *Ferdinando II.* (Naples 1884).

Ferdinand III., Grand-duke of Tuscany, and Archduke of Austria, was born at Florence, 6th May 1769. On his father's succeeding his own brother on the imperial throne in 1790, he succeeded to the government of Tuscany. Here he inaugurated many judicial, economical, and legislative reforms; encouraged commerce, founded hospitals, and opened up good roads through the state. A lover of peaceful progress, he remained strictly neutral in the first coalition against France, and was the first sovereign in Europe to recognise and treat diplomatically with the French Republic in 1792. Next year the combined menaces of Russia and England constrained him to relinquish his neutral policy and become a passive member of the coalition formed against France, but on the French occupation of Piedmont in 1795 he speedily resumed friendly relations with France. In 1797, in order to save his states from annexation to the Cisalpine Republic, Ferdinand concluded a treaty with Bonaparte on most unfavourable terms, undertaking to pay a war-levy to France, and to transfer to the Museum of Paris some of the chief masterpieces of the Florentine galleries, among them the 'Venus de' Medici.' The continued intrigues of France in his states drove him into an Austrian alliance, which furnished Bonaparte with a pretext for declaring war simultaneously against Austria and Tuscany, and in 1801, at the peace of Lunéville, Ferdinand was forced to renounce all claim on Tuscany. The peace of Paris, however, reinstated him in Tuscany in 1814, and even restored his art-treasures. He died 17th June 1824.

Ferdusi. See FIRDAUSI.

Ferentino, a town of Italy, 55 miles by rail SE. of Rome. Portions of its ancient limestone walls are in the cyclopean style. Pop. 10,000.

Ferghana, a province in the SE. of Russian Turkestan, adjoining Eastern Turkestan, was formed in 1876 out of the khanate of Khokand (q.v.); area, 55,000 sq. m. In the N. are the Ferghana and Tchatkal ranges (part of the Tian-Shan); in the middle the lofty Alai Mountains and plateau and the Trans-Alai Mountains, with Kaufmann Peak (over 25,000 ft.); in the S. the Pamir (q.v.) covers 20,000 sq. m. The Syr-Daria traverses northern Ferghana, now the great cotton region of Russian Turkestan, and by irrigation canals fertilises a plain of some 13,000 sq. m. The population exceeds 2,000,000, more than half being Sarts, one-fourth Uzbegs, the rest Kirghiz, Tajiks, &c., and a few Russians and Jews. The chief towns are the capital Skobelef or New Marghilan (pop. 16,000), Khokand (105,000), Old Marghilan; Namangan and Andijan (Transcaspian railway termini); and Osh (50,000). See TURKESTAN.

Ferguson, ADAM, a Scottish philosopher and historian, was born 20th June 1723 at Logierait, in Perthshire, of which parish his father was minister. He studied at the universities of St Andrews and Edinburgh, and was appointed in 1745 for his

knowledge of Gaelic chaplain to the famous Black Watch, in which capacity he was present at the battle of Fontenoy, and is said to have charged the enemy sword in hand among the foremost. In 1757 he succeeded David Hume as keeper of the Advocates' Library in Edinburgh, and was next appointed professor in the Edinburgh University, first of Natural Philosophy (1759), and subsequently (1764) of Moral Philosophy—a subject much more to his mind. While holding this office he accompanied the young Earl of Chesterfield (1774) on his travels on the Continent, and acted as secretary to the commission sent out by Lord North to try to arrange the disputes between the North American colonies and the mother-country (1778–79). The state of his health compelled him in 1785 to resign his professorship, in which he was succeeded by Dugald Stewart, who had previously been his deputy; but he was appointed to Dugald Stewart's own chair of Mathematics, and allowed to discharge its duties through Playfair. He next travelled on the Continent, and after his return lived a while at Neidpath Castle in Tweeddale, then farmed fourteen years at Hallyards in the vicinity. His last years he spent at St Andrews, where he died 22d February 1816. Ferguson gave up at fifty the convivialities of his time, and reaped the benefit in the unusual health and mental vigour he enjoyed to the last. Scott and Lord Cockburn have left graphic descriptions of the fine old man that reveal a love for his own virtues no less than mere admiration for a monument of the past. It was in his house that the boy Scott had his one memorable glimpse of Burns. Ferguson's writings are his *Essay on Civil Society* (1766), *Institutes of Moral Philosophy* (1772), *History of the Progress and Termination of the Roman Republic* (1782), and *Principles of Moral and Political Science* (1792). His *History of the Roman Republic* was long a standard authority on its subject, was translated into both French and German, and was recommended by Carlyle in his rectorial address at Edinburgh as 'particularly well worth reading.' See Memoir by John Small (1864).

Ferguson, James, a self-taught Scottish astronomer, was born near Rothiemay, in Banffshire, 25th April 1710. His father being a poor day-labourer, he enjoyed only three months of instruction at school, and his subsequent acquirements were the result of his own insatiable thirst for knowledge. His natural bent was chiefly towards practical mechanics and astronomy; and while keeping sheep, to which he was sent at ten, he was constantly busy in making models of spinning-wheels and mills, and at night in mapping the stars with a stretched thread and beads strung upon it. After working some years at cleaning clocks, making sun-dials, and the like, he took to drawing patterns for embroidery and copying pictures and prints with pen and ink. He then supported himself and his parents by drawing portraits, first in Edinburgh, and after their death in London; his leisure time being all the while given to making orreries, and to other astronomical pursuits. In 1748 he began lecturing on astronomy and mechanics with great acceptance. In 1761 he received from George III. a pension of £50, and he was elected F.R.S. two years later. He now gave up portraits, and devoted himself to lecturing throughout the country, and to writing on his favourite subjects with an assiduity unbroken by unhappy domestic circumstances. He died in London, 16th November 1776. Ferguson's principal works are *Astronomy explained upon Sir Isaac Newton's Principles* (1756; 13th ed. revised by Sir David Brewster, 2 vols. 1811), and *Lectures on Mechanics, Hydrostatics, Pneumatics, and Optics* (1760; also edited by Brewster, 1805). See the Life by Dr Ebenezer Henderson, with an Autobiography (1867; 2d ed. 1870).

Ferguson, Patrick, inventor of the breech-loading rifle, was born in 1744 at Pitfour, Aberdeenshire, and, entering the army in 1759, served in Germany and Tobago. In 1776 he patented his rifle, firing seven shots a minute, and sighted for ranges of from 100 to 500 yards; and with it he armed a corps of loyalists, who helped at the battle of Brandywine (1777) to defeat the American army. He himself had a chance there of picking off an officer, but 'let him alone, disgusted with the idea of firing at the back of an unoffending individual, who was acquitting himself very coolly of his duty.' Next day he learned that the officer was Washington. Three years later, on October 7, 1780, Major Ferguson fell, defending King's Mountain, South Carolina, with 800 militia against 1300 Americans. This affair, which was not unlike that of Majuba Hill, turned the tide of southern warfare. See James Ferguson's *Two Scottish Soldiers* (Aberdeen, 1888).

Ferguson, Robert, the 'Plotter,' was born about 1637, near Alford, in Aberdeenshire, and in 1662 was ousted as a Presbyterian from the Kentish vicarage of Godmersham. As Shaftesbury's right hand, as Monmouth's 'evil genius,' he played for ten years a leading part in every treasonable scheme against the last two Stuart kings, and twice had to flee the kingdom. But after the Revolution, of which in 1706 he published a History, he changed sides, and conspired as busily for the losing Jacobite cause. He died, wretchedly poor, in 1714. His younger brother, James, commanded a brigade at Blenheim, and died very suddenly at Bois-le-Duc in 1705. See *Ferguson the Plotter* (1887), by James Ferguson, and his *Two Scottish Soldiers* (1888).

Ferguson, Sir Samuel, poet and Celtic scholar, was born at Belfast in 1810, educated at Trinity College, Dublin, and called to the bar in 1838. He gave himself more to Irish antiquities than to law, and in 1867 was appointed the first Deputy-keeper of Records in the Four Courts, in which capacity his qualities of organisation and arrangement were conspicuous. As president of the Royal Irish Academy he gave a powerful impetus to the scientific study of early Irish art, and its *Transactions* contain many invaluable papers from his pen. In 1878 he was knighted, and on 9th August 1886 he passed away (see the Life by his wife, 1896). His musical and spirited poems, steeped in the truest patriotism, early began to appear in *Blackwood's*, the *Dublin University Magazine*, &c.; *The Forging of the Anchor* (1831); *Lays of the Western Gael* (1865); *Congal, a Poem in Five Books* (1872); *Poems* (1880). His edition of the *Leabhar Breac* appeared in 1876; his *Ogham Inscriptions* in 1887.

Fergusson, James, D.C.L., F.R.S., 'the historian of architecture,' was born at Ayr in 1808, and after spending some years as an indigo-planter in Bengal, explored nearly every corner of India, sketching and studying the rock-temples, which were illustrated in his earliest works. His invaluable *History of Architecture* (4 vols. 1865–76; 3d ed. 1894), appeared first as a *Handbook* in 1855. He published works on fortification and on the defences of Portsmouth, and was a member of the Royal Commission on the defences of the United Kingdom. His other works include *The Palaces of Nineveh and Persepolis Restored* (1851), *Tree and Serpent Worship* (1869), and a *History of Rude Stone Monuments* (1872). He died 9th January 1886.

Fergusson, Robert, a Scottish poet, was born at Edinburgh, 5th September 1750, the third son of an industrious clerk from Aberdeenshire. A bursary for boys of his name enabled him to get

a good education at Dundee grammar-school and St Andrews University, where he took to writing verses, and discovered his disinclination for the clerical life to which he had been destined. Medicine proving equally distasteful, he found employment at Edinburgh in the office of the commissary clerk, contributing the while to *Ruddiman's Weekly Magazine* poems which quickly gained him such local reputation as unhappily proved his ruin. His society was eagerly sought, and in that convivial time he was led into excesses which permanently injured his health. At last he fell into a religious melancholy, which became complete insanity after an injury to the head received in a fall down-stairs. He died on the 16th October 1774, and was buried in the Canongate churchyard, where fifteen years later Burns, at his own expense, erected a memorial-stone with a poetical inscription over his grave. His poems were collected in 1773. There are editions by T. Ruddiman (1779), D. Irving (1800), Robert Chambers (1840), A. B. Grosart (1851), and Ford (1905). As a poet Fergusson possessed vigour, fancy, fluency in versification, and an original vein of comic humour, but lacked imagination, energy, and passion. Such poems as 'The King's Birthday,' 'Braid Claith,' and 'Leith Races' are remarkably happy in hitting off the ludicrous side of local manners; 'The Farmer's Ingle' has a more lasting interest as the prototype of 'The Cottar's Saturday Night.' Burns had an admiration for 'his elder brother in the Muses' out of proportion to his merits. Grosart's monograph (1897) is too eulogistic. See Fairley's *Bibliography* (1916).

Fergusson, Sir William, surgeon, was born at Prestonpans, Scotland, on 20th March 1808. He studied medicine in the schools of Edinburgh, and was subsequently (1836) elected a surgeon in the infirmary. But in 1840 he left Edinburgh for London, having accepted the chair of Surgery in King's College, together with the post of surgeon in the hospital attached to the college. In 1866 he was made a baronet, in 1867 serjeant-surgeon to the Queen, and in 1870 he became president of the Royal College of Surgeons, London. He died in London on 10th February 1877. As a surgeon he proved himself a fit rival to Liston and Syme, performing his operations with great boldness, skill, celerity, and coolness. He especially distinguished himself in cases of stone, cleft palate, diseased leg and arm bones, diseased jaw, tumour, and hare-lip. See H. Smith, *Sir W. Fergusson, a Biographical Sketch* (Lond. 1877).

Feriæ, the ancient Roman term for holy days during which political and legal transactions were suspended, and slaves enjoyed a cessation from labour. Feriæ were thus *dies nefasti*, the opposite of the *dies fasti*. Days which were consecrated to a particular divinity, on which any public ceremony was celebrated, and the like, were feriæ. In contradistinction to these, which were *feriæ publicæ* or public holidays, there were *feriæ privatæ*, which were observed by single families in commemoration of some particular occurrence of importance to them or their ancestors. Birthdays, days of purification after a funeral, and the like, were also observed as family feriæ. See Fasti.

Feringhee, a name applied in the East to Europeans, whose land is vaguely called *Feringistan*. The term is a corruption of Frank, and dates from the Crusades.—In Bengal the mixed descendants of the Portuguese, while differing only in religion from the natives, are especially distinguished by the title of *Firinghis*.

Ferishtah. Mohammad Kasim Hindu Shah Firishta, or Ferishtah, a celebrated Persian historian, was born about the middle of the 16th century, at Astrabad, on the Caspian Sea. At a very early age he went with his father to India, where we find him, when twelve years old, at Ahmednagar, in the Deccan. Here he afterwards became captain in the bodyguard of Murtaza Nizam Shah; and when this king was deposed by his own son, Ferishtah went to Bijapur (998 A.H., 1589 A.D.), where the reigning monarch received him with great honour. His death is supposed to have taken place shortly after the year 1612. His great work is the *Tarîkh-i-Firishta*, or History of the Mohammedan power in India, which he finished in 1018 A.H. (1609 A.D.). Twenty years were spent in its preparation, and, according to Ferishtah himself, thirty-five books were used for and partly embodied in it.

Ferman'agh, a county of Northern Ireland, in the south-west of Ulster, 45 miles long by 29 broad; area, 714 sq. m., of which 166 are arable, 368 pasture, about 100 uncultivable, and 72 water (including Upper and Lower Lough Erne). The surface is mostly a succession of mountains and hills, culminating in Cuilcagh (2188 feet); the rocks include limestone, with many cavities and underground watercourses, Millstone Grit, and Old Red Sandstone. Some coal, iron, and marble occur. The principle river is the Erne, which traverses the county in the direction of its longest axis. The soil in the low grounds is a deep rich loam, but in the limestone and sandstone districts it is cold and thin. The climate is mild and moist, though healthy. The chief products are oats, barley, wheat, potatoes, turnips, and hay; the chief exports, oats, butter, and eggs; and a little coarse linen is manufactured. Fermanagh returns two members to Westminster, and, with Tyrone, seven to Belfast. Pop. (1851) 116,047; (1871) 92,794; (1901) 65,443; (1911) 61,836, more than half Roman Catholics. Enniskillen is the county town. Among the antiquities are a round tower and St Mary's Abbey on an island in Lough Erne, Danish raths, and ruined castles.

Fermat, Pierre de, a French mathematician, was born at Beaumont de Lomagne, near Montauban, in 1601, and at an early period, in conjunction with his friend Pascal, hit upon a very ingenious mode of considering figurate numbers, upon which he subsequently based his doctrine of the calculation of probabilities. Fermat employed himself greatly with the properties of numbers, and made many acute discoveries in regard to their composition and analysis. He also squared the parabola in a much simpler way than Archimedes at an earlier period had done, and made many other discoveries in geometry. His method of finding the greatest and least ordinates of curved lines was analogous to the method of the then unknown differential calculus. In addition to his scientific attainments Fermat possessed an extraordinary knowledge of ancient and modern languages. He died at Toulouse, 12th January 1665. A collection of Fermat's works appeared at Paris in 1670–79.

Fermentation. — The term fermentation (Latin, *fervēre*, to boil) was originally applied to all chemical processes which were accompanied by frothing or effervescence due to the escape of gas from a liquid, and it was only after the discovery and discrimination of the various kinds of gas, in the time of Priestley, that the word 'fermentation' was limited to alcoholic fermentation—the mysterious change which occurred spontaneously when liquids containing sugar were exposed to the air, or could be artificially induced, as in brewing, by the introduction of yeast into the saccharine extract. Fermentation was regarded as a purely chemical process, and yeast as a chemical precipitate; even after the discovery in 1837 that yeast was a living organism (see Germ Theory), Liebig long maintained the current opinion, until van-

quished by the new facts revealed by the researches of Pasteur (1857–60). The great French investigator showed that just as alcoholic fermentation—the conversion of sugar into alcohol and carbon dioxide—was caused by yeast, so many other characteristic changes undergone by organic matter were also caused by micro-organisms. To take a familiar instance, the souring of milk, due to the production of lactic acid from the milk-sugar, was termed the lactic acid fermentation, and was traced to the agency of a bacillus which was termed the lactic acid ferment. The less familiar production of butyric acid from milk by the aid of rancid cheese was also traced to a bacillus—the butyric acid ferment—and the idea was established that many different micro-organisms existed, each capable of bringing about a characteristic chemical change or fermentation. All these agents were living organisms, and were therefore termed *organised ferments*. Their effects followed on the introduction of a minute trace of the living material, were accompanied by the growth and ceased with the death of the organism, and were generally recognised as being inseparable from the vital manifestations of the cell. 'Without life, no fermentation,' was the dictum of Pasteur, which summed up the opinion of the scientific world almost to the end of the 19th century.

Other remarkable changes had, however, long been known which were brought about by materials elaborated in plants and animals, and were also characterised by the facts that a very large amount of change could be effected by a very small amount of the material and that the agent was destroyed by heat. Such were the digestion of meat by the Pepsin (q.v.) of the stomach, the conversion of starch into sugar by the Diastase (q.v.) of malt, and the 'inversion' of cane-sugar by the invertase of yeast. In these cases, however, the agents could be extracted from the organisms in which they were produced, and were termed at first *unorganised ferments* and later (Kühne) *enzymes* (Greek—in leaven or yeast).

The sharp distinction drawn between agents producing very similar effects seemed to many minds improbable, and the theory was advanced (Traube, 1858) that all these actions were really due to enzymes, which in the case of the organised ferments could not readily be separated from the cells of the organism. Experimental proof of this theory was, however, lacking until E. Buchner in 1897 succeeded in preparing from yeast a liquid which, in the complete absence of all living cells, was capable of bringing about the alcoholic fermentation of sugar. Evidence of a similar, if somewhat less cogent, nature was later found to show that the characteristic effects of certain bacteria (the lactic and acetic fermentations) were also due to the presence of enzymes, and the result of Buchner's classical experiment has been that we are now able to say with some degree of confidence that the fermentations produced by living organisms are brought about by the aid of enzymes (or ferments).

Nature and Mode of Action of Enzymes.—Many chemical changes are known in which simple inorganic substances play a part closely analogous to that taken by the more complex enzymes in the chemical transformations which proceed in living organisms. Such substances are termed *catalysts*, and their action, known as *catalysis*, is characterised, like that of enzymes, by the facts: (1) that they remain unchanged at the end of the transformation, and (2) that they bring about a very large amount of change relatively to their own weight or chemical equivalent. A single instance will suffice to illustrate the relations which exist. A solution of cane-sugar, when kept free from living organisms, may be preserved indefinitely or may be boiled without undergoing any measurable degree of change. If, however, a small quantity of a strong acid, such as hydrochloric acid or sulphuric acid, be added, a remarkable change occurs slowly in the cold, very rapidly on heating, which results in the complete decomposition of the cane-sugar and the production of two new simple sugars known as grape-sugar (glucose) and fruit-sugar (fructose). The acid which has been added still remains in the solution unaltered, and can if necessary be removed by suitable means and used over and over again. In this case catalysis has been effected by a simple substance of perfectly well-known composition and constitution. Precisely the same change can be produced in the solution of cane-sugar by the action of an extract prepared from yeast, the cells of which have previously been killed. If this material be used, the solution cannot be boiled, as the agent is destroyed by heat. At temperatures of about 30°–50° C. (86°–122° F.), however, the change goes on rapidly and leads to the same result as when acid is used and the solution boiled. Moreover, the agent contained in the yeast extract can be separated from the resulting mixture of grape and fruit sugars (by dialysis) and used over and over again. The yeast extract, or some constituent of it, has in this case played precisely the part of the acid in the former experiment, i.e. it has acted as a catalyst.

Here, however, a very important point must be noticed. Whereas the acid added is a well-known simple chemical substance, the yeast extract is a mixture of different substances, some of a very complex and up to the present unknown constitution. Experiment has shown that the catalytic power is associated with some substance contained in the extract which has several properties, by the aid of which it can be roughly separated from the other constituents of the mixture. Thus it can be precipitated by alcohol, and when dissolved in water will not pass through parchment paper. In this way a concentrated preparation can be obtained which has the original catalytic properties of the extract. This preparation and the original extract are both said to contain the enzyme, but it has so far proved impossible to isolate the enzyme and recognise it as a definite pure chemical compound. It remains known to us only by its power of producing the characteristic change in cane-sugar solution. This is true, at the moment, of all enzymes, and the various preparations made and sold as enzymes and ferments (such, e.g., as pepsin, trypsin, pancreatin, &c.) are simply mixtures which bring about certain characteristic changes and, presumably, contain more or less of the enzyme in question. The enzymes themselves still remain unknown to us.

The conditions of animal and vegetable life impose a very remarkable limitation on all chemical changes which proceed in living organisms. The temperature must not rise beyond a certain comparatively low point, and no strong acids or alkalis or other powerful reagents can be employed, since, with few exceptions, living cells are killed at a temperature of about 50°–60° C. (122°–140° F.), and are rapidly destroyed by acids and alkalis. Hence we find that in living cells agents (the enzymes) are present, by means of which the most complex chemical changes can be brought about at low temperatures, the imitation of which in the laboratory by the aid of ordinary chemical methods often involves the use of high temperatures and powerful reagents which would be instantly fatal to life. Enzymes, therefore, are the agents by which chemical changes are brought about in living organisms. These chemical changes are of two chief kinds, since, in all living matter, two processes are constantly proceeding—the forma-

tion of the complex material of the cell from simple substances (termed chemically synthesis, or physiologically anabolism), and the decomposition or breaking down of these complex materials into simple substances which are excreted (termed chemically analysis, and physiologically katabolism).

Enzymes are active in bringing about changes of both kinds, and in very many cases it has actually been proved that the same enzyme can produce a change in either direction according to the conditions which prevail. Thus the same enzyme (lipase) which, in the process of digestion in the animal intestine, converts emulsified fats into glycerol and fatty acid, can also produce the reverse change, and from fatty acids and glycerol build up fat, the condition necessary for this second change being the presence of a relatively large proportion of glycerol and only a small proportion of water.

Extraction of Enzymes.—Enzymes are, as a rule, secreted by special cells, and in some cases pass out of the cell and become mixed with the material upon which their activity is to be exerted. In other cases they remain within the cell, but can frequently be extracted by means of water, glycerol, or dilute acids. It is usually necessary to kill the cell before carrying out such extractions, and in some cases the enzyme can only be removed by rupturing the wall of the cell by grinding with sand and pressing out the contents.

Types of Fermentation or Enzyme Action.—The changes which are brought about by the aid of enzymes comprise practically the whole series of chemical transformations which occur in living organisms, and it is therefore not surprising to find that a very large number of enzymes are known. Each enzyme is only capable of bringing about one kind of change, and, further, can only affect one particular class of substances chemically very closely allied, or, in some cases, only a single substance. They differ in this respect most markedly from inorganic catalysts, by the aid of many of which the most diverse substances can be attacked. The process of digestion affords many instances of this difference. Three constituents of food—fats, proteins, and starch—are all broken up into simple products by the digestive enzymes before being absorbed. In the body a special enzyme, or rather series of enzymes, is required for each of these substances; the fat-splitting enzyme (lipase) has no action on starch or protein, the enzyme which saccharifies starch (diastase) has no effect on fat or protein, and those which digest protein (pepsin, trypsin) leave both fat and starch unaltered. Chemically all these three substances can be broken up by one method—boiling with acid—the products being essentially the same whether enzyme or acid be used. So far does this specialisation go, that even the different sugars, e.g. milk-sugar and cane-sugar, require different enzymes (lactase and invertase) for their decomposition, lactase being quite without action on cane-sugar, and invertase quite indifferent to milk-sugar.

I.—The first great group of enzymes comprises those concerned in the breaking up of complex substances by addition of water into simple compounds, a process termed *hydrolysis* (Greek, 'breaking up by water'); $AB + H_2O = A{\cdot}OH + BH$, or conversely, building up complex substances from simple constituents with removal of water $A{\cdot}OH + BH = AB + H_2O$, a chemical change known as *condensation*.

Reference has already been made to some of these enzymes. Lipase, which decomposes fats into glycerol and a fatty acid, occurs in the animal body (see DIGESTION), and in a large number of seeds in which it decomposes the reserve of fat and renders it assimilable by the growing seedling. The lipase of the castor-oil bean is used on a large scale for the decomposition of fats for soap-making. The enzymes which act on the carbohydrates (sugars and substances which yield sugars when hydrolysed) are extremely numerous, and occur both in the animal body and in seeds, and are widely distributed in plants. Among them are Diastase (q.v.), which converts starch into the sugar known as maltose, invertase, and lactase, which respectively decompose cane-sugar and milk-sugar, maltase and many others. The enzymic decomposition of the proteins is a very complicated process (see DIGESTION), which probably involves the successive action of a considerable number of enzymes. The best known are Pepsin (q.v.), which occurs in the stomach and only acts in acid solution, and trypsin, which is found in the animal intestine and produces its effect in an alkaline medium.

II.—A second group of enzymes brings about a change, the nature of which is not quite understood, although the change itself is of the greatest importance. These are the coagulating enzymes or *coagulases*. The effects of two of these are very familiar. The first causes the formation of a curd in milk, and is known as Rennet (q.v.) or rennin. The second, known as thrombase, produces the coagulation of the blood, a soluble constituent of which (fibrinogen) is converted into an insoluble form (fibrin), a clot being thus formed. A third enzyme of this group is known as *pectase*, and is of great importance in vegetable life, since it assists in the building up of the skeleton of plants.

III.—A fundamentally important chemical change, which occurs in both the animal and vegetable organism, is oxidation, a process in which the various tissues and foodstuffs undergo a slow combustion in the oxygen of the air into simple products, with the result that energy is liberated available for the uses of the organism, and ultimately heat is produced. Unfortunately comparatively little is yet known of the exact mechanism by which this complete oxidation is brought about. In both the animal and vegetable organism, however, a number of enzymes have been discovered which have a limited power of oxidation, and can transfer oxygen either from the air or from some compound containing it to the substance undergoing oxidation. In many cases the product of partial oxidation is coloured, familiar instances being the brown colour developed on cut apples or pears, the blackening of leaves injured by frost, the blue colour produced when certain fungi are broken, and the colours of some flowers. Such enzymes are termed *oxydases* and *peroxydases*, and others are known which remove oxygen from its compounds and are called *reducases*.

IV.—Another very widely diffused enzyme has the remarkable function of liberating oxygen in the free state from hydrogen peroxide, and is known as *catalase*. This enyzme occurs in blood and most animal tissues, as well as in plants. Its function is not definitely known, but is probably that of decomposing hydrogen peroxide formed in the various oxidation processes of the living organism. So widely spread is it, in fact, that at one time it was thought that all enzymes had the power of decomposing hydrogen peroxide, and it was only gradually found that this was not the case, but that this property was confined to one specific enzyme.

V.—Enzymes belonging to all the previous groups may, and do, occur not only in the higher plants and animals, but in every form of living cell, however simple. Many organisms which consist of a single cell (unicellular), such as bacteria and yeasts, possess in addition the power of producing

very extensive chemical changes of a somewhat different kind from those already considered. These consist in the rearrangement of the elements of some complex substance in such a way that simple compounds are formed, and, this being the essential point, energy is rendered available for the organism. In some cases the organisms live without oxygen (anaerobic bacteria), and the only source of energy is the fermentation of some constituent of the medium in which they grow. In other cases oxygen plays much the same part as with the higher animals and plants, but the power of fermentation is also exercised.

Alcoholic Fermentation.—Of all the processes of this kind the best known and the most important economically is alcoholic fermentation. This ensues when 'yeast' is introduced into a liquid containing sugar and a supply of nitrogenous nutriment, and kept at a temperature somewhere between 0° and 30° C. (32° and 86° F.).

The Yeast (q.v.) used in brewing is a species of a particular genus (Saccharomyces) of the Fungi. It consists of a single cell, and increases by budding —a small protuberance appearing in the wall of the mother-cell and gradually increasing until a new cell is formed, which ultimately separates. Both cells then form buds, and so the growth continues. A very large number of genera and species belonging botanically to the same family (Saccharomycetaceæ) are known, and many, but not all, of these produce alcoholic fermentation in greater or less intensity. Some species of closely allied organisms belonging to other families (the Torulaceæ and Schizo-saccharomycetaceæ) also possess the power of alcoholic fermentation, which is in addition characteristic of some of the higher fungi (e.g. Mucoraceæ). In all these cases the course of alcoholic fermentation is similar, although the intensity of the process varies very greatly. When a single cell of yeast is introduced into a suitable medium it commences to grow and rapidly increases by budding. During the growth a small proportion of the sugar is used as food for the building up of the tissue of the new cells, but by far the greater part is decomposed into alcohol and carbon dioxide. At the same time the nitrogenous constituents of the medium are decomposed, and the resulting ammonia is assimilated by the organism and built up into the protein constituents of the cell. The other products of decomposition of these nitrogenous materials remain in the medium and are found in all fermented liquors. They consist of various alcohols (fusel oil) and acids (succinic acid, &c.), and are of the highest importance with regard to the taste and smell of the product. It was formerly thought (Pasteur) that these substances were formed from the sugar, but it has now been clearly proved (Felix Ehrlich) that they are derived from the nitrogenous constituents of the medium, and vary according to the nature of this. The flavour of fermented liquors therefore varies with the source of the nitrogenous material employed. The alcohol and carbon dioxide are, however, accompanied by a small and variable proportion of glycerol (about 3 per cent.), which is formed from the sugar. The remainder of the sugar is converted quantitatively into alcohol (51 per cent.) and carbon dioxide (49 per cent.), almost equal weights of the two being formed.

The range of substances which can be fermented by yeast is very limited. With the exception of one or two artificially prepared simple compounds, the only substances directly fermented by yeast are the simple sugars—grape-sugar, fruit-sugar, the less known galactose (derived from milk-sugar), and mannose. In addition to this, however, the naturally occurring more complex sugars (and a few other compounds), which yield the foregoing when boiled with acids, are also fermented. Such are cane-sugar, which yields grape-sugar and fruit-sugar; maltose, yielding grape-sugar alone; milk-sugar, yielding grape-sugar and galactose. With respect to these sugars, however, the different yeasts may vary considerably, some, such as the ordinary brewing yeasts, fermenting cane-sugar and maltose but not milk-sugar, others cane-sugar but neither of the other two, and so with the rest. The reason of this is of great interest. It is that these complex sugars are not directly fermented by yeast, but are first split up into the simple fermentable sugars, in each case by the special enzyme (see *ante*) required. Yeasts which ferment cane-sugar contain invertase, those which do not attack cane-sugar are quite devoid of invertase.

It was early discovered that the whole of the fermentation process occurs inside the yeast-cell, the liquid outside the cells being at all stages of the process incapable of producing fermentation. The sugar diffuses into the cell and there undergoes fermentation, and the alcohol and carbon dioxide diffuse back out of the cell into the surrounding medium, where the alcohol remains, whilst the carbon dioxide, being produced in far greater quantity than is necessary to saturate the liquid, is mainly given off as gas.

All attempts to obtain a preparation from yeast which should ferment sugar in the absence of yeast-cells failed until, in 1897, E. Buchner succeeded by grinding the yeast for a short time with sand and kieselguhr to rupture the cell-membranes, and then removing the liberated cell-juice (cytoplasm) by means of a filter-press. Since then it has been found possible (Lebedev) to obtain a similar preparation in many cases by drying the yeast and then simply digesting with water at about blood heat for a few hours and filtering. Obtained in either way the liquid brings about active fermentation of sugar into alcohol and carbon dioxide, but at a much slower rate than the living yeast from which it was prepared. Thus was decided one of the great scientific controversies of the 19th century—Can fermentation proceed without life? The yeast-juice of Buchner contains the enzyme which brings about alcoholic fermentation, and to this has been given the name *zymase*. Further study of the properties of the juice has, however, shown (Harden and Young, Neuberg) that the process of fermentation is much more complex than had been anticipated from the phenomena exhibited by living yeast. The whole phenomenon is dependent on the presence of mineral phosphates, and cannot proceed in their absence, and the production of carbon dioxide and alcohol probably represents the final stage of a series of reactions. It seems quite certain that the alcohol is formed by addition of hydrogen to preformed acetaldehyde. If this substance is protected from reduction (Neuberg's fixation method) by the addition of sodium sulphite, it is found among the final products, and a corresponding quantity of glycerol is produced by the reduction of another intermediate product. Glycerol was thus manufactured in Germany from starch when the supply of fats failed. Further, yeast-juice is an instance of a peculiarity exhibited by several enzymes. It contains two agents, both of which are required for fermentation. One—termed the enzyme—is more complex than the other, is inactivated by heat like all other enzymes, and cannot pass through parchment paper. The other is of simpler character, is not inactivated by heat, and can readily pass through parchment paper. To indicate its function as a coadjutor of the enzyme it is termed the *co-enzyme*, but its real nature is as little known as that of the enzyme itself. The two can readily be separated and two solutions obtained, neither of

which will ferment sugar, whereas the mixture of the two has a vigorous action.

Bacterial Fermentation.—Many Bacteria (q.v.) produce characteristic fermentations, which are of the most varied type and may affect sugars, fats, proteins, and many comparatively simple compounds. In general, very little is known of the mechanism of these fermentations, but it has been proved in several cases (e.g. lactic acid and acetic acid fermentations) that the organism effects the change by means of an enzyme, and it is probably a fair conclusion that all bacterial fermentations are enzyme actions. Perhaps the best known example is the lactic acid fermentation, in which sugar is converted almost quantitatively into lactic acid. This process is used commercially for the production of lactic acid, and is the chief change which occurs in the souring of milk. The organisms of the butyric fermentation convert sugar into a complex mixture of substances, prominent among which is butyric acid. Some organisms of this class yield a large proportion of butyl alcohol, at one time proposed as a commercial source of rubber, and acetone, prepared during the Great War in this way for use in the production of cordite. The cellulose fermentation, by which the cellulose of vegetable remains is ultimately broken up in the soil into hydrogen or marsh gas (according to the special organism) and carbon dioxide is of great importance as forming one stage in the 'carbon cycle' in nature. Other important fermentations are the oxidation of alcohol to acetic acid (manufacture of vinegar), and the conversion of ammonia in the soil by the aid of oxygen into nitrous acid and ultimately nitrates. The bacterial decomposition of proteins is also effected by many bacteria. It occurs wherever albuminous matter is exposed to infection from the air, and is then known as Putrefaction (q.v.).

Fermo, a town of Italy, is situated on a rocky height 4 miles from the Adriatic, and 36 SSE. of Ancona. It is well built, is surrounded with ancient walls, and has been the seat of an archbishop since 1589. Formerly Fermo possessed a university. Pop. 20,000. Its port, Porto San Giorgio (pop. 5000), on the Adriatic, has some trade in corn, silk, and wool. In the immediate vicinity of Fermo are the ruins of the ancient *Firmum.*

Fermoy, a clean, well-built town in County Cork, Ireland, on the Blackwater, 19 miles NE. of Cork city. Its origin dates from the 12th century, when it was the seat of a Cistercian abbey; but the present town was the creation of a Scottish merchant toward the close of the 18th century. It contains a Catholic cathedral, St Colman's College, and barracks. The river is crossed by a noble stone bridge, erected in 1866. The town has a trade in flour and agricultural produce. The population is about 7000.

Fern. See FERNS.

Fern, MALE, *Aspidium* (*Nephrodium*) *filix-mas,* a name given by old herbalists in contrast to the Lady Fern, *Asplenium* (*Lastræa*) *filix-fœmina,* which, from the aspect of their foliage and common association in woods, they imagined to represent the two sexes. The large subterranean rhizome contains a volatile oil, to which the long-established medicinal value as a vermifuge (particularly in tapeworm) is due.

Fern, SWEET (*Comptonia asplenifolia*), an ill-named shrub of the sweet gale family (Myricaceæ; see CANDLEBERRY, BOG-MYRTLE), a native of the mountain-woods of North America, forming a small bush with linear, pinnatifid, fern-like leaves. Its leaves have a powerful aromatic fragrance when rubbed. It is tonic and astringent, and is used as a domestic remedy for diarrhœa.

Fernandina, a port of entry and capital of Nassau county, Florida, on an island 28 miles NNE. of Jacksonville, forms a terminus of the railway connecting the Atlantic with the Gulf of Mexico, and has a considerable transit trade with the West Indies, Charleston, and Savannah, its shipments of lumber being especially great. It is a popular bathing resort. Pop. 5500.

Fernando Noronha, a volcanic group of one large island (6½ miles by 2) and several small ones, belonging to Brazil, in the South Atlantic, 200 miles ENE. of Cape San Roque. The islands are fertile and thickly wooded. They were visited by Cook in 1775, Darwin in 1832, and the *Challenger* Expedition in 1873.

Fernando Po, an island on the west coast of Africa, in the Bight of Biafra, with an area of 1185 sq. m., forms geologically a continuation of the Cameroon Mountains of the mainland. The island, oblong in shape, with steep, rocky coasts, and disposed in a NNE. direction, is bisected by 2° 39′ N. lat. Its northern half is almost entirely occupied by the volcanic peak (10,000 feet) known to the English as Mount Clarence, to the Spaniards as Pico Santa Isabel; and its southern half contains a short range lying E. and W. The island is covered with luxuriant vegetation. The average annual temperature at Santa Isabel, the capital (pop. 1500), is 78° F. The island is inhabited by the Bubis, a Bantu tribe, and by some negroes. Cocoa, coffee, coconuts, copra, palm-oil, and palm-kernels are the principal products. Discovered by the Portuguese Fernão do Pao in 1472, the island has belonged to Spain (1777–1827), England, and Spain (since 1841). Pop. 12,000.

Ferne Islands. See FARNE ISLANDS.

Ferney, a village in the French department of Ain, 4½ miles NW. of Geneva, and 2 miles W. of the lake. It is celebrated as the place where Voltaire resided during the last years of his life. He purchased the estate in 1758, and from that time was known variously as the seigneur, the philosopher, and the patriarch of Ferney. During these years Voltaire acted as a dictator of letters throughout French-speaking Europe, and his château was a kind of pilgrimage resort for all sorts and conditions of literary and political celebrities.

Ferns (*Filices*), as the most abundant and beautiful, most varied and typical class of higher (i.e. Vascular) Cryptogams, are of special interest alike to the botanist, the horticulturist, and the lover of nature. While Linnæus included under his Filices all the Vascular Cryptogams, since Jussieu the equisetums, rhizocarps, club-mosses, and selaginellas have been separated off as distinct classes (see HORSETAIL, WATER-FERNS, LYCOPODIUM, SELAGINELLA, ISOETES), and by some modern authors the Ophioglosseæ (see MOONWORT) also.

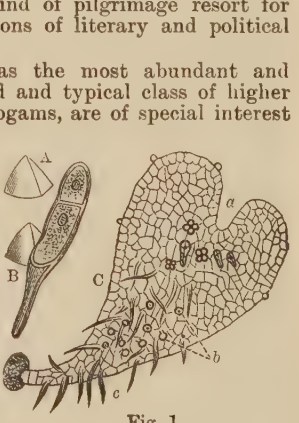


Fig. 1.
Germination of Prothallium: A, spore; B, germinating spore; C, under surface of prothallium, showing archegonia, *a*; antheridia, *b*; rhizoids, *c*.

Since what we familiarly call the fern-plant is only the spore-bearing member of two alternating generations, it is convenient for the comprehension of the life-history of the group, and still more for comparison with that of the other above-named Vascular Cryptogams, and of these with

Gymnosperms (q.v.) and Phanerogams (q.v.), to begin with the minute fern-spore, and trace its history round to the spore again, although necessarily only in the briefest outline. In fig. 1, A, this double-walled and characteristically formed and marked spore is represented; in B it is germinating into a short filament which soon broadens into

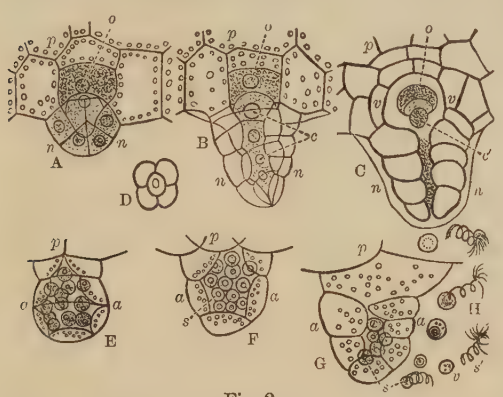


Fig. 2.

A—D, archegonia; A—C, longitudinal sections; D, transverse section of neck; *p*, prothallium; *n*, neck of archegonium; *c*, neck canal cells; *v*, venter of archegonium; *c'*, ventral canal cell; *o*, oosphere. E—G, antheridia in longitudinal section; *p*, prothallium; *a*, antheridium; *s*, spermatocytes. H, spermatozoids, *s'*, escaping from their vesicle, *v*, which contains nutrient substance for developing sperms.

a thin, flat, bilobed cellular expansion, the *prothallus*, C. This develops unicellular root-hairs from the under surface, and grows to a size varying on the average from $\frac{3}{8}$th to $\frac{5}{8}$th of an inch in diameter, resembling most nearly a small thallus of Liverwort (q.v.). It leads a perfectly independent existence, usually for several months, but

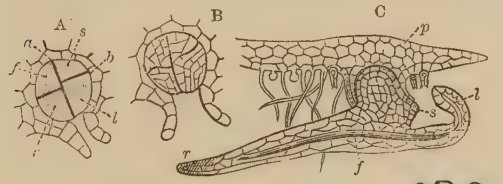


Fig. 3.

A, fertilised oosphere, showing first *a*, and secondly *b*, division-walls, mapping out the inclination of growth of the stem, *s*; foot, *f*; root, *r*; and first leaf, *l*. B, embryo at later stage, C, vertical section through prothallium, *p*; a young fern, *f*; *l*, first leaf; *s*, stem; *r*, root. D, prothallium with young fern attached to it.

sooner or later develops organs of sex, of which both are most commonly present upon the same prothallus. Near the apex of the prothallus we find the female organs or *archegonia*, each archegonium being a flask-shaped group of cells, of which the deepest central cell enlarges greatly to become the ovum, which fills the body of the flask, while those above it undergo mucilaginous degeneration and disappear, so leaving the neck of the flask as an open way of access to the egg-cell from the exterior (fig. 2, A–D). The male organs (*antheridia*) arise as epidermic papillæ among the root-hairs, and divide into spheroidal groups of cells inclosing a large central cell, which soon segments into a group of spermatocytes (see fig. 2, E–G). These undergo maturation, and escape in the ciliated state as free-swimming spermatozoids, which in surface moisture, caused by rain or dew, find their way towards the archegonia. One spermatozoid suffices to fertilise an egg-cell, and, however many archegonia may be fertilised, the small prothallus is only able to bear a single fern-plant. The fertilised ovum segments into four portions (fig. 3, A–B), of which two divide to form the so-called *foot*, by which the young fern remains for a time attached to and nourished by the parent prothallus (fig. 3, C); another goes on dividing to form the first root, while the remaining one gives rise to the stem and leaf. As the fern grows it slowly exhausts the prothallus, which dies off and disappears, and the fern gradually assumes the familiar vegetative development characteristic of the group.

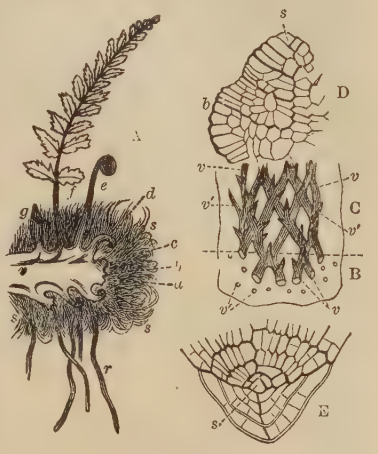


Fig. 4.

A, section along Rhizome of Aspidium, showing vascular bundles, *v*; stages of leaf development from apical buds to dead leaf-stalk, *a—g*; scale hairs, *s*; and roots, *r*. C, tangential section of fern-rhizome, shown partially in transverse section at B, where *v'* represents smaller bundles passing through cortex to the leaves. The main bundles, *v*, anastomose and form the netted cylinder, a portion of which is shown at C. D, tip of developing leaf of Ceratopteris; *s*, apical cell; *b*, lateral lobe of leaf. E, longitudinal section of root-tip of Pteris; *s*, apical cell, root-cap below.

The fern-stem and leaves grow by an apical cell (fig. 4, D); the root-tip, too, has its apical cell, which also develops a root-cap (fig. 4, E). In the mass of embryonic tissue produced by the segmentation of the apical cell we soon distinguish (*a*) an external *dermatogen* layer which

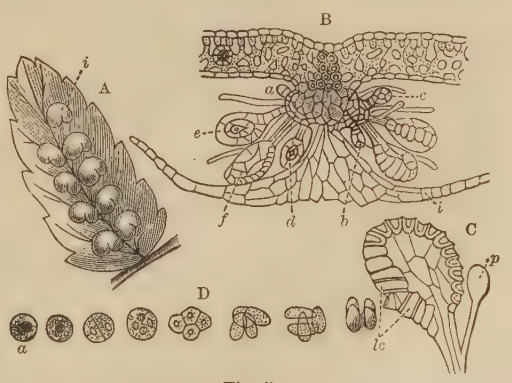


Fig. 5.

A, Under-side of a leaflet of *Aspidium filix-mas*, with sori, *i*. B, transverse section, with a sorus consisting of the sporangia in different stages of development, *a—f*, and the indusium, *i*. C, sporangium, with annulus, and the lip-cells, *lc*, and paraphysis, *p*. D, development of spores from mother-cell, *a*.

gives rise to the epidermis and its outgrowths, (*b*) internal strands of tissue of which many cells undergo characteristic modifications and give rise to the future fibro-vascular bundles, the whole lying imbedded in (*c*) the less modified ground tissue, which for the most part remains parenchy-

matous, but may in part become lengthened and hardened (as sclerenchymatous and prosenchymatous tissue), mainly for the purpose of increased mechanical strength. The fibro-vascular bundles form a meshwork anastomosing where bundles are given off into the leaves; they are closed and definite—i.e. contain no cambium and are consequently incapable of continued growth, save by addition at the growing-point. Their structure is usually concentric, the bast surrounding the wood. The axis forms most commonly a short root-stock; this, however, in some genera grows erect to a considerable height, as in the tree-ferns (see TREE-FERN), and in many species of Pteris, Davallia, Polypodium, &c., the rhizome is long and creeping. The leaves are developed in a close spiral succession just behind the growing-point, and are of slow growth, usually requiring two years to mature. Even in the expanded leaf growth may continue for a long time, the indefinite growth of the twining leaf of Lygodium being only the extreme case of this. Their peculiar *circinate vernation*—i.e. inrolled spiral or crozier-like folding in the bud—is very characteristic, and, as this must arise by a greater growth of the under than the upper surface, so the expansion of the leaf can be readily observed to be due to the gradual reversal of the disproportion, equilibrium being only reached with maturity. The leaf is sometimes entire, but is more frequently pinnate, bipinnate, or decompound: this arises, however, in a somewhat different way from the pinnation of the leaves of phanerogams (see LEAF), being due to a dichotomy with unequal development of either fork alternately. The leaf-stalk or *rachis* is thus a false axis. The mode of origin is well revealed by reference to those tasselled varieties (fig. 6, A) which so frequently appear in widely distinct species in cultivation, exuberantly vegetative conditions admitting of the almost equal development of many successive secondary axes.

Fig. 6

A, Tasselled variety of Male Fern (*A. filix-mas*, var. *Cristata*). B, Fertile frond of Royal Fern (*Osmunda regalis*).

The production of sporangia and spores is in most ferns carried on by all the leaves indifferently (whence the attempt formerly so prevalent, but botanically unnecessary, to distinguish them from ordinary leaves as *fronds*). In many cases, however, this becomes restricted to particular portions of the leaf, apical in the common royal fern (*Osmunda regalis*, fig. 6, B), or median as in *O. interrupta*, or even to special fronds, as in the common hard fern (*Blechnum spicant*) or the parsley fern (*Allosorus crispus*). In such cases the vegetative development of the spore-bearing fronds is of course greatly checked, and we have a distinct foreshadowing of the stamens and carpels of the phanerogams (although the spores have not as yet themselves acquired any character of distinct sex, much less the sporangia and the leaves which bear them). The fern may also exceptionally bud directly from the prothallus without archegonia (*apogamy*), or the prothallus from the frond without spores (*apospory*). Many ferns (particularly *aspleniums*) also multiply directly by budding upon the fronds.

At fig. 5, A, we have a fertile pinna of the common male fern (a name which, of course, refers merely to an old misinterpretation of the contrast of its rough foliage with that of the lady fern), showing the groups or *sori* of spore-cases. The same figure (B) gives a section of a sorus, with developing sporangia under its epidermic cover or *indusium*. The sporangia (B, C) grow from epidermal or subepidermal cells, and at maturity contain about 64 spores, which are often angular and dark-coloured (D). The spore-case is ruptured when ripe in various ways at once of practical interest and of high systematic importance, and the spores are thus diffused in great numbers to take their scanty individual chance of germinating as new prothallia.

Systematists vary somewhat as to the orders into which to divide this very large class, which includes about 150 genera and about 4000 living species, besides a great number of extinct forms. A convenient enumeration of these, however, may be taken as follows:—

A. Sporangia thick-walled and without ring, arising in the leaf-tissue, and not as epidermal hairs (trichomes). I. Marattiaceæ—4 genera, with about 30 species in tropical America, Asia, and Oceania: Marattia, 10;* Angiopteris, 7.

B. Sporangia epidermal, with ring. (*a*) Ring indistinct. II. Osmundaceæ—2 genera, 11 species, scattered through all regions: Osmunda, 7 (see ROYAL FERN); Todea, 4. (*b*) Ring well developed; 6 orders, distinguished by details of sporangial structure—viz. III. Schizæaceæ—4 genera, tropical: Schizæa, 14; Aneimia, 30; Lygodium, 30; Mohria, 2. IV. Gleicheniaceæ—3 genera, tropical, 40 species: Gleichenia, 8; Mertensia, 30; and Stromatopteris, 1. V. Hymenophyllaceæ (see FILMY FERNS)—3 genera, 200 species, chiefly tropical: Hymenophyllum, 80; Trichomanes, 120. VI. Cyatheaceæ, chiefly Tree-ferns (q.v.)—6 genera, with about 170 species, chiefly of southern tropical and warm temperate zones: Alsophila, 60; Hemitelia, 30; Cyathea, 40; Cibotium, 6; Dicksonia, 20. VII. Parkeriaceæ—2 genera, with only 2 species, *Ceratopteris thalictroides*, eaten as a vegetable in tropical Asia, and *Parkeria pteridioides*, found floating in tropical American waters. VIII. Polypodiaceæ. While the preceding families contain the genera above named, and a few others less known, the Polypodiaceæ constitute the great majority (nine-tenths) of the whole group, and are widely distributed through all regions of the globe, although chiefly in warm climates. Of the chief families of these abundant and often remarkable ferns the following is a brief summary:—

(1) Sorus not covered by indusium. (*a*) Acrosticheæ, with sporangia uniformly scattered upon the back of the frond or part of it—5 genera, 200 species, mostly tropical American, East Indian, and Australasian: Acrostichum, 170; Platycerium, 8, the stag's-horn ferns familiar in greenhouses, and remarkable for their ecological adaptations. (*b*) Polypodieæ, or Polypodies (800 species), with sori variously arranged. (i.) Sori in streaks following the veins: Gymnogramme, 74, of which *G. chrysophylla* and *G. tartarea*, both West Indian, are cultivated as the Golden Fern and Silver Fern, names which well describe the characteristic beauty of the mealy wax which is so copiously secreted by glandular epidermic cells as to cover the lower surface. Sori in round or elliptical patches: Polypodium, 150, mostly tropical (see POLYPODY); Phegopteris, 70 (Beech Fern). Sori linear: Ceterach, of which the common Scaly Fern, *C. officinarum*, was long in repute as an astringent medicine. (ii.) Sori along the edge of the frond: may be continuous and uncovered

* The numbers following generic names indicate the approximate number of known species.

(Notochlæna), or covered by a false indusium produced by the infolded edge of the frond, which is continuous in Pteris, 120 (see BRACKEN), discontinuous in Allosorus, 34 (Parsley Fern), while in Adiantum, 108 (see MAIDENHAIR FERN), the patches of sori are developed upon an inturned edge.

(2) Sorus covered by indusium. (*c*) Asplenieæ, or Spleenworts (400 species), mostly tropical, with long or linear sori, with indusium arising laterally from above a vein: Blechnum, 50 (the Hard Fern); Asplenium, 300 (the Spleenworts); Scolopendrium, 8 (see HART'S-TONGUE). *Diplazium esculentum* furnishes an edible rhizome in the East Indies. (*d*) Aspidieæ, or Shield Ferns (250 species), with dorsal sori of rounded shape, with shield-shaped or kidney-shaped indusia: Aspidium (Nephrodium), a large genus (220 species), including the Male Fern (see FERN, MALE) and many other well-known forms. Minor genera are Cystopteris, 9 (the Bladder Fern); Woodsia, 11; Struthiopteris, 3. (*e*) Davallieæ, with sporangia on a tooth, or in a furrow of the leaf edge—4 genera, with 200 species, almost all tropical: Davallia, 112. For Salviniaceæ and Marsileaceæ, see WATER-FERNS.

Fossil Ferns.—Although fossil ferns have been described from rocks of Silurian age, yet such remains are so fragmentary as to afford no positive evidence of their fern nature, and most palæophytologists now consider the majority of such fossils to be the remains of Algæ. From the Carboniferous rocks, however, the evidence of fossil ferns in abundance is clearly authenticated by excellent casts, and by beautiful petrifications, which, when prepared for the microscope by slicing the rock into thin sections, reveal the fern type of structure with marvellous completeness. Drawings and photographs of such ferns, and sections of them showing microscopical details, are given in the works by Williamson, Kidston, Scott, Carruthers, Renault, Grand' Eury, Gwynne-Vaughan, Potonié, Seward, Solms-Laubach, Bertrand, Sterzel, Zeiller, and others.

Until near the close of the 19th century it was a generally accepted idea that the Carboniferous period was an age of ferns. More recently, however, it has been absolutely proved that many of the fossils supposed to be the remains of ferns were in reality plants of a much higher organisation with fern-like foliage, but bearing seeds or structures closely approaching them. Such fossils have recently received great attention, because they appear to bridge over a wide gulf in the evolution of plants, filling, indeed, the gap between Cryptogam and Phanerogam, and they have received the general name of Pteridosperms. This epoch-making discovery caused a revolution in botanical circles, and led to a re-investigation of the whole of the fossil fern-like flora, and many so-called Carboniferous ferns were regarded with suspicion. Notwithstanding the change of opinion following the discovery just mentioned, it may still be said that ferns were undoubtedly abundant during Carboniferous times. What are perhaps the most elementary of such ferns have been grouped by Seward under Coenopterideæ, a term including the Botryoptereæ and Zygoptereæ of previous authors. These comprise such forms as *Botryopteris antiqua*, *Stauropteris burntislandica*, *Metaclepsydropsis duplex*, *Diplolabis pettycurensis*, &c., all of which occur in a limestone at the base of the Carboniferous rocks at Pettycur, S. Fife, and they may be considered among the most ancient examples of fossil ferns known to science in a petrified form revealing microscopical structure. In higher zones of the Carboniferous, and in more recent rocks, fossil ferns of higher types abound. Some of these are minute, resembling filmy ferns, others are gigantic like the tree-ferns of New Zealand and Ceylon. During the progress of the vast epochs of time through which the world has passed, many types of ferns have entered the arena and vanished, leaving merely their fossil remains, or, as must have happened with the majority, nothing whatever as a memento of their existence. Other types, strange to relate, have persisted from Carboniferous times even to the present day, and among such may be mentioned the Osmunda type and the Marattia type. From the imperfect preservation of the sori and sporangia, the precise systematic position of fossil ferns can rarely with much certainty be determined. See PALÆONTOLOGY.

Uses of Ferns.—Like other perennial stems and root-stocks, those of ferns contain a store of starch, and this becomes in many species of economic importance to communities which have not reached the agricultural stage. Foremost among these is the rhizome of *Pteris esculenta*, the Tara (q.v.) of the Maoris, to which may be added *Aspidium edule* of Nepal, while the *Cyathea medullaris* in New Zealand, *Angiopteris evecta* in the South Seas, and other tree-ferns yield a kind of sago. Survivals of this use of ferns, or reversion to it in time of famine, also occur among more advanced peoples (see BRACKEN), and developing fern fronds are occasionally still eaten as a kind of salad in northern countries. Before the epoch of chemical manufactures the common ferns were a convenient source of potash, and their fronds are still often gathered as bedding for cattle. Their astringency gave them also a place in medicine, but the syrup known as *Capillaire* (see MAIDENHAIR) and the occasional use of male fern as a vermifuge alone survive in modern pharmacy. The characteristic beauty of their foliage has, however, given them in recent times a place in horticulture so important, especially in England, as to be unreasonably compared to the historic Tulipomania (see TULIP) itself. The hardy ferns succeed well on shady rockwork, and the exotics under glass; their propagation, either by division of the root-stock (Davallia, &c.) or by sowing tolerably fresh ripe spores in saucers, kept moist and shaded under a glass (Pteris, Adiantum, &c.), is also easy. Many can be grown under a large bell-glass in rooms, or better in Wardian cases.

Various superstitions attach to ferns—the root of some kinds, for example, was in some places credited with the power of opening locks. By 'watching the fern' in solitude during the night of St John's Eve (24th June) one might hope to meet fairy benefactors, and receive a purse of gold; but the most widespread superstition is that fern seed, properly gathered, renders the bearer invisible. On the same eve of St John the fern puts forth at dusk a small blue flower, which soon disappears; and the wonderful seed, quickly ripening, falls at midnight, and should be caught in a white napkin. Fern seed is in some places a 'wish-seed,' enabling the bearer to attain his utmost wishes.

See works by Bower, Campbell, Christ, Seward, Heath, Druery, Scott, Lowe, Britten, De Bary, Goebel, Van Tieghem, Diels, Engler, Williamson, Sim, and others; also the several works on ferns by Sir W. J. Hooker (*British Ferns*, *Garden Ferns*, *Filices Exoticæ*, *Species Filicum*); and, for systematic studies, Smith's *Historia Filicum;* or general, for beginners, Moore's *British Ferns*. For particular genera and species and their culture, see Nicholson's *Dictionary of Gardening*, Bailey's *Cyclopedia of American Horticulture*, &c.

Fer Oligiste, a French name for Hæmatite (q.v.). See IRON AND STEEL.

Feronia, a genus of Rutaceæ. *F. Elephantum*, the sole species, is the wood-apple.

Ferozabad, Ferozepore. See FIROZABAD, FIROZPUR.

Ferrandi'na, a town of Italy, on a height above the Basento valley, 43 miles ESE. of Potenza by rail. Pop. 8000.

Ferrar, NICHOLAS, born in 1592, at fourteen entered Clare Hall, Cambridge, of which in 1610 he was elected fellow. He studied medicine, and travelled five years on the Continent (1613–18), then engaged in the business of his father, a London merchant, and in 1624 was returned to parliament. But in 1625 he retired to Little Gidding in Huntingdonshire, and founded there the religious community familiar to every reader of Mr Shorthouse's *John Inglesant;* next year Laud ordained him deacon. With his brother and brother-in-law and their families the community numbered some thirty persons, who with constant services and perpetual prayer combined the occupation of fine bookbinding. Nicholas himself died on 4th December 1637, worn out by asceticism; but the 'Arminian Nunnery,' which received two visits from Charles I. (in 1633 and 1642), was not broken up by the Puritans till ten years after his death. See the two lives, one by his brother John, edited by Mayor (1855), and *Nicholas Ferrar, his Household and his Friends* (1892).

Ferrara, capital of an Italian province, stands in the marshy delta of the Po, 30 miles from the Adriatic, and 29 NE. of Bologna by rail. A walled city since 604, it is still fortified with walls, bastions, ditches, and a citadel. The old castle or ducal palace of the Estes, built in the Gothic style in the 14th and 15th centuries, with corner towers, moats, and heavy machicolations, is the most conspicuous secular building in Ferrara. After the extinction of the Este family it was until 1860 the residence of the papal legates. The most notable churches are the cathedral and those of San Francesco, San Benedetto, and Santa Maria in Vado, which contain paintings by native artists (Garofalo, Dosso Dossi, &c.) and others (Guercino, Seb. Filippi). The university, founded in 1264, reorganised in 1402, closed in 1794, and reopened in 1824, has three faculties (medicine, jurisprudence, mathematics), many professors, but very few students. Its excellent library (100,000 vols., rare incunabula, and 1000 MSS.) contains original works of Tasso, Ariosto, and Guarini. Ferrara is specially remarkable for its art associations. Under the patronage of the Dukes of Este it produced a good school of painters; in literature it is closely associated with Tasso, Ariosto, and Guarini. The last named was born at Ferrara, as was Savonarola. At the period of its greatest prosperity Ferrara had about 100,000 inhabitants; though the commune still has 108,000, the town proper has hardly more than 50,000. After passing through various vicissitudes Ferrara became subject to the house of Este about the close of the 12th century, and remained in their hands until the extinction of the family in 1598, when it passed to Pope Clement VIII. In 1860 Ferrara was incorporated in Italy. See books by Gardner (1904) and Miss Noyes (1904).

Ferrara, ANDREA, a broadsword-maker of the 16th century, respecting whose personal history nothing is certainly known beyond the fact that he was established at Belluno in North Italy in 1585, where, along with his brother, he enjoyed great repute as an armourer. According to a tradition long current in Scotland, he was a Spaniard by birth; but the probability that he was an Italian and a native of the city of Ferrara is quite as strong. It is claimed for him that he tempered sword-blades by the same method as that employed by the smiths of Damascus. See SWORD; and *Cornhill Magazine*, vol. xii. (1865).

Ferrari, GAUDENZIO, Italian painter, was born at Valduggia, in Piedmont, in 1484. A scholar of Andrea Scotto, he also caught some inspiration from Da Vinci and Raphael. The chief characteristics of his style are correct and vigorous delineation, strong but often hard colouring, considerable power of invention, and skill in the arrangement of drapery. He executed innumerable paintings both in fresco and in oil, the greater part of which are possessed by the Lombard galleries.

Ferrari, PAOLO, Italian dramatist, was born at Modena in 1822, and produced his first comedy in 1847. Of his many later works, *Goldoni* (1852) and *Parini e la Satira* (1857) rank amongst the finest examples of modern Italian comedy, and are distinguished—as, indeed, are most of his plays—by a piquancy and sparkling dialogue, as well as cleverness of construction and occasional sharp contrasts, such as have been mostly identified with French comedy. He died professor of history at Milan, 10th March 1889.

Ferrates are combinations of ferric acid, $HFeO_2$, a weak unstable compound of iron and oxygen, with bases.

Ferrer, FRANCISCO (1864–1909), a theoretical anarchist, distinguished himself by zealous and devoted educational work at Barcelona, especially as founder of 'lay schools,' highly unpopular with clericals and monarchists. He was imprisoned for a year, tried, but acquitted, for alleged complicity in the plot to assassinate the king and his bride (1906). Accused (without evidence) of being instigator of the Barcelona rising of 1909, he was tried by court-martial and summarily shot—a victim of clerical spite, as was believed by many liberals as well as socialists. See book by W. Archer (1911).

Ferrers, LAWRENCE SHIRLEY, EARL, the last nobleman who died a felon's death in England, was born in August 1720, and succeeded to the peerage as fourth earl in 1745. He was subject to ungovernable paroxysms of passion, in the fury of one of which he killed his old land-steward, for which, being tried by his peers in Westminster Hall, he was hanged at Tyburn, 5th May 1760.

Ferret, a half-tamed albino polecat. It is slightly smaller than the wild form, measuring about 14 inches in length without including the tail, and has white or yellowish fur and the usual red—i.e. unpigmented—eyes. Like some other albinos, it is delicate and requires to be carefully housed in cold weather. The variety is virtually constant, except when the ferrets breed with polecats, which they will readily do; then a 'variety-hybrid' with intermediate colouring results. The ferret has been for long in human hands, for Aristotle knew it, and the Romans used it as we do. It seems to have originated in Africa, or in southern Europe—e.g. Greece—and may have been reared by the ancient habit of keeping a polecat to hunt for mice, before the days of the domestic cat. In spite of its long training, it is hardly tame, far less affectionate, and needs to be looked after lest it go chicken-hunting on its own account. Even infants are not safe from its deeply ingrained thirst for blood. It is used both in Europe and America to kill rats, to hunt out rabbits, and even to catch

Ferret.

fowls, which it can kill very neatly with a single bite on the neck. Like its relatives, it is brave as well as bloodthirsty, and will attack a large rat without hesitation. In hunting rabbits it is often allowed to work its will in the warren, the terrified inmates being shot or snared as they bolt. Frequently, however, the ferret has a long string attached, so that it may be pulled out. In other cases it is muzzled, and sometimes even belled. Without muzzle or leash there is always a risk of losing the ferret, for if hungry he may gratify his natural inclinations on the first rabbit and fall asleep after his meal, or he may get so excited over his work that he will refuse to come out for days. In time, however, desire for water brings him to the surface again; for blood, as Jefferies remarks, causes great thirst. The ferret generally breeds twice a year, each brood consisting of six or nine, which the mother sometimes devours. See ERMINE, POLECAT, WEASEL.

Ferricyanogen, formerly FERRIDCYANOGEN, a compound radical supposed by chemists to exist in ferricyanic acid and the ferricyanides. It cannot exist in the free state. The most important of the ferricyanides is that of potassium, also called red prussiate of potash. It is prepared by passing a stream of chlorine gas into a solution of potassium ferrocyanide till the liquid turns dark-red; on evaporation the salt is obtained in crystals. The reaction is as follows:

Potassium Ferrocyanide.		Chlorine.		Potassium Chloride.		Potassium Ferricyanide.
$2Fe(CN)_6K_4$	+	Cl_2	=	$2KCl$	+	$2Fe(CN)_6K_3$.

The chief use of potassium ferricyanide is for the manufacture of Turnbull's blue, an important dye. This substance is formed when a solution of a ferricyanide is mixed with that of a ferrous salt (green vitriol, for instance); it consists of ferrous ferricyanide, $Fe_4K_2(CN)_{12}$. Ferric salts yield no precipitate with ferricyanides. Strong acids separate hydroferricyanic acid, $H_2Fe(CN)_6$.

Ferrier, SIR DAVID (knighted 1911), physician and scientist, was born at Woodside, Aberdeen, in 1843, and educated at the university there, where he graduated with the highest honours in 1863, and soon after gained the inter-university distinction of a Ferguson scholarship. After a period of study at Heidelberg he settled as a student of medicine at Edinburgh, and graduated in 1868 at the close of an exceptionally distinguished course. In 1872 he was appointed professor of Forensic Medicine at King's College, London, and afterwards became physician to its hospital, and also to the National Hospital for the Paralysed and Epileptic. He was elected Fellow of the Royal Society in 1876, of the Royal College of Physicians the following year, and was made LL.D. by Aberdeen in 1883. Dr Ferrier's chief scientific work has been in the region of the brain, and its relations to such diseases as epilepsy, his name being especially famous for a brilliant series of experimental researches into the localisation of its functions, which have made him a *bête noire* to the anti-vivisectionists. In 1876 he published *The Functions of the Brain*, which was followed by *The Localisation of Cerebral Disease* (1878), and the Croonian lecture (1890) on cerebral localisation; and alone or with others he has written on cognate subjects in the Royal Society's *Transactions* (1884, 1898, &c.). He was one of the founders, and for a time was an editor, of the journal of neurology, *Brain*.

Ferrier, JAMES FREDERICK, metaphysician, was born in Edinburgh, June 16, 1808. His father was a brother of Miss Ferrier, the novelist; his mother, a sister of Christopher North. He was educated by Dr Duncan at Ruthwell, at the Edinburgh High School, and at Greenwich by Dr Burney, next entered the university of Edinburgh, and passed thence to Magdalen College, Oxford, where he graduated B.A. in 1831; next year he was admitted to the Scottish bar, but never practised, while the dominant influence of Sir William Hamilton made him a metaphysician. In 1842 he was elected to the chair of History in the university of Edinburgh, and in 1845 to that of Moral Philosophy in the university of St Andrews. Ferrier early attracted notice by some metaphysical essays, which appeared in *Blackwood's Magazine;* and in 1854 he published the *Institutes of Metaphysics*, in which he endeavours to construct a system of idealism in a series of propositions demonstrated after the manner of Euclid. He afterwards edited the collected works of his uncle and father-in-law, Christopher North. His own *Lectures on Greek Philosophy* were edited in 1866. Ferrier died at St Andrews, June 11, 1864. See Life by Miss Elizabeth Haldane (1899).

Ferrier, SUSAN EDMONSTON, Scottish novelist, was born in Edinburgh in 1782. Her father, James Ferrier, one of the principal clerks of the Court of Session, and the colleague in that office of Sir Walter Scott, lived on terms of intimacy with the wits and literati of his day in Edinburgh, and Miss Ferrier's talents and quick powers of observation were early called into play in the midst of the literary society in which her youth was passed. Her first work, *Marriage*, begun in 1810 in concert with Miss Clavering, but soon relinquished by the latter, appeared in 1818, and this was followed by *The Inheritance* (1824), and *Destiny* (1831). The merit of these tales, which are characterised by genial wit, a quick sense of the ludicrous, and considerable ability in the delineation of national peculiarities, is sufficiently proved by the fact that by some Scott was credited with the authorship. Miss Ferrier enjoyed the esteem and friendship of Sir Walter, who repeatedly gave expression to his appreciation of her talents, praised her portraits of society, and called her his 'sister-shadow,' and derived consolation from her sympathy in the season of gloom which darkened the close of his life. She figures in Lockhart's *Life of Scott*, and amongst her papers was found an article, 'Recollections of Visits to Ashiestiel and Abbotsford,' published, along with a Memoir and her works (6 vols. 1881). She died at Edinburgh, Nov. 5, 1854. See Life by her grand-nephew (1899).

Ferro, or HIERRO, the most western of the Canary Islands (q.v.). This island was selected as a first meridian by a scientific congress called together at Paris by Richelieu in 1630. The meridian chosen, 20° W. of Paris, and 17° 39′ W. of Greenwich, is not, however, that of the west coast of Ferro, which really lies 20° 1′ 45″ W. of Paris. Nevertheless it was universally agreed to regard it as lying exactly on the 20th meridian W. of Paris. This first meridian was long used by some European nations. See LATITUDE AND LONGITUDE.

Ferrocyanogen, a compound radical supposed by chemists to exist in ferrocyanic acid and the ferrocyanides. It cannot exist in the free state. The most important of the ferrocyanides is the potassium salt; it is prepared in the following manner. A mixture of potassium carbonate, iron filings, and animal matter, such as dried blood, horn clippings, &c., is heated to redness in iron pots. Potassium cyanide is thus formed. The mass is extracted with water, the cyanide combines with iron, forming ferrocyanide, which dissolves, and may be purified by recrystallisation. The chief use of potassium ferrocyanide is for the preparation of Prussian blue—ferric ferrocyanide (see DYEING and CALICO-PRINTING)—which is formed on the

addition of a ferric salt to solution of the ferrocyanide. A ferrous salt produces a white or light-blue precipitate of ferrous ferrocyanide. By the action of dilute sulphuric acid on potassium ferrocyanide, prussic acid is produced; if strong sulphuric acid be used, the ferrocyanide is completely decomposed, yielding carbonic oxide gas, and sulphates of iron, potassium, and ammonium. Hydrochloric acid causes the separation of ferrocyanic acid, $H_4Fe(CN)_6$, in small white crystals insoluble in hydrochloric acid. Most of the metallic ferrocyanides are insoluble, and many have characteristic colours. Iron cannot be detected in either ferro- or ferricyanides by any of the common reactions. Potassium ferrocyanide is not poisonous. The chemistry of these compounds is not yet thoroughly understood.

Ferrol, a Spanish seaport in Galicia, stands on a narrow arm of the sea, 11 miles by water and 33 by rail NE. of Corunna. A poor fishing-town until 1752, it now is one of the strongest fortified places in the kingdom, and possesses one of its three largest arsenals (with dockyards, naval workshops, &c.), but the annual trade has decayed somewhat. The harbour is safe and capacious, and has a very narrow entrance, defended by two forts. The town has manufactures of naval stores, linen, cotton, and leather, and exports corn, brandy, vinegar, and fish. The 30,000 inhabitants are engaged principally in the arsenal and in the sardine fishery. In 1805 a French fleet was defeated by the English off Ferrol. The town was taken by the French in 1809 and 1823, and in 1872 was the scene of a republican rising.

Ferrotype, or ENERGIATYPE, a photographic process, first made public by Robert Hunt in 1844, in which the negative was developed by a saturated solution of protosulphate of iron, with mucilage of gum-arabic, and fixed by soaking in water to which a small quantity of ammonia or hyposulphite of soda had been added.

Ferry, a passage by boat across water. Common rowing-boats are generally used for ferrying foot-passengers, but when horses and carriages have to be taken across, a flat-bottomed barge, with an inclined plane at one end, to rest upon the shore, for landing and embarking, is generally used. This may also be rowed across, but is usually drawn by a cable. The rope stretched across the river passes through rings or over pulleys attached to the barge, and the ferrymen move the barge across by pulling the rope. The rope restrains the barge from drifting in the direction of the stream. With a small boat this difficulty is obviated by the ferryman rowing obliquely, as though he were steering for a point higher up the river. Rafts are sometimes used for ferrying; and steam ferry-boats of various kinds and sizes are familiar to everybody.

Flying-bridge is the name given to a kind of ferry-boat which is moved across a river by the action of the combined forces of the stream, and the resistance of a long rope or chain made fast to a fixed buoy in the middle of the river. The boat thus attached is made to take an oblique position by means of the rudder; the stream then acting against the side tends to move it in a direction at right angles to its length, while the rope exerts a force in the direction towards the buoy. The course of the boat is analogous to the path of a rising kite. The holder of the kite corresponds to the buoy, the wind to the tidal stream, and the tail to the rudder. Flying-bridges may be used for military purposes. In the case of a wide river the rope or chain requires to be of considerable length, and must be supported by movable buoys or by small boats. Such flying-bridges are familiar to those who have sailed up the Rhine. In some cases, instead of an anchor laid in the stream, two shears or masts are erected, one on each bank, and firmly secured by guys. A stout hawser is then stretched tight from the top of one mast to the top of the other. There is a large iron ring or 'grummet,' to which is fastened one end of the boat rope, the other end being made fast to the boat or boats of which the bridge is composed.

Ferry, JULES FRANÇOIS CAMILLE, French statesman, born at Saint Dié in the Vosges, April 5, 1832, was admitted to the Paris bar in 1854, and speedily identified himself with the opponents of the Empire. His hostility was carried into journalism, and a series of articles in the *Temps*, in which he analysed the accounts of the prefect who was then rebuilding Paris, were republished as the *Comptes Fantastiques d'Haussmann* (1865). In 1869 he was elected to the Corps Législatif, where he voted against the war with Prussia; and during the siege of Paris by the Germans (1870–71) he played a prominent part as central mayor of the city. He was minister to Athens in 1872–73, and in 1879 became minister of Public Instruction, in which capacity he brought forward an education bill containing a clause, which was levelled at the Jesuits, shutting out members of 'unauthorised religious communities' from the schools. The clause was twice thrown out in the senate, but the expulsion of the Jesuits was effected by decrees founded on laws long since fallen into disuse, and brought about the dissolution of the ministry in September 1880. M. Ferry then formed a cabinet, which remained in office until November 1881. Again becoming premier in February 1883, he boldly embarked on a policy of 'colonial expansion,' involving a war in Madagascar, and an invasion of Tronquin, where a military disaster brought about his downfall in March 1885. He died 17th March 1893. See A. N. Rambaud, *Jules Ferry* (1905).

Fertilisation is that essential process of sexual reproduction in which the male element (spermatozoid, antherozoid, pollen-tube) comes into contact and more or less complete union with the female element or ovum (see REPRODUCTION), and through which the subsequent division and differentiation of the ovum becomes effectively possible (see EMBRYOLOGY). The term is, however, often more loosely employed to denote those preliminary processes by which the male fertilising element is brought into conditions for beginning fertilisation proper. Hence, while the zoologist speaks commonly of the fertilisation of the ovum, but of the fecundation of the female animal, the botanist, in speaking of the fertilisation of the flower, is referring to the wind or insect agencies by which the pollen is brought to the stigma, and of the details of floral structure and mechanism adapted to these, the term fecundation thus being more frequently applied to the subsequent and essential process. See FLOWERS.

Fesa, or FASA, a town of Persia, in the province of Fars, about 80 miles SE. of Shiraz, with a population of 10,000. It has manufactures of silken fabrics, and some trade in tobacco.

Fescennine Verses, one of the oldest forms of popular poetry in Italy, consisted of dialogues in rude extempore verses, generally in Saturnian measure, in which the parties rallied and ridiculed one another. The making of them formed a favourite amusement of the country-people on festive occasions, especially at the conclusion of harvest and at weddings. But, degenerating into extreme license, the practice had at last to be regulated by law. The Fescennine verses are usually considered to derive their name from the Etrurian town Fescennium.

Fesch, JOSEPH, Cardinal and Archbishop of Lyons, was born 3d January 1763, at Ajaccio. Of Swiss parentage, he was the half-brother of Letizia Ramolino, the mother of Napoleon Bonaparte. During the French Revolution he became commissary to the Army of the Alps under his nephew in Italy. The First Consul having resolved on the restoration of the Catholic worship, Fesch resumed the clerical habit—for he had originally taken holy orders—and was active in bringing about the concordat with Pope Pius VII. in 1801. He was now (1802) raised to be Archbishop of Lyons, and in the following year to be cardinal. In 1804 he was sent as French ambassador to Rome, where he ingratiated himself with the pope by his adroit management and ultramontane sentiments. Two years later he was appointed associate and successor of Dalberg, Prince Primate of the Confederation of the Rhine. At a national conference of clergy assembled at Paris in 1810 he gave utterance to views which lost him the favour of Napoleon, who was still further exasperated against him on account of a letter which Fesch wrote to the pope, then (1812) in captivity at Fontainebleau, and which was intercepted. After this he lived in a sort of banishment at Lyons. At the approach of the Austrians in 1814 he fled to Rome, where he spent nearly the whole of the rest of his life. His resistance to the will of his nephew, and indeed his whole conduct, seems to have been actuated by sincere zeal for what he considered to be the interests of the church. He died at Rome, 13th May 1839. Of his large collection of paintings he bequeathed a part to the city of Lyons. See Life by Ricard (Paris, 1893).

Fescue (*Festuca*), a large and widely diffused genus of grasses, very nearly allied to Brome-grass (q.v.), and including many of the most valuable pasture and fodder grasses—e.g. Meadow Fescue (*F. elatior*, var. *pratensis*), with the allied Tall Fescue (var. *arundinacea*), Sheep's Fescue (*F. ovina*), of which as many as eight varieties are enumerated, but of which, besides the common form, (var. *vulgaris*) only Hard Fescue (var. *duriuscula*) is of agricultural importance. Red Fescue (*F. rubra*) has also the important varieties, creeping (var. *genuina*), tufted (var. *fallax*), various-leaved (var. *heterophylla*), and violet (var. *violacea*). See GRASSES, and PASTURE.

Fess, one of the heraldic ordinaries. See HERALDRY.

Fessa. See FESA.

Festiniog, a village of Merionethshire, North Wales, 22 miles by rail WNW. of Bala, and 3½ S. of Blaenau-Festiniog. Standing amid waterfalls and mountains (the loftiest Moelwyn, 2529 feet), it is a great tourist centre. Pop. 8000. Blaenau-Festiniog, 27 miles SSW. of Llandudno Junction, and 13 NE. of Port Madoc by the 'Toy Railway' (1869), is a place of recent growth, inhabited chiefly by slate-quarrymen.

Festivals, or FEASTS, a term denoting certain periodically recurring days and seasons set aside by a community for rest from the ordinary labour of life, and more or less hallowed by religious solemnities. These may be joyful occasions commemorating the lives of heroes, or general days of humiliation for disasters. But even when sorrow was to be expressed the mortification of the body did not always suffice, but plays, songs, dances, and processions full of boisterous mirth were resorted to—as in the festivals of Isis at Busiris, of Mars at Papremis, in the Adonia of Egypt, Phœnicia, and Greece—because the divine wrath or sorrow was, like that of man, to be changed into satisfaction. Festivals have also helped onward the progress of civilisation itself. Besides helping to knit together into unity the body politic, they stimulated the artistic sense to emulation in music and the dramatic art, and thus laid the foundations of the greatest æsthetic triumphs. Enthusiastic, wild, metaphysical Egypt invested the countless days consecrated to her deified stars, plants, animals, and ideas, to the Nile, to Ammon, Kneph, Menes, Osiris, to Horus, to Neitha, to Ptah, with a mystery, sensuality, and mournfulness always exaggerated, sometimes monstrous. The Hindu, no longer daring to offer human sacrifices, shows his odd and cruel materialism by throwing into the waves, on his festival of rivers, some of his costliest goods, gold, jewels, garments, and instruments; while in the licentiousness and debaucheries perpetrated on the festival of Siva, the god of procreation, or on the Bacchantics of the goddess Bhavani, he exceeds even those of the Egyptians on their Neitha feasts at Bubastis, and the Greek worship of Aphrodite in her Cyprian groves.

The ancient Persians alone of all nations had no festivals, as they had no temples and no common worship. These 'Puritans of Polytheism,' who worshipped the sun only, and his representative on earth, fire, scorned show and pomp and large religious gatherings. A striking contrast to them is formed, in another hemisphere, by the ancient Mexicans, who were found to possess one of the most richly developed calendars of festivals, scientifically divided into movable and immovable feasts. As a strange and singular phenomenon among festivals we may also mention here that 'of the Dead' or 'of Souls,' celebrated among the wild tribes of North America. At a certain time all the graves are emptied, and the remains of the bodies buried since the last festival are taken out by the relatives, and thrown together into a large common mound, amid great rejoicings and solemnities, to which all the neighbouring tribes are invited.

Greece had received the types of civilisation, religion, and art from Egypt and the East, but she developed them all in a manner befitting her glorious clime and the joyous genius of her sons. At the time of the *Iliad* two principal festivals only—the harvest and the vintage—seem to have been celebrated (ix. 250); but they soon increased to a very large number. The religious part of the festival—homage offered to personified ideas—consisted mostly in the carrying about of the deity of the day to the sound of flute, lyre, and hymns, and in a sacrifice, followed by a general meal upon certain portions of the animal offered. Then followed scenic representations symbolising the deeds of the gods; after which came games and matches of all kinds—foot, horse, and chariot races, leaping, boxing, throwing, and wrestling. Separate accounts are given of some of the more remarkable Greek festivals under BACCHUS, MYSTERIES, and PANATHENÆA, and of the 'Holy Games' proper, the Olympian, the Pythian, the Nemean, and the Isthmian, under these heads. As all these festivities were provided out of the public purse the individual did not suffer more than a welcome interruption of his usual business, and under that genial sky the penalty to be paid for occasional indolence was not too heavy.

Rome adopted and acclimatised the foreign deities as she went on from conquest to conquest, exactly as, with her usual prudence and practical sense, she conferred her right of citizenship on the nations subjected to her rule. Her yoke was thus less galling to the new provinces, while at the same time the populace at home found sufficient distraction in the many ancient and newly imported festivals, with their quaint rites and gorgeous pageantry. Yet the Romans never exceeded in their festivals a hundred in a year, and in these, again, a

distinct line was drawn between civil and religious ones. Some of the principal religious festivals were the *Sementinæ*, on the 25th of January—the rural festival of the seed-time; the *Lupercalia*, in honour of Pan; the *Cerealia;* the night festival of the Bona Dea; the *Matronalia;* and the *Minervalia*. To the purely civil ones belong the *Janualia*, the 1st of January and the New-year's Day, when the new consuls entered upon their office, and friends used to send presents (*strenæ*) to each other; the *Quirinalia*, in memory of Romulus, deified under the name of Quirinus; and the *Saturnalia*, in remembrance of the golden age of Saturn, beginning on the 19th of December. The celebration of these festivals was in all respects imitated from the Greeks, with this difference only, that the games connected with them became with the pre-eminently bellicose Romans terribly lifelike images of war. Their sea-fights; their pitched battles between horse and foot, between wild beasts and men; their so-called Trojan games, executed by the flower of the nobility; their boxing-matches (with gloves that had lead and iron sewed into them); circus, arena, and amphitheatre, gave, especially in later times, the greater satisfaction the greater the number of victims.

With the first and strictest monotheists, the Hebrews, the remembrance of their liberation from Egypt, and the momentous period of preparation in the desert which followed it, mingled with almost all their religious observances, and especially their festivals, and infused into them all a tone of deep and fervent gratitude; while at the same time it held ever before their eyes the cause of their nationality, and their aim and destiny 'to be a kingdom of priests and a holy people.' The Hebrew festivals, too, are of an historical, agricultural, astronomical, and political nature; but they mostly combine all these characteristics, and are always hallowed by the same religious idea. Connected with their festivals were no plays and no representations of a god's deeds, no games and no cruelty, no mystery and no sensuality, but the sacrifice of the day, and a special occupation with the divine law. The influence of the number Seven (q.v.) is seen in the recurrence of many of the Jewish solemnities. The Sabbath, the first and most important of these septenary festivals, is treated of under its own head. The most exalted of new-moon festivals was that of the first day of the seventh month, 'the day of remembrance of the sounding' or 'of trumpets' (Lev. xxiii. 24), to which in later times, when the Seleucidian era was introduced, the name of *Rosh hashana* (New Year) was given; notwithstanding that in Exodus (xii. 2) Nisan is spoken of as the first month of the year. After a period of six years of labour the earth, too, was to celebrate a Sabbath-year; what it produced spontaneously belonged to the poor, the stranger, and to animals. After a revolution of seven times seven years the year of Jubilee or Jobel was to be celebrated, in which all the Hebrew slaves were set free, and all land which had been sold in the interval was restored to the former owners, in order that the original equilibrium in the families and tribes should be maintained intact. The pre-eminently agronomical and historical festivals were the three *Chaggim*—viz. Pesach (Passover, q.v.), Schabuoth (Feast of Weeks), and Succoth (Feast of Tabernacles), on which three every male was obliged to go up to Jerusalem and offer some of the first fruits, besides the prescribed sacrifices. Post-Mosaic and exclusively historical were the feasts of Purim, of Haman, and of the Maccabees.

Only a cursory glance can be here taken of the Christian festivals, which are treated separately under their various names. They were for the most part grafted, in the course of time, upon the Jewish and Pagan ones, but always with a distinct reference to Christ and other holy personages. The weekly day of rest was transferred from Saturday to Sunday, and called the Day of Joy or Resurrection. For a long time both Saturday and Sunday were celebrated, especially in the East. Two separate celebrations took the place of the Jewish Passover: the *Pascha Staurosimon* was the festival of the Death, the *Pascha Anastasimon* of the Resurrection of our Lord (see EASTER); and the festival of Pentecost, or the law-giving at Sinai, became the festival of the outpouring of the Holy Ghost and of the inauguration of the New Covenant.

In the course of the 4th century two new festivals were introduced: Epiphany (q.v.), which originated in the East; and that of the Nativity or Christmas (q.v.). Circumcision, Corpus Christi, the festivals of the Cross, of the Transfiguration, of the Trinity, and many others are of still later date. The veneration felt for Mary as the 'Mother of God' found its expression likewise in the consecration of many days to her special service and worship; such as that of her Presentation, Annunciation (Lady Day), Assumption, Visitation, Immaculate Conception (q.v.), and many minor festivals, over and above the month of May and the Saturdays, which in some parts were entirely dedicated to her, in order that the Mother might have her weekly day like the Son. Besides these, there were festivals of Angels, of Apostles, Saints, Martyrs (on the supposed anniversary of their death, called their birthday, *dies natalis*), of Souls, Ordinations, &c. Some were of special importance owing to special circumstances; thus St Patrick's Day (March 17th) is especially sacred to Irishmen, St Andrew's Day (November 30th) to Scotsmen, and St George's Day (April 23d) to Englishmen. In the United States we find corresponding festivals in Washington's Birthday (February 22d), Independence Day (July 4th), Decoration Day (q.v.; observed in 1889 as a legal holiday in twenty-two states), and Thanksgiving Day (usually the last Thursday of November).

Celebrated at first with all the primitive simplicity of genuine piety, most of the church's festivals were ere long invested with such pomp and splendour that they surpassed those of the ancient Greeks and Romans. Burlesque, even coarse and profane representations, processions, mysteries, and night-services were in some places, although unauthorised by the general church, connected with them, and voices within the church loudly denounced these 'pagan practices.' Ordinances forbidding mundane music and female singers for divine service were issued, the vigils were transformed into fasts, days of abstinence and penance were instituted, partly as counterpoises, but with little result. Nor did the prodigious increase of these festive occasions, and the rigour with which abstinence from labour was enforced in most cases, fail to produce the natural results of indolence and licentiousness among the large mass of the people. But it was only after the most decided and threatening demands, as by the German Diet of Nuremberg in 1522, that Pope Urban VIII. was prevailed upon to reduce the number for Catholic Christianity (1642). Benedict XIV. (1742) and Clement XIV. (1773) followed in the same direction.

The Christian festivals have been divided variously into *feriæ statutæ* (returning annually at fixed times), *indictæ* (extraordinary, specially proclaimed), *duplicia* (double reminiscence, or of higher importance), *semiduplicia* (half double), &c. It was long the custom to recite the office of the Feria in addition to that of any feast chancing to fall on it. Hence, on the more important

solemnities, a *double* office had to be recited, one of the feria, another of the feast. *Semi-doubles* were those in which the two offices were made into one. The church celebrates certain festivals till the *octave* or eighth day after they fall due. Another division is into weekly and yearly feasts, these latter being subdivided into greater and minor, or into movable and immovable. There is also a distinction made between *integri* (whole days), *intercisi* (half-days), &c.

The only trace of the ancient manner of dating a festival from the eve or vesper of the previous day —a practice discontinued since the 12th century, when the old Roman way of counting the day from midnight to midnight was reintroduced—survives in the 'ringing in' of certain days of special solemnity on the night before, and in the fasts of the vigils.

Some of the principal Mohammedan festivals (see MOHAMMEDANISM) are partly based upon those of the Jews and Christians, such as the weekly Friday (the Jewish Day of Atonement); others are the Birthday of the Prophet, that of Hussein, of Mohammed's granddaughter Zeynab, of the Night of the Prophet's Ascension to Heaven, and Bairam (q.v.). See HOLIDAY.

See BREVIARY, and works on this subject by Buxtorf, Lightfoot, De Wette, Baumgarten, Mai; also Thomassin, *Traité des Festes;* Gavantus, with Merati's Notes; and Probst, *Brevier u. Brevier-gebet.*

Festoon, in Architecture, a sculptured wreath of flowers, fruit, leaves, &c., frequently used as an ornament in Roman and Renaissance buildings. Like many of the other ornaments of classic architecture, it owes its origin to one of the sacrificial

Festoon:
St Mark's Library, Venice.

emblems—viz. the flowers with which the heads of the animals, the altars, &c. used to be decorated.

Festus, PORCIUS, Roman procurator of Judæa, who succeeded Felix (q.v.), 60 A.D., and died a few years afterwards. In 62 Paul defended himself before him. See Acts, xxv.

Festus, SEXTUS POMPEIUS, a Latin grammarian, who flourished most probably in the 2d century A.D., and is one of our most important authorities on the Latin language. His epitome of the great work (now lost) of Verrius Flaccus, *De Verborum Significatione,* was arranged alphabetically in twenty books, of which only the latter half (M—V) survives, and even that in a single deplorably mutilated MS. This came from Illyria, and fell into the hands of Pomponius Lætus, a distinguished scholar of the 15th century. It ultimately passed into the library of Cardinal Farnese at Parma, and is now preserved at Naples. The work, in spite of all its imperfections, is a grand storehouse of knowledge on points of mythology, grammar, and antiquities. We have, too, a meagre abstract of Festus's abstract, compiled by a priest Paulus in Charlemagne's time. All previous editions of Festus are of little value compared with that of K. O. Müller (1839), in which he has made use of the Farnese MS. and other sources, distinguishing the value of each.

Fetch. See DOUBLE.

Fetichism, the worship of a fetich, or more strictly the belief that the possession of a thing can procure the services of a spirit lodged within it. The fetich is an object capable of being appropriated by an individual, and counted as animate and conscious. We find fetichism flourishing not only in Africa, but among the natives of both Americas, the Polynesians, Australians, and Siberians, and indeed in the lower strata of all known civilisations. The word itself is ultimately due to the Portuguese, the first Europeans to trade on the west coast of Africa, who expressed their conception of the religion of the natives by the Portuguese word *feitiçāo,* 'magic;' but it received its currency through the medium of the French, the well-known treatise of Charles de Brosses, *Du Culte des Dieux Fétiches* (Dijon, 1760), having carried the word over Europe. Comte used it as a term to describe what he believed to be a necessary stage in the development of all religions in which all external bodies, natural or artificial, are supposed to be animated by souls essentially analogous to our own. Lord Avebury's definition of fetichism is closer to its modern scientific sense—'that stage of religious thought in which man supposes he can force the deities to comply with his desires.' He makes it the next stage in the ascent of religion from pure atheism through totemism and shamanism into idolatry. But it is impossible to admit this transition from fetichism to idolatry, because the latter necessarily implies the superiority of the god over the man; the former, on the contrary, the superiority of the man over the god. Idolatry is properly the worship paid to an image which is taken to be the usual or merely temporary abode of a superhuman personality. Sir E. Tylor's definition—'the doctrine of spirits embodied in, or attached to, or conveying influence through certain material objects'—includes the meaning, but is not expressed with his usual exactness and point.

Fetichism may be said to be *primitive* when man, personifying everything around him, chooses among these imaginary personalities an object capable of being appropriated to himself, the spirit of which becomes his protector or his slave. Again, that may be called *secondary* fetichism which implies belief in the incorporation of a spirit in some object chosen as a fetich, either by a simple act of spontaneous choice or through a magical operation. The latter is far more widespread than the former, and obviously presupposes a belief in animism in Sir E. Tylor's sense of the word. Any object may become a fetich, provided only it is capable of being appropriated literally or metaphorically by an individual. Such objects are flints, shells, claws, feathers, earth, salt, plants, manufactured articles, anything peculiar or unknown or not understood, trees, streams, rocks, and even certain animals, as the serpents of Whydah. All savage thinking is of course based on fancied analogies, and it is quite enough for an object to be accidentally associated with an event for it to be regarded as the cause and even the author of that event, whence its elevation to the rank of a fetich. Again, fetiches are attached to individuals, to families, or to tribes, and it is even not unusual to see them beaten and kicked as a warning when they have failed to bring the luck that was expected. Even in the crooked sixpences which we carry in our purses, and in the luck-tokens of our gamesters, there is something more than an analogy to the fetich of the savage.

See ANIMISM; Fr. Schultze, *Der Fetichismus* (Leip. 1871); Roskoff, *Das Religionswesen der niedersten Naturvölker* (*ib.* 1880); Bastian, *Der Fetisch an der Küste*

Guineas (1884); Baudin, *Fétichisme et Fétichеurs* (1884); Miss Kingsley's two books on West Africa (1897 and 1899); and Nassau's *Fetichism in West Africa* (1904).

Fétis, François Joseph, Belgian musician, also critic and historian of music, was born at Mons on 25th March 1784. His first appointment was that of organist and professor of music at Douai (1813). He then held successively the post of professor of counterpoint and fugue at the Paris Conservatory (1821), and that of director of the Brussels Conservatory (1833), combining with this last the office of musical director to the king of the Belgians. He died at Brussels, 25th March 1871. He wrote a considerable quantity of music, including operas and sacred music; but he is principally noticed for his works on the theory of music—*Traité de l'Accompagnement de la Partition* (1829), *Treatise on the Theory and Practice of Harmony* (1844), and *Treatise on Counterpoint and Fugue* (1824). But even more valuable than these are his *Universal Biography of Musicians* (1835–44; 2d ed. 1860–65), and *General History of Music* (1869–76). These books, although not free from careless errors, especially in chronology, and although marred by the writer's bias and partiality, are yet of great value to the historian of music.

Fetwa, the decision of a Turkish Mufti given in writing.

Feu and **Feu-duty,** in Scots law. A feu may be described as a right in land, granted in perpetuity—the granter being called the 'superior,' and the grantee the 'vassal'—in consideration of an annual payment in money, grain, cattle, or services, called *feu-duty*, and certain other contingent burdens called casualties of superiority (see Casualties). Though the term feu was used by feudalists to express any relation of superior and vassal, in Scots law it was opposed to ward or military holding, and to blench or nominal holding. The superior and vassal each continues to have in law an estate, or right of ownership, in the land. But at the present day the vassal holds the land by a permanent and indefeasible tenure, so long as he pays the feu-duty, and the right of the superior is substantially nothing more nor less than the right to draw a fixed sum secured upon the land from the vassal. The system of feuing property for building purposes has several advantages over that of the long building-leases common in England. From its perpetual character it gives to the holder a greater interest in the property, and usually leads him to erect more enduring structures than he would do under a lease. For as time runs on the feu often increases in value, while the reverse must always be the case with the interest of the tenant in leasehold property. Hence the movement for leasehold enfranchisement in England, which is scarcely intelligible in Scotland. Neither does feuing interfere with the letting of property on lease or otherwise. Almost all the houses in Edinburgh and the other towns of Scotland which are let, either on leases or from year to year, are held by their proprietors in feu. Modern feu-duties are in general paid in money. When the stipulation is for a duty in grain the quantity is valued by fiar prices (see Fiars), and paid in money accordingly. Since 1874 the feu-duty, whether of money or grain, must be of fixed amount—i.e. not contingent. The original deed transferring the land in feu from the superior to the vassal is called a feu-charter or feu-contract, which is now a very simple and intelligible document. Registration has now the effect of sasine in making the vassal's right real; and, unless otherwise stipulated, the vassal is now perfectly free to transfer his property to any one. No charter or other writ of the superior is now necessary to complete the transferee's title. Usually the feu-charter reserves to the superior all minerals in the ground, and stipulates that the vassal shall build his house either in a particular style or of a certain value. By the Scottish statute 1597, chap. 246, it is declared that all vassals by feu-farm failing to pay their feu-duty for two years together shall lose their right; but the superior is bound to accept payment of arrears before declaring an 'irritancy'—i.e. forfeiture. For the most part, land proprietors near towns and manufacturing villages are anxious to add to their annual rental by feuing grounds for building purposes. The rate of feu varies widely, from as low as £8 to as high as £500 per acre per annum; a common rate is from £20 to £40 per acre. Whatever be the amount, it is payable by the feuar—not the tenant to whom the feuar may have let the property. When a building consists of several floors forming distinct dwellings, the feu-duty payable in respect of the land is allocated by arrangement between the parties in certain proportions among the respective proprietors. When the feu-duty is thus split up each proprietor is responsible only for his own share. In the same way, when a property is sold subject to a *cumulo* feu-duty, it is necessary, with the consent of the superior, to *allocate* this feu-duty on the different portions of the subject. When feu-duties are offered for sale the vassal has an opportunity of extinguishing his feudal tenure, and becoming the superior. It is not unusual in feuing building-lands for the superior to make the roads and drains, the vassals being bound to contribute relatively to the first expense, or at least the subsequent maintenance of both. Interest does not run *ex lege* on arrears of feu-duties till a demand for payment is made.

Feud in the middle ages meant a war waged by private individuals, families, or clans against one another on their own account. See Vendetta.

Feudalism. The feudal system formed in medieval Europe the connecting link which united the primitive society, whose basis was entirely personal, with the modern reign of law and order. It may be described as a great military and social organisation based on the holding of land, yet containing, imbedded within itself, like fossils in the rocks, the relics of the earlier systems which in each different country had preceded it. The result of the system was the establishment of the various great European powers on the ruins of the Roman empire, and the preservation of order and discipline in the wild times of the disintegration of that empire. For a clear understanding of the feudal system, how it came to be introduced, and the changes it wrought, a glance is necessary at the social systems which preceded it, and which can for this purpose be classed under two leading types, the Teutonic and the Roman, known respectively as the Mark system and Emphyteusis. The industry of Stubbs, Seebohm, and others has thrown a flood of light on the working of the mark system in the primeval German forests, by which we can almost accurately reproduce the primitive society and trace its growth.

In the first century the tribes seem to have been purely nomadic, each kept together under the control of its head, having cattle and other belongings, but no idea of permanent possession of the land, or, indeed, of anything more than taking the pasture and fruits of the earth for the time being, and defending their temporary encampment as long as they remained there. Each chief had his personal following, called by the Romans his *comitatus*, composed principally of the younger

sons of the chief families, and of men who preferred a life of adventure to peaceable cattle-feeding. The chief's council was composed of the heads of the chief families. In many of the larger tribes there were subordinate divisions, presided over by inferior chiefs, but the organisation, whether of the whole or of an individual part, was the same. Probably originally every man was free and equal, but by degrees a class rose up composed partly of prisoners taken in war and kept as slaves, partly of gamblers who, having lost all else, staked their freedom, and lost that; others, again, from mere poverty, might voluntarily surrender their freedom for subsistence, and thus a class of unfree men would gradually spring up. By degrees these nomadic tribes took to settling and cultivating the land, the influence of increasing wealth and civilisation and the knowledge of agriculture, derived from their Roman neighbours, tending largely to promote this result; but still the same broad principles obtained. A group of families would settle on an unoccupied tract of land, and the council of the heads would assign to each family a spot to build a homestead, and to put up cattle-sheds and stackyards; all the rest of the land they occupied in common. A fertile glade was chosen for a common meadow, and to each family the council allotted a share proportionate to its numbers. Each family cut and harvested its own hay, then the fences were thrown down, and the meadow became common pasture till the grass began to grow again next spring. Around the village and the meadow were the woods and wastes, always common, never divided or inclosed; these were called the 'mark,' a word meaning a boundary, and which yet lingers in the Scottish and Welsh Marches, and whence came the name of the Province of Mercia.

The next step in civilisation was the knowledge of tillage, and as arable ground could not well be re-allotted every year, a portion large or small came by degrees to be attached to each homestead, and not included in the yearly subdivision. Still, however, there was no ownership of land as we understand it. The head of each family was a member of the community, a freeman and a political unit, and in that capacity had a homestead assigned to him; this homestead was the outward badge or sign of his status as a freeman. This village was called the mark, a group of marks formed a district, called by Roman writers 'Pagus,' and by English writers a Hundred. The pagus elected a chief, who was a kind of local judge, and each pagus sent representatives to the national assembly, in whom the central power was vested. In war each pagus sent a hundred champions to the host, the nucleus of which was the chief of the tribe with his comitatus. Thus the host was simply the nation in arms, arranged according to the same divisions as in peace; and when a country was conquered they had merely to settle down in the order they stood, and recommence their mark life in a new place. The position of a Teutonic land-owner, then, was that he held his land not of any superior, but in token of his status as a freeman and head of a household; and on his death the assembly of the markmen would confer the homestead on the man on whom that headship devolved, which also, to some extent, they had the power of regulating. Such a system was it that in the 5th century the Saxons, Angles, and Jutes introduced into England; and its traces, notwithstanding the lapse of fourteen centuries, may still be found in village greens and many of the rights of common, whenever the latter are not manorial. Large grants of land were made to distinguished warriors of the comitatus, who settled down with their dependents and slaves, forming villages on their lands in analogy to the mark. The whole country was now looked upon as one great mark, the unallotted lands forming a sort of treasury out of which grants could be made to new-comers by the great council. Theoretically, the possession of land still was the badge of a freeman; yet, as these grants of land were alienable, and could be sold, a class of landless men gradually arose, and as these had no visible sign of their status it became the rule that every landless man must commend himself to some land-owner who should be responsible to the state for him. Also, the smaller land-owners would often commend themselves to some powerful lord for the sake of honour and protection. A second stage in the progress of social organisation was thus reached; the purely personal basis was no longer the sole foundation of society, the land-owner, not the freeman, became the unit; the host was the body of land-owners in arms; but still it was open to the landless man to select his own lord, and such selection created no indissoluble tie; besides this, the freeman was still in political theory the equal of the noble, and thus the personal basis, though obscured, was not entirely lost sight of.

In the meantime developments somewhat corresponding to these were taking place in the Roman empire; long or perpetual leases of lands taken in war were granted by the state in the tenure called Emphyteusis. About the time of Constantine this tenure was also adopted by private persons and corporations, and was extended from land to houses, the person to whom the grant was made being called Emphyteuta. It may be defined as a grant of land or houses for ever or for a long period on the condition that an annual sum (canon) shall be paid to the owner or his successors, and, if not paid, the grant shall be forfeited. The emphyteuta is not legal owner, nor a mere hirer; but the agreement is determined by the Lex Zenoniana to rest neither on letting nor on selling, but to be a peculiar contract depending on agreements of its own. The emphyteuta had the usufruct of the land, was entitled to its fruits, and under certain restrictions could alienate his possession, which on his death passed to his heirs; but the ownership remained with the *dominus-emphyteuseos* or lord, and the emphyteuta was bound to pay the agreed rent, to manage the property as a good paterfamilias, and to pay all the burdens and deliver the receipts to the lord. A good account of this tenure may be found in Hunter's *Roman Law*, pages 426–429. In the later empire, by a modification of this tenure, the frontier lands on the Rhine and Danube were granted to chiefs of the German tribes on condition of their being always ready to defend the integrity of the empire, this service being taken in lieu of the canon or rent of the ordinary emphyteusis. Thus the rival systems of the German mark and the Roman emphyteusis were brought into direct juxtaposition, and when the barbarians, who for so long had hung 'poised on the edge of the empire,' broke into the Roman world, carrying their ideas of social organisation with them, it was natural that the grants of conquered lands to great warriors should be made on terms analogous to emphyteusis rather than (as happened in the earlier conquest of Britain) on the older mark system. These grants were called *beneficia*, the *beneficium* being held on condition of the performance of certain services, of which the most important was naturally military. As in England also, so on the Continent the weaker and poorer would commend themselves to some powerful lord, surrendering their allodial lands (i.e. those held in absolute ownership) to him, to be received back in a sort of emphyteusis tenure on condition of the performance of military service. Hence arose feudalism. Littré makes the Low Lat. *feudum* of Teutonic origin, and thus cognate with Old High German *fihu*, Gothic *faihu*,

A.S. *feoh* (our *fee*), mod. Ger. *vieh*, cattle being originally the only wealth. It came subsequently to mean property of any kind, including land, the second part of the root being taken from the word *od*, also meaning property or pay; thus *fee-od*, *feodum*, or *feudum* means property held on condition of pay or services rendered. Guizot in *Civil. France*, iv. 41, says: 'The word (feudalism) appeared for the first time in a charter of Charles the Fat in 884.'

So now the third stage of progress was reached, when land became the sole basis of society, the sacramental tie of all public relations; the poor man depended on the rich, not as his chosen patron, but as the owner of the land he cultivated, the lord of the court to which he did suit and service, the leader whom he was bound to follow in the field (see Stubbs, i. 167). The feudal theory was that the king was the sole allodial or absolute owner of all the land in the kingdom; the chief lords held their lands from him on condition of military service; their vassals from them on similar conditions; and sub-vassals from them again, and so on in an infinite chain; each vassal owing fealty to his own immediate lord, but being bound by no tie whatever to the lord's lord. Such was the leading principle of the system which prevailed over France and Germany at the time of the Norman Conquest, which was introduced into England by William the Conqueror and his Normans, and engrafted on the Saxon mark system, but modified by the genius of William I. to suit his own theories of statesmanship. It was introduced about the same period into Scotland by various adventurous Norman knights, and engrafted on the older clan system with such modifications as suited their purpose. Thus three distinct types of feudalism arose with marked differences, as we shall see. The disruptive tendency of the continental feudalism is obvious; the system was there pushed to its logical conclusion. Thus, for instance, the Duke of Brittany was vassal of the king of France, and owed him fealty, as did the vassals of the duke to him, but between the king and the vassals of the duke there was no tie whatever. When therefore the duke chose to throw off his allegiance and rebel against the king, his vassals were bound by their feudal obligations to support him. Such a system could only result in making France a mere congeries of powerful barons bound by slight ties to a nominal head. The weakness of the Carolingian kings and the early Capets largely conduced to this, as did also the degeneracy of the people, who seem to have forgotten that they ever had rights, and who became the ready tools and subservient slaves of the ambitious nobles. In Germany, though the disintegrating tendency was equally marked, the social development was different, owing to the sturdy independence of the German people making it necessary for any chief who aimed at independent power and throwing off the yoke of the central authority to identify himself with the nationality and the aspirations of his vassals. In this way the Guelphs became practically independent lords of the vast fiefs in Swabia, and many another great chief threw off his feudal allegiance, and Germany became a collection of confederacies, the feudal lord of each being representative of the race of his vassals, as well as supreme land-owner.

William I. in introducing feudalism into England had no intention of becoming himself a mere *roi-fainéant;* he intended to be king of all England, lord of the lowest as well as the highest, not mere feudal lord of a number of practically independent chiefs. In this policy of course he had to face the opposition of his chief followers, whose object was to carve out large lordships for themselves, rendering a nominal homage to William, but practically independent of him. William's policy showed a grasp of the principles of statesmanship rarely equalled; being obliged to reward his chief followers handsomely, he soon saw that it would be dangerous not to make large grants of land, and equally dangerous to make such grants as would enable them to set up independent kingdoms. The plan he took was to make extensive grants, but to scatter them through various counties. For instance, his half-brother Odo of Bayeux got 439 manors, but they were scattered through 17 counties; Robert of Mortain had 793 manors scattered through 20 counties. Thus, had either of these been minded to rebel, no coherence or union was possible among vassals so scattered, and in each county an attempt to collect forces for rebellion would have resulted in a collision with a powerful sheriff at the head of his *fyrd* (the army of the shire), who, being a continuation of the Saxon and popular system of government, and being royal officers entirely, might be trusted to curb the lawless barons. This, however, was not all. No sooner was William I. firmly seated on the throne, and the Domesday survey completed, than in 1086 at Salisbury he took a step which was in direct violation of the elementary feudal principles; for he summoned a great meeting to which we are told there came 'all his witan and *all* the land-owners of substance in England, whose vassals soever they were, and they all submitted to him and became his men, and swore oaths of allegiance to him that they would be *faithful to him against all others.*' Thus there was provided a direct tie between the king and all the freeholders which no intermediate tie would justify them in breaking.

We may now consider the nature of the services on condition of which land was feudally held, premising that in English nomenclature the man who held land was called a *tenant*, the land holden was his *tenement*, and the conditions of holding his *tenure*. Tenures, then, were of three kinds, answering to the three chief classes of the community, viz. free, unfree or base, and religious; and each of these might be for certain services—i.e. a fixed amount of money or labour at fixed periods—or uncertain—i.e. such amounts and at such times as the lord might require. For example, the free and uncertain tenure, usually considered the noblest of all the tenures, was on condition of following the lord when he went to battle (which might of course be every year, or not at all for a number of years), with a body of men and for a number of days in the year accurately proportioned to the size and value of the holding; this was called Tenure in Chivalry or by Knight Service. The free and certain tenure was the payment of a fixed sum of money, or sometimes the performance of some service of a peaceful and usually agricultural nature, and this was termed Free and Common Socage. The base tenures were those which depended originally on the performance of menial offices, and were in fact the tenures by which serfs allowed to squat on the lords' land held their little patches at the will of the lord; a modernised and greatly modified form of this tenure still exists in England under the name of Copyhold (q.v.). The religious tenures, under which in early times all the church lands were held, were known as Frankalmoign and tenure by Divine Service, the theory being that the prayers of holy men were all they could be called on to give by way of service to men, and the difference between the two being simply that in the former the number and times of the prayers was left to the conscience of the tenant, in the latter a certain number of masses was laid down, and if they were not duly said the lord had his remedy by distress; this last tenure became obsolete at the Reformation. Frankalmoign or free alms is still the tenure whereby in England

the parson holds the church and glebe, the nearest thing to allodial ownership known in England. The necessity, especially in military tenures, of knowing accurately who the tenant was, gave rise to a number of so-called 'incidents of tenure.' Thus, on death of a tenant, the custom of the particular manor, which was pretty much the same all over the country, pointed out who by descent became his rightful successor; if the heir was a minor, another incident gave the lord the wardship of his person and lands till his majority; if a female, the lord might dispose of her hand in marriage, lest she should marry a hereditary enemy; if the tenant wished to sell his land, the lord must accept the new-comer as his tenant; and if the tenant died altogether without heirs, the land escheated to the lord. Accordingly, the lord might always know who his tenant was, and where to look for his services.

In England, though the oath at Salisbury to a large extent took the sting out of feudalism and minimised its disruptive effect, all these results and incidents developed themselves with great luxuriance and symmetry; but in or about the time of Henry II. a custom arose of commuting all the services for money to be spent in pay of mercenary soldiers, and thus another blow was dealt at the personal relationship based on land-holding which was of the essence of the feudal system. Later still, in the reign of Edward I., was passed the famous statute known as Quia Emptores (18 Ed. I. chap. 1), prohibiting any vassal from granting any land to be held in fee-simple under himself, and enacting that if he wished to sell it he must do so out and out, so that the purchaser thenceforth should hold of the same chief lord as the seller had held of before. Thus the formation of the infinite chain of lord, vassal, and sub-vassal was checked, till in process of time it has come about that nearly all freeholders in England hold directly from the crown. About the same time in France the influence of powerful kings began to absorb the semi-independent dukes and princes into the crown, but not till the following century was the result finally achieved by Louis XI. He broke the feudal power of the great Duke of Brittany, the last, as he was the most powerful of the feudatories of the crown. In this way French feudalism became a thing of the past by the absorption of all the mesne lords, finally bringing about the same end which William I. accomplished by masterly policy in England; but bringing it about by dint of the sacrifice of all the great nobles, and reducing France to the condition of a powerful king with a weak and servile people, a state of things necessarily leading to the greatest tyranny and to revolution and upheaval. Meantime in England the progress was steady and certain. Quia Emptores destroyed the disruptive force of feudalism; but the old military tenures remained in name, though in fact they were little more than excuses whereby the lord contrived to screw money out of the unlucky tenant in the guise of fines for alienation, reliefs on taking up the inheritance by the heir, heriots, first-fruits, prime seisins, &c. There were also the aids given by the tenant at certain expensive epochs of his lord's life, viz. when he was taken prisoner and required ransom, when his eldest son was dubbed a knight, and when his daughter was married—*pur ransommer son corps, pur faire fitz chevalier, et pur marier sa fille.* The extortion to which the feudal system finally degenerated, when all its original purpose was gone, was put an end to by the Statute abolishing Military Tenures, passed on the restoration of Charles II.; and from that time forward feudalism to all intents and purposes was dead in England, save only so far as it affected the forms of conveyance of land. A few of the old tenures were preserved, probably on account of their picturesqueness and of their being too light to be any real burden, such as the tenures of grand and petit sergeanty, under the latter of which the Dukes of Marlborough and Wellington hold their lands on condition of the presentation of a flag to the sovereign.

We have seen how in France the disruptive nature of the feudal system and its tendency to create a class of petty sovereigns more powerful than their feudal lord proved the destruction of the system itself in that country in the 15th century; and how the very introduction of it into England was marked by a violation of one of its essential features, so that feudalism in its integrity never existed in England. But probably the country where the system can be most advantageously studied in its development and decay is Scotland; into this country it was introduced not by a powerful monarch like William I., but by a number of restless and ambitious Norman knights journeying north in search of adventure, who by their good swords and their Norman talent for organisation made themselves chiefs of powerful clans. The process by which this was accomplished and its general good effect on the country have been well shown by the Duke of Argyll in *Scotland as It Was and as It Is* (2 vols. 1887). From these Norman knights the great houses of Bruce, Stewart, Fraser, Grant, Comyn, and many others take their rise; but the poverty of the country and the sparseness of population, constantly reduced by devastating wars, prevented the aggrandisement of the feudal lords, and checked the disruptive tendency of the system just sufficiently to preserve its vitality to a comparatively modern period. Indeed, in the rebellion of 1745, it became evident that sufficient of the feudal spirit remained to be a source of danger to any government which chanced to be unpopular with the Highland chieftains, and also sufficient of its disruptive and disintegrating tendencies to render any enterprise depending on their support extremely precarious. Accordingly, after the suppression of that rebellion, the military tenures were abolished by legislation very similar to that which at the Restoration had abolished them in England. Nothing analogous to the oath at Salisbury ever took place in Scotland; accordingly the development of the system which made every chieftain a king in miniature, whose little realm was a sort of microcosm of the whole kingdom, proceeded unchecked. No statute analogous to Quia Emptores ever prevented subinfeudation, and accordingly to this day there may be any number of links in the chain of superior and vassal and sub-vassal; while in England, since no sub-vassal could be created after 18 Edward I., the intermediate lords have for the most part gradually dropped out, and most land-owners now hold directly from the crown, which was one result aimed at by William I., resulting in the most complete consolidation of the country.

Those who wish to see the remains of the feudal system in visible, albeit dead and fossilised form, may do so more completely on the banks of the Rhine than almost anywhere else. The castle of the feudal baron towers on its height; the village of his dependents nestles at its foot, with the church whose priest was his tenant in frankalmoign, or maybe his chaplain; the pier, it may be, which paid his dues—in fact, all the machinery of a tiny kingdom. Between one baron and another there might be friendship; there was more often feud. Over a number of the barons was some feudal lord, a prince-bishop perhaps, or a duke, and over them again the king; and in legend and story as well as in visible remains of the ancient buildings may be traced all the ramifications of the system, till the

eye of fancy can without much difficulty reconstruct it again.

See the histories of Hallam (1818) and Stubbs (1874–78); works by F. W. Maitland, Vinogradoff, and J. H. Round; Seebohm, *Village Community* (1883); Guizot, *Histoire de la Civilisation en France* (1845); Waitz, *Deutsche Verfassungsgeschichte* (new ed. 1879–86).

Feu de Joie, or 'running-fire,' a discharge of musketry into the air, by a line of soldiers, in honour of a victory or other great occasion. It commences with the right-hand man of the line, and passes rapidly down it, each man discharging his rifle after a short but regular interval, till the extreme left of the line is reached.

Feuerbach, Ludwig Andreas, German philosopher, fourth son of the following, was born at Landshut, 28th July 1804. After he had studied theology for two years at Heidelberg under Paulus and Daub, Hegel attracted him to Berlin, and ere long he abandoned theology for philosophy. In 1828 he became *privatdocent* at Erlangen, but failed as a lecturer, and next retired to Bruckberg, where his wife's means enabled him to live in studious quiet for more than twenty years. In 1830 he published anonymously his *Gedanken über Tod und Unsterblichkeit*—an attack on the doctrine of immortality—and during the next few years, works on the philosophers between Bacon and Spinoza, on Leibnitz, and Pierre Bayle. But these historical works only paved the way to a critical investigation into the nature of religion and its relation to philosophy, the results of which have been given to the world in several works well known to speculative theologians. The most celebrated of these is his famous work on the nature of Christianity, *Das Wesen des Christenthums* (1841), which had the honour of translation into English from the pen of Marian Evans (George Eliot). Starting from the Hegelian doctrine that the Absolute comes to consciousness only in humanity, Feuerbach denies to it any existence beyond the human consciousness, maintaining it to be merely the projection by man of his own ideal into the objective world, on which he feels his dependence. All authority above man, and consequently all moral obligation, is therefore consistently regarded as a delusion proceeding from man himself, and the highest good is explained as that which is on the whole most pleasurable. Yet even this highest good is further explained as consisting in resemblance to that ideal humanity which man creates for himself, and worships as God. A kind of ideal theism is therefore retained by Feuerbach; but when his doctrines were adopted by the mass of German communists, they degenerated, perhaps logically, into an actual atheism, which ignored any moral or social law imposed on the individual from any other source than himself. The last years of the philosopher were vexed with poverty, from which he was relieved by the offerings of admirers, by paralysis, and at last by death, 13th September 1872. His works were collected, with additions and corrections to bring them into accordance with his later views, in 1846–66. See books by Grün (1874), Beyer (1872), Starcke (1885), Engels (1888), Bolin (1891), and Lévy (1904).

Feuerbach, Paul Johann Anselm von, one of the most distinguished criminal jurists of Germany, was born at Jena, 14th November 1775. From the gymnasium at Frankfort-on-Main, where his father was an advocate, he passed in 1792 to Jena to study first philosophy, then law. Already he had made a brilliant reputation by his *Kritik des natürlichen Rechts* (1796), and his *Anti-Hobbes* (1798), when he began to deliver lectures which introduced into criminal jurisprudence a new method of treatment, systematised in his *Lehrbuch des gemeinen peinlichen Rechts* (1801; 14th ed. 1847). This celebrated work placed Feuerbach at the head of a new school of jurists, who maintain that the decision of the judge in every case ought to be determined solely by an express deliverance of the penal law, never by his own discretion, and who on that account obtained the name of Rigorists. It gave a powerful impetus to the feeling in favour of more humane and less vindictive punishments. In 1801 he was appointed professor in Jena, but in 1802 accepted a call to Kiel. In 1804 he removed to Landshut; but next year he was transferred to an official post in Munich, and in 1808 was appointed privy-councillor. The new penal code which he planned for Bavaria (1813) was taken as a basis in the emendation of the criminal law of several other countries. During this period also he published his *Merkwürdige Kriminalrechtsfälle* (1808–11). In his *Geschworenengericht* (1813) he maintained that the verdict of a jury is not necessarily adequate legal proof of a crime. Supplements were published in 1819 and 1821, and a second volume was added in 1825. In 1814 Feuerbach became second president of the Court of Appeal in Bamberg, and afterwards first president of the Court of Appeal at Anspach. In 1832 he published a work on Kaspar Hauser (q.v.). He had just edited a collection of his *Kleine Schriften* when he died suddenly at Frankfort-on-Main, 25th May 1833. An interesting life was written by his son Ludwig (2 vols. 1852).

Feuillants, Congregation of, a reform of the Cistercian order, remarkable as forming part of the great religious movement in the Roman Catholic Church during the 16th century, contemporary with and probably stimulated by the progress of the Reformation. The author of this reform was Jean de la Barrière, abbot of the Cistercian monastery at Feuillants in Languedoc (20 miles south-west of Toulouse), who, painfully struck by the relaxation of its discipline, laid down for himself a new and much more austere course of life, in which he soon found many imitators and associates among the brethren of his order. The rule thus reformed was, after considerable opposition from the advocates of the old rule, approved, with certain modifications, by Pope Sixtus V., the reformed congregation, however, being still left subject to the authority of the abbot of Citeaux; and a convent was founded for them by Henry III. in the Rue St Honoré, Paris. The subjection to the abbot of Citeaux was removed by Pope Clement VIII. in 1595; and Urban VIII. in 1630 separated the congregation into two branches, one for France and the other for Italy, each under a distinct general. The rules of both these branches were subsequently modified about the middle of the same century.

The celebrated revolutionary club of the Feuillants took its name from this order, whose convent in the Rue St Honoré was its meeting-place. It was founded in 1790 by Lafayette, Sieyès, Larochefoucauld, and others holding moderate opinions, but it soon fell before the devouring fire of revolution. At length, on the 28th March 1791, the assembly in the cloister was forcibly dispersed by a raging mob. In October 1791 the extreme right and the right in the Legislative Assembly were often called Feuillants.

Feuillet, Octave, a distinguished French novelist, born at Saint-Lô, in La Manche, 11th August 1821. He was numbered for some time in the band of Dumas' literary assistants, and began his own literary career with *Le Fruit défendu*, in the *Revue Nouvelle*. From 1848 he published in the *Revue des Deux Mondes* a series of

proverbs, comedies, tales, and romances, collected in *Scènes et Proverbes* and *Scènes et Comédies* (5 vols. 1853–56). Elected Scribe's successor in the French Academy (1862), and afterwards librarian to the emperor, he died 29th December 1890. Some of the earlier novels, as the pathetic story *La Petite Comtesse*, gave promise of power, but his popularity as a novelist really awoke with the publication of the masterpiece *Le Roman d'un Jeune Homme Pauvre* (1858), and the only less beautiful *Sibylle* (1862). These were followed by *M. de Camors* (1867), *Julia de Trécœur* (1872), *Un Mariage dans le Monde* (1875), *Les Amours de Philippe* (1877), *Le Journal d'une Femme* (1878), *Histoire d'une Parisienne* (1881), and the striking *La Morte* (1886). He wrote many successful comedies, but it remains true that his dramatic faculty is more effectively displayed in his novels than in his work for the stage. Feuillet had many excellent gifts as a writer of fiction. His stories are cleverly constructed, gracefully told, and unstained by coarseness; he is thoroughly acquainted with the high circles in which his characters move; he has pathos and even passion at his command. Yet he cannot be classed as a great novelist. He never created a really strong character; he frequently strikes a false note; he indulges in morbid sentimentalism, and has a weakness for treating dubious situations while posing as a strict moral teacher. These defects are in the main unapparent in *Le Roman d'un Jeune Homme Pauvre*, but the story, though interesting and in parts charming, yet fails to leave a powerful impression on the reader.

Feuilleton (Fr., lit. 'a small leaf'), the name applied to that portion of a political newspaper set apart for intelligence of a non-political character, for criticisms on art or literature, or for fiction, and usually separated from the main sheet by a line. The feuilleton was first adopted in 1800 by the Abbé Geoffroy for dramatic criticisms in the *Journal des Débats*, but by degrees the element of belles-lettres became dominant, and the result was a species of light journalistic literature, in which Jules Janin became the acknowledged king. In the years immediately preceding the revolution of February 1848 entire romances were spun out in the feuilleton, as the novels of Eugene Sue in the *Constitutionnel*. Among the later French *feuilletonistes* may be named Fr. Sarcey, P. de Saint-Victor, Alb. Wolff, Jul. Claretie, and A. Scholl. The French system has been imitated in Germany, though with less success than in France, but has hitherto found less favour in England. The more eminent of recent German *feuilletonistes* are K. Frenzel, P. Lindau, L. Pietsch, F. Gross, O. Bauck, and the humorists, Eckstein, Stettenheim, Trojan, and Dohm.

Féval, Paul Henri Corentin, a French novelist, born at Rennes, September 27, 1817. Of his many bright and vigorous novels may be named *Les Mystères de Londres* (1844), *Le Fils du Diable* (1847), and *Le Bossu* (1858), the last named dramatised with much success. Féval became converted to the strictest Roman Catholicism in 1876. He died at Paris, 8th March 1887.

Fever (Lat. *febris*) is a condition of the system in which the most marked sign is rise in temperature. It is one of the most common accompaniments of disease, especially of disease caused by infection. When it occurs in a moderate degree, it must be regarded in general as a necessary accompaniment to the processes which form the defensive mechanism of the body against bacteria and other outside influences which produce disease. In some persons a feverish condition is provoked by very slight causes, as in children and in hysterical subjects.

The temperature of the body is regulated by a nervous and chemical mechanism, so that in health it ranges between 98·4° and 99·5° Fahr., liable to slight variations from the eating of food, muscular exertion, and a natural fluctuation which rises about four in the afternoon and sinks to its lowest point in the early morning. The maintenance of the proper amount of heat when the surrounding air becomes colder is brought about by contraction of the vessels in the skin, and a destructive oxidation of the bodily tissues. In the feverish state the latter process takes place to an excessive degree, and the skin, which at first is cold and bloodless, becomes later flushed in an attempt to get rid, from the surface, of the unusual amount of heat produced in the deeper tissues. In this condition the body wastes rapidly, the loss to the system being chiefly in the form of nitrogen compounds; so that in the early stages of a fever a patient excretes about three times the amount of urea that he would excrete on the same diet if he were in a state of health. The degree of the fever is estimated by the height of the temperature above the normal standard. In most of the febrile diseases, like influenza, rheumatic fever, diphtheria, &c., a rise to 102° or 103° is usual; in others, the oxidation process in the tissues is more violent, and in pneumonia, typhoid fever, &c., it frequently stands at 104° or 105°; when it reaches as high a point as 106°, the term 'hyperpyrexia' (excessive fever) is applied, and this is regarded as a point of danger; while if it exceeds 107° or 108° Fahr. for more than a short period death almost always results. Sometimes in febrile diseases, in apoplexy, &c., the temperature may rise to 110° or more before death takes place.

The commencement of a fever is usually marked by a 'rigor' or shivering, which may only exist as a slight but persistent feeling of chilliness, or may form a distinct stage of the attack, as in malaria, or may even be so violent, as sometimes happens with children, that well-marked convulsions appear. There are other feelings of illness also, such as pain in the back, headache, sickness, thirst, and great lassitude. This stage, known as the 'chill' or 'cold stage,' is soon followed by the full development of the 'hot stage.' The skin now feels hot and dry, and the temperature, raised above the normal level, is often found to show daily variations corresponding to those of health—that is, a rise in the evening, with a fall towards normal or even sometimes below normal every morning. There is an increase in the rate of the pulse and of the breathing; the tongue is dry and furred, especially in some fevers, like typhoid; thirst is marked, the appetite disappears; while the urine is scanty, and of high colour. The bowels are generally constipated, though in some fevers, like dysentery and typhoid, in which the intestine is diseased, there is diarrhœa. The nervous system shares in the general disturbance, so that sleeplessness and often delirium come on. The wasting of the muscles is very marked after some days of fever, and there is consequently great loss of strength, even although considerable quantities of food are taken. Some fevers come to a sudden end by *crisis*, when the temperature falls to normal along with profuse perspiration, copious flow of urine, and disappearance of the nervous symptoms. Pneumonia and typhus fever end typically in this way. Other fevers, of which typhoid is an example, end by a gradual subsidence of the temperature known as *lysis*, the sick person becoming better each day for a week or so till the normal is reached.

The term *exanthemata* is applied to that group of fevers which are characterised by a distinctive rash—e.g. scarlet fever, measles, smallpox. All these and some others, in which the temperature,

after rising to a certain point, remains more or less steady there for some days, are known as *continued fevers*. Some attacks of fever tend to have a distinct fall of temperature every day, and this type, frequently seen, for example, in the disease called empyæma, is known as *remittent fever*. *Hectic fever*, which occurs in advanced consumption, with a high rise by day and a fall of temperature below normal, accompanied by profuse sweating in the early morning, is of the remittent type. *Intermittent fever* is one in which there is periodically a complete subsidence of the symptoms with recurrence at regular intervals. This is specially characteristic of the malarial fevers, and these are named *quotidian* if the fever recurs each day, *tertian* if it recurs on the third, fifth, &c., days, and *quartan* if on the fourth, seventh, &c. These periodic returns of the fever depend on the length of time necessary for a cycle of development to take place in the parasites which cause the disease. The term *malignant*, when applied to fevers, is indicative of special severity.

As regards treatment of the fever, the condition being in mild degrees simply a manifestation of the reaction of the body to the disease, no treatment beyond means intended for the comfort of the sick person are, as a rule, necessary. The continued fevers run a course of more or less definite duration, and in general sponging with tepid water to keep the skin clean, the administration of mild diaphoretic and diuretic medicines, the maintenance of the recumbent position in bed, and careful restriction of the diet to milk, light soups, and farinaceous materials afford all the treatment that is necessary. Among the drugs frequently used may be mentioned mindererus spirit, sweet spirit of nitre, salicylate of soda, and aceto-salicylic acid, better known as aspirin. When the fever is undesirably but not dangerously high, some of the coal-tar derivatives are frequently administered, e.g. antipyrin, phenacetin, &c. Quinine, as well as having a general application in feverish states, is the drug used *par excellence* in malaria with the object of killing off the parasite to which the attacks are due.

When the temperature has reached an alarming height, and especially in cases where the heart's action is much weakened, the use of these 'febrifuge' drugs is not admissible, and the great remedy is to cool the patient by the bath. The fevered person is usually placed in water at about the normal temperature of the body; and, by adding cold water, this is cooled down to a temperature of 60° or 70° Fahr. The relief to the patient is remarkable, the body parts rapidly with its superfluous heat, and general improvement takes place. This lasts for several hours, after which the bath may be repeated if necessary. The same result is attained by the use of the wet-pack, which consists in a wet sheet wrapped round the patient as he lies on the bed.

Fever-bush (*Lindera Benzoin* or *Benzoin odoriferum*), a shrub common in the northern United States, remarkable for its graceful form and beautiful leaves. A decoction of its aromatic and tonic bark is used as a stimulant in fevers.

Feverfew (*Matricaria—Pyrethrum—parthenium*), a composite perennial, common in hedge-banks and waste places, but in Britain usually as a garden escape. It is closely allied to camomile, and still more to wild camomile (see CAMOMILE), and like these is of immemorial use in medicine as a tonic and bitter, its popular name recording its febrifugal properties. Like many other popular medicines, it has now been replaced by more potent remedies, save occasionally in the domestic practice of country districts, or in that of the herbalist. A double variety is not uncommon in gardens. The Mayweed (*M. inodora*) with leaves more resembling those of camomile, but almost scentless, and arge flowers with white ray and yellow disc, is common in cornfields and waste places in Britain and throughout Europe. See PYRETHRUM.

Feverwort (*Triosteum perfoliatum*), a perennial of the order Caprifoliaceæ, a native of North America, where its dried and roasted berries have been occasionally used as a substitute for coffee; its roots act as an emetic and mild cathartic. It is sometimes called *Tinker's Root*, from the physician who first brought it into notice.

Common Feverfew (*Matricaria parthenium*).

Fez, or more properly FAZ, one of the capitals of the sultanate of Morocco, lies inland in 34° 6′ N. lat. and 4° 58′ W. long., about 100 miles E. of Rabat on the Atlantic. Standing in a pear-shaped valley surrounded with hills, which are clothed with orchards of orange, pomegranate, apple, and apricot trees, and with olive-gardens, whilst the plain is strewn with numerous ruined buildings, Fez presents a strikingly oriental appearance. The town itself, divided into two parts by a little stream that joins the Sebu 2½ miles to the NE. of the town, is encircled by crumbling walls, and has narrow, dirty, sunless streets. For more than a thousand years Fez has been one of the sacred cities of Islam, being especially renowned for its university and schools of learning. The university, attached to the mosque of the Cherubim, called also the mosque of Muley Edris (one of the largest and most venerated in North Africa) was founded in 859; at present it is frequented by about 1500 pupils, who come from all parts of the Mohammedan world. Attached to this mosque is a library, computed to contain 30,000 MSS. Besides the university there are also fourteen colleges. The extensive palace of the sultan is now partly in ruins. A railway from Fez to Rabat by Mequinez was completed in 1915. Fez is one of the busiest commercial towns of north-west Africa; its merchants import European manufactured wares and the productions of tropical lands, which they despatch by periodical caravans to Timbuktu and the interior of Africa, and export (since 1885 very largely by way of Rabat, instead of as formerly by Tangier) the products they receive thence in return, such as fruits, gums, ivory, gold, together with those of the native industries, chief amongst which are morocco leather, fez caps, pottery, and gold and silver wares. The population is very variously estimated from 150,000 to 50,000; a native computation in 1898 puts it at only 24,000, embracing Arabs, Berbers, Jews, and Negroes. Fez was founded by Muley Edris in 808, and was the capital of the Edrisi dynasty as long as it lasted. Towards the end of the 11th century the town was made the capital of an independent kingdom, founded (1086) by the Almoravid prince, Yussuf ibn Tashfin, and from that time onwards it ranked, on account both of the veneration it was held in as a sacred city and of its learning, as one of the first cities of Islam. But from the date of its incorporation with Morocco, in 1548, it began

to decay in importance. It was occupied by a French relieving force in May 1911. See Meakin's books (1899–1902), and other works named at the article MOROCCO.

Fez, a red brimless cap of fine wool, fitting closely to the head, with a tassel of black or blue, worn in Turkey (till 1924), Persia, Greece, Albania, Egypt, and on the shores of the Levant generally. The name is derived from the town of Fez, where such caps were long made; at present the best are manufactured in Tunis, but fezes of fair quality are prepared in Germany, France, and Switzerland. In Africa they are usually called *tarbûsh*.

Fezzan, a province of North Africa, transferred in 1912 from the Turkish empire to Italy, is politically attached to Tripoli, to the south of which country it lies. Extending some 390 miles N. and S., and some 300 E. and W., Fezzan belongs to the desert region of North Africa. It consists of a huge depression, fenced in on all sides except the west by low ranges of hills, and traversed by barren, stony, shelterless plateaus, between which lie long shallow valleys, containing numerous fertile oases. The northern barrier of the province is the range of Jebel es-Soda, which strikes off nearly due east from the south-east corner of the Saharan plateau called the Hammada el-Homra, and is continued towards the south-east by the Haruj el-Aswad. The Jebel es-Soda measures about 125 miles in length, and has an average altitude of 2950 feet. South of this range stretches for some 80 miles a series of low elevations, strewn with smooth stones, destitute of water, and almost entirely devoid of plant and animal life; beyond these again comes a region of sandy alluvial soil, containing saline deposits, with a tolerably good supply of water at 10 to 12 feet below the surface. South of the Hammada el-Homra Fezzan is invaded by the *edeyen* or Saharan sand-dunes; and these are separated from the Hammada of Murzuk on the south by the Wady Ladshal, a watercourse extending north-east for about 125 miles. The southern border of the province is formed by the Tümmo Hills, more than 2500 feet high, which connect the Ahaggar plateau in the north-west with the mountainous region of Tibesti in the south-east. The entire region slopes gently towards the east.

The oases, mostly depressions in the valleys, are the only cultivated spots, where a little grain and a few vegetables are raised, and where grows the date-palm, the principal source of food for the inhabitants and their domestic animals. Of these camels, poultry, and pigeons are alone kept in any great number. The climate is on the whole uniform and healthy. Fezzan is both hotter in summer and colder in winter than Tripoli; its temperature ranges from 23° to 112°, the annual mean being 70° F. The atmosphere is very dry: rain scarcely ever falls. The principal winds blow from the south and east, but from December to April north and west winds are very prevalent. There is no industry, no export trade except in soda, obtained from extensive salt lakes north-west of Murzuk, and very little commerce. Formerly, however, the Fezzan merchants occupied a very important position as intermediaries in the trade between Tripoli and Egypt on the one hand, Bornu and Timbuktu on the other; but the opening of new routes and the attempts to check the trade in slaves—the great staple of this route—have destroyed the commercial importance of Fezzan. The inhabitants, variously estimated at from 50,000 to 200,000, are a mixed race, embracing Tuareg, Tibbu, Bornu, Haussa, and Arab elements grafted on the original nomadic stock. They are frivolous, pleasure-loving, and idle, but noted for their honesty and good-nature, as well as notorious for their immorality. In their manners and social customs they have borrowed largely from Arab originals; in religion they are Mohammedans of the Sunnite creed. The principal town of the province is Murzuk (pop. 5000).

Fezzan is the ancient Phazania, or the land of the Garamantes, who were conquered by the Roman Balbus in 20 B.C. In the 7th century the country was subdued by a lieutenant of 'Amr, the Moslem conqueror of Egypt. From the 10th century onwards, except in the 13th century, when it was held by the kings of Kanem, Fezzan was ruled by native or Arab dynasties. From the 16th century its history was a series of struggles against Tripoli, until in 1842 it became Turkish, in 1912 Italian.

Ffestiniog. See FESTINIOG.

Fiacre, or FIACRACH, ST, an Irish hermit who settled near Meaux in France, building a small monastery there. He died about 670, and from the 9th to the 17th century was famed as a worker of miracles, especially curing a kind of tumour. His shrine, ultimately deposited in the cathedral of Meaux, was long an object of pilgrimage. His name has been oddly perpetuated in connection with Cabs (q.v.) and Hosiery (q.v.).

Fiars (connected with the French *affeurage*, 'taxation,' and the English *feor*) is a term meaning 'prices,' and now in Scotland used to denote the prices of grain fixed annually, mainly for the purpose of settling the rate at which the stipends of the parochial clergy are converted into money. The *fiars* prices are the prices of the different kinds of grain of the growth of each county for the preceding crop, as fixed by the sentence of the sheriff, proceeding on the report of a jury summoned for the purpose, before whom the evidence of farmers and corn-dealers is produced. The original use was to fix crown rents, but at an early date the system was applied to church stipends. See TEINDS. Fiars prices, in addition to being the basis for payment of stipend, are also used in varying degrees in different districts in connection with the payment of grain rents of farms, and in the settlement of valuations as between landlord and tenant or incoming and out-going tenants.

The procedure in 'striking the fiars' is regulated by Act of Sederunt, 21st December 1723, re-enacted in the Codifying Act of Sederunt, 1913. The time fixed by this act for summoning the jury is between the 4th and 20th of February, and the sentence of the sheriff, applying the verdict of the jury, and fixing the fiars prices for the preceding crop, must be pronounced before the 1st of March. The sheriff selects a jury of fifteen, of whom eight are heritors, who elect one of themselves as chancellor, receive the evidence tendered, and on that evidence fix or, as it is termed, 'strike' the fiars prices of the several sorts of victual. An Act of Sederunt, 29th January 1918, permits the sheriff, in fixing the fiars prices, to dispense with a jury, and to proceed to fix the fiars prices on such evidence as seems to him proper and sufficient. Since the passing of this act the general practice has been for the sheriff, instead of calling witnesses to attend at the Fiars Court to speak to their individual transactions in grain, to require farmers and others in the various parishes in the county to fill up signed statements giving details of their transactions in the different kinds of grain during the year. The existing system of striking fiars prices is open to adverse criticism, on the ground that it is antiquated in principle, uncertain in results, and troublesome in operation. Remedies were suggested by departmental committees in reports dated 30th August 1901 and 31st May 1911. The report, dated 20th April 1917, of a departmental committee on fiars prices in Scotland sets out the fluctuations in these

prices in recent years. A bill for the standardisation and commutation of victual stipends was brought forward by the Secretary for Scotland in 1920, but was withdrawn. The departmental committee on the endowments of the Church of Scotland in their report, dated 4th April 1923, recommend the conversion of victual stipend into a fixed and permanent money value, on the basis of average value over a period of fifty years up to and including 1922. In England, under the Tithe Commutation Acts, one set of values, based on an average of the preceding seven years, is fixed for the whole country (see TITHES). See Paterson, *Historical Account of the Striking of the Fiars in Scotland* (1852); *Fiars Prices*, by William Hector; *Position of Fiars Prices and Conversion of Grain Payments*, by N. Elliot (1879). For the fiars prices prior to 1776, see Bald's Tables. See also Taylor's *Tables of Value of Tithe Rent Charges* (1879), and, for fiars prices in the several counties of Scotland, see annual issue of Oliver and Boyd's *Edinburgh Almanac*.

Fiasco, a term borrowed from the usage of the Italian theatre, and now naturalised in France, Germany, and England, for a failure in acting or singing, or by extension of the metaphor for a failure of any kind. In Italy it is not uncommon to hear an audience cry out, 'Olà, olà, *fiasco*,' even when the singer has only made a single false note. The word means literally 'a bottle,' and its metaphorical use may contain an allusion to the bursting of a bottle.

Fiat, in English law, a short order or warrant of a judge or public officer for making out or allowing processes, letters-patent, &c.

Fiber. See MUSQUASH.

Fibre. See FIBROUS SUBSTANCES, MUSCLE.

Fibrin is a protein substance appearing in the blood during coagulation. In blood, which has escaped from a blood-vessel, there appears, in the course of a few minutes, a fibrous network, which, with the corpuscular elements of the blood enmeshed in it, becomes denser and undergoes contraction, forming the clot. Fibrin is the material of which this fibrous network is composed.

Fibrin is most easily prepared by whipping blood during coagulation with a bundle of fine twigs. The fibrous, elastic threads, as they are formed, adhere to the twigs, and the resulting mass of fibrin may then be freed from the other components of the blood by washing in water. It is a stringy, elastic, white substance, insoluble in water, alcohol, or ether, soluble in dilute salt solution, and precipitable by saturation with sodium chloride or magnesium sulphate, reactions which place it in the globulin class of proteins.

Fibrin arises from a substance of apparently similar chemical nature, *fibrinogen*, which is normally present in the circulating blood. On examining coagulating blood with the ultramicroscope the fibrin is seen to be deposited as very small needles, at first exhibiting some freedom of movement, but, rapidly becoming more numerous and interlacing with one another, ultimately forming a stationary mass. The process is apparently one partly of crystallisation and partly gelatinisation.

The conversion of the fluid fibrinogen to the solid fibrin is brought about by a substance, *thrombin*. Thrombin is not present as such in circulating blood, but again is formed from a precursor *prothrombin*. Two views exist as to the cause of the transformation of prothrombin to thrombin in shed blood. According to one of these, there arises from the blood-platelets, which are in great part destroyed when blood is shed, a substance *thrombokinase*, which, reacting with the prothrombin in the presence of calcium in the ionic state, changes the prothrombin to thrombin. According to the other view, prothrombin and ionic calcium in themselves can produce thrombin, but are prevented from doing so in the circulating blood by the presence of a substance of phosphatide nature. On the escape of blood from a vessel, there is produced, either from the disintegrated blood-platelets or the injured tissues, a substance, also of phosphatide nature, and probably identical with the phosphatide *cephalin*, which has the property of neutralising the antiprothrombin substance, thus allowing the prothrombin-thrombin change to proceed.

Fibroline, a yarn made from flax, hemp, and jute waste, and used with linen or cotton yarn for the backs of carpets and such-like purposes.

Fibrous Substances (all except asbestos animal or vegetable) owe to a peculiarity of structure their capacity for being spun, woven, and felted. Human hair or horse-hair is not suitable for ordinary textile fabrics, because either resembles a very thin flexible rod with smooth sides, so that when an attempt is made to twist a number of them into a yarn, or form them into a felted substance, they will not hold together. Horse-hair used singly is made into cloth because it is exceptionally strong. But nearly all fibres suitable for woven or felted fabrics, such as wool, silk, cotton, or flax, have on their surface serrations or projections of some kind, or they have a proneness to twist and curl, either of which characters causes them to interlock, so that when they are spun into yarn they do not untwist again. These little prominences or projections are only seen when the fibre is highly magnified.

In addition to suitable structure, the value of a fibre for industrial purposes depends upon its strength and elasticity, and upon its capability of being bleached and dyed. Length and fineness are also considered, as well as abundance of supply.

The wool of the sheep and the shawl goat is described under WOOL and KASHMIR GOAT. See their respective heads for alpaca, mohair, fur, and silk. There are a few other animal fibres of some interest or importance, such as camel's hair, from which an excellent cloth is made, and cow-hair, which is used in considerable quantity for inferior kinds of woollen goods. A fibre of a silky nature is obtained from the byssus of a large Mediterranean bivalve shell-fish (*Pinna nobilis*), which is made into shawls and gloves.

Different parts of plants yield fibres. Only dicotyledonous plants have a true bark, and from these come the most important textile fibres of vegetable origin. These generally consist of strong, fine, flexible bast fibres from the bark sheath, of which flax, hemp, rhea, and jute are examples (see BAST). The most valuable of all, however —viz. cotton, consists of hairs which surround the seeds of the plant. In monocotyledonous plants, which also yield many serviceable fibres, these are commonly obtained from the fibrous portions of leaves and of leaf-stalks. More rarely they occur as hair-like fibres which form appendages to leaves or surround their base. Coir (q.v.) fibre is from the husk of the nut of the coconut palm.

Vegetable fibres consist essentially of Cellulose (q.v.), a substance which is not easily acted upon by chemical reagents such as affect allied bodies found in plants. This is an important property in connection with some of the manufacturing processes through which they require to pass.

During the Great War, under stress of shortage of raw materials, various fibrous substances, which had never before been used, or only in some slight measure experimented with, were pressed into service, in Central Europe more especially, in the production of textiles, paper, explosives, &c. Experiments were made, too, in deriving foodstuffs

from fibrous materials hitherto classed as indigestible, and cattle foods of this description were indeed actually adopted.

Cotton, flax, hemp, jute, sisal hemp, and cotton-grass are described under these heads; ramie, rhea, or China-grass under BŒHMERIA; and New Zealand flax (*Phormium tenax*) under FLAX. The vegetable fibres noticed in what follows, though less known than those used in our principal textile industries, are nearly all of some importance commercially. Besides these there are quite a number of plants yielding fibres known to have valuable properties which have not, except in the countries in which they grow, received any industrial application.

FIBRES FROM DICOTYLEDONS.—*Asclepias syriaca* (Silk Weed).—The seeds of this plant are covered with a silky down which is used for a variety of purposes, such as the stuffing of beds and for mixing with wool for certain kinds of cloth and felt. The species is a native of Syria, but is also found in North and South America, and is cultivated in some parts of Europe.

Beaumontia grandiflora is another plant yielding a hairy or silky fibre from the seeds. This is considered to be one of the best and strongest of the seed-hairs called 'vegetable silk.'

Broussonetia papyrifera (Paper Mulberry).—A fine white cloth called tapa is made in a number of the Pacific Islands by beating the bark of this tree. The bark of this and another species of Broussonetia is much used for making paper in Japan. The fibrous portion of the bark of the young shoots of white mulberry (*Morus alba*) has been used as a textile material in Italy (see MULBERRY).

Crotalaria juncea (Sunn Hemp).—Indigenous to Southern Asia and the tropical portion of Australasia; cultivated all over India. The fibre is very suitable for cordage, considerable quantities being exported from India for this manufacture.

Daphne longifolia, D. papyracea, D. Wallichi.—The fibre of the bark of each of these Indian plants is used in the manufacture of paper and ropes.

Eriodendron anfractuosum (Silk-cotton tree).—This is a tropical American tree of the order Bombacaceæ, whose seeds are covered with silky hairs, used for stuffing cushions, &c. The cotton-tree of India and Ceylon, *Bombax malabaricum*, is used in the same way.

Hibiscus cannabinus (Hemp-leaved hibiscus, Deccan hemp).—In Bombay, the Central Provinces, and Madras (regions unsuitable for jute-growing), this small herbaceous shrub is largely cultivated for its fibre, which is used as a substitute for jute. It is rather coarse and harsh, though strong. In India it is made into ropes, sackcloth, and nets, and largely into paper.

Humulus lupulus (Hop).—From the hop vine a useful fibre is obtained, which is turned to account for making cloth in Sweden. In England it has been made into millboard.

Tilia europæa (Common Lime-tree).—The bast fibres of this tree are extensively used in Russia for mats, ropes, and other purposes.

FIBRES FROM GYMNOSPERMS.—*Pinus sylvestris* (Pine-wool).—Fibre obtained from the leaf-needles of the Scots pine has, on the continent of Europe, been made into a blanket stuff for hospitals, flannels, and hosiery. It is usually mixed with cotton or wool. The material is believed to have medicinal properties.

FIBRES FROM MONOCOTYLEDONS.—*Agave americana* (Spanish aloe).—An excellent fibre is obtained from this plant, which grows in great abundance in all parts of tropical America. It has also been successfully introduced into some countries of the Old World. The fibre is made into ropes, twine, and netting, as well as into matting and imitation haircloth.

Agave mexicana.—A plant distinct from the last, though often confounded with it. The fibres of both are used for the same purpose. Paper was made by the ancient Mexicans from *A. mexicana* in the same way as the Egyptians made it from the papyrus.

Attalea funifera (Piassava).—From this palm much of the cordage used on the Amazon River is made. The strong fibres used surround the young leaves. These are known in commerce as piassava fibre, or at least one kind of it, which is used in Europe chiefly for brushmaking. Another kind of piassava is got from *Leopoldinia piassava*, also a Brazilian palm.

Bromelia ananas (*Ananassa sativa*) (Pine-apple).—In some places, such as the Bahamas and India, this plant is cultivated for its fruit, but in Malacca, Java, China, and some other eastern places chiefly for its fibre. Several species of bromelia yield useful fibres. The *B. pigna* of the Philippines yields the fine thread from which the costly pina cloth or pina muslin is made. *B. sylvestris*, called in Central America the *pita*, and in Mexico the *istle*, also produces an excellent fibre.

Carludovica palmata (Panama screw-pine).—The unexpanded leaves yield the straw of which Panama hats, so much valued for their durability, are made.

Caryota urens (Kittool).—From the leaves of this Indian palm the kittool fibre, now largely used to mix with bristles in brushmaking, is obtained. Strong ropes are made of it in India.

Copernicia cerifera (Carnauba or Carnahuba—q.v.—palm).—A Brazilian palm remarkable for the number of useful products obtained from it. In that country the fibres of its leaves are used for ropes, mats, brooms, &c.

Corypha australis (Australian cabbage-palm).—The fibre obtained by splitting the leaves is made into clothing, netting, and hats.

Macrochloa tenacissima (Esparto-grass).—Esparto fibre is now manufactured into Paper (q.v.) on a great scale. For this purpose it is extremely well suited, being fine and strong, with a tendency to curl. Until comparatively recently much of the esparto-grass of commerce was supposed to be the *Lygeum spartum*, an allied plant.

Musa textilis (Manilla hemp).—The chief use of this fibre is in ropemaking, but matting is also made from it on a considerable scale in Dundee. It is prepared from the leaf-stalks of a wild plantain growing in the Philippine Islands.

FIBRE FROM A FLOWERLESS PLANT, *Cibotium barometz* (Pulu fibre).—The fibre so called surrounds the stalks of the fronds (leaves) of the plant, which is a fern growing in the Sandwich Islands. This fibre, like some of those occurring as hairs on seeds, is called 'vegetable silk.' It is used in the United States and Australia for stuffing in upholstery work.

Fibro-vascular Bundle. See LEAF, STEM, BARK, VEGETABLE HISTOLOGY, &c.

Fib'ula, a clasp or buckle (see BROOCH, BUCKLE). For the bone so called, see LEG.

Fichte, JOHANN GOTTLIEB, a distinguished German philosopher, was born at Rammenau, near Bautzen, in Upper Lusatia, 19th May 1762, of a family distinguished for their simple piety, uprightness, and firmness of character. His earlier years were marked by a love of solitary musing and meditation. In 1774 he was placed at the gymnasium of Pforta, near Naumburg; and in 1780 he entered the university of Jena, where he devoted himself at first to theology, but afterwards to philosophy. During the years 1784–88 he supported himself in a precarious way as tutor in various Saxon families. Subsequently he went to Zurich in a similar capa-

city, where he first met Johanna Maria Rahn, who afterwards became his wife. Circumstances preventing their immediate union, Fichte in 1791 accepted a tutorship at Warsaw, in the house of a Polish nobleman. The situation proving disagreeable, it was thrown up, and Fichte proceeded to Königsberg, where he had an interview with Kant, of whom he had become an ardent disciple. At first he met with a rather chilling reception. With the view of establishing a better understanding, he resolved to write his 'Critique of all Revelation' (*Kritik aller Offenbarung*), published in 1792. Kant, on the work being submitted to him, praised it highly, and ultimately recommended Fichte to his own publisher, Hartung. In the meantime, however, Fichte's available means of subsistence being exhausted, he was forced to ask the loan of a small sum of money from Kant, which the latter refused. A temporary appointment as tutor in the family of the Count of Krokow, near Danzig, relieved him from immediate difficulties; and the high literary fame which rapidly followed the publication of the *Kritik* having opened to him a new career in life, he returned to Zurich in 1793, where on 22d October he married Johanna Rahn. In 1794 he was appointed to the chair of Philosophy at Jena, where he commenced to expound his system of transcendental idealism. His prelections were distinguished by singular earnestness and oratorical power, combined with the enunciation of the loftiest moral principle.

He now clearly broke away from the limitations of the Critical Philosophy of Kant, of which he had already declared, writing to Niethammer in 1793: 'My conviction is, that Kant has only *indicated* the truth, but neither unfolded nor proved it.' His 'Doctrine of Knowledge' (*Wissenschaftslehre*, Jena, 1795), his work on the 'Foundation of Natural Rights' (*Grundlage des Naturrechts*, 1796), and the 'Ethical System' (*System der Sittenlehre*, 1798) contain a systematic exposition of his philosophy in its earlier form, expressed in an abstract and somewhat repellent terminology which was laid aside in his later and more popular works. In 1799 an absurd accusation of atheism, fervidly but fruitlessly refuted, led to his removal to Berlin, where he delivered lectures on philosophy to a select auditory. In 1800 appeared his work 'On the Vocation of Man' (*Ueber die Bestimmung des Menschen*). In 1805 he obtained the chair of Philosophy at Erlangen, with the privilege of residing at Berlin during winter. Here he delivered his celebrated lectures 'On the Nature of the Scholar' (*Ueber das Wesen des Gelehrten*, 1805–6). In 1806 appeared his 'Characteristics of the Present Age' (*Grundzüge des gegenwärtigen Zeitalters*), and in the same year his 'Way to the Blessed Life, or the Doctrine of Religion' (*Anweisung zum seligen Leben oder Religionslehre*). In these works we find the highest expression of his philosophy in its mature form, divested of the earlier technicalities. In his relation to the public events of his time Fichte exhibited a high-toned and earnest patriotism. The victories of Napoleon at Auerstadt and Jena drew forth the famous 'Addresses to the German Nation' (*Reden an die Deutschen*). In these addresses, following out the leading idea of his 'Characteristics,' Fichte summoned his fellow-countrymen, in tones of spirit-stirring enthusiasm, to the duty handed down to them from past ages, of founding an empire of reason in which mind alone should assume the guidance of human affairs. With impassioned eloquence he pointed out the true means of national regeneration in a system of public education, of which he laid down the plan and delineated the chief features. His patriotic zeal was fully appreciated by the king, who on the restoration of peace requested him to draw up a constitution for a new university in Berlin. In 1810 the university was opened, with a host of brilliant names, Fichte, Wolff, Müller, Humboldt, De Wette, Schleiermacher, Neander, Klaproth, and Savigny. By the votes of his colleagues, Fichte was unanimously elected rector. Here, as at Jena, he laboured with unremitting energy for the suppression of all those customs which he deemed barbarous in themselves, and incompatible with the true idea of a scholar. But his public career came to a premature close. In 1813 the war of independence broke out, and the hospitals of the Prussian capital were soon crowded with patients. Fichte's wife was one of the first who offered her services as a nurse. For five months she tended the sick with all the patient tenderness and devotion of her nature. At last she was seized with fever, 3d January 1814. After a fearful struggle she recovered; but her husband caught the infection, and in spite of all remedies sank under its influence, and died 27th January 1814. Of Fichte it may be said that he combines the penetration of a philosopher with the fire of a prophet and the thunder of an orator; and over all his life lies the beauty of a stainless purity. See *Fichtes Leben*, by his son (1831); and Dr William Smith's *Memoir*, prefixed to his translation of the *Popular Works* (4th ed. 1889).

The fundamental idea of the *Wissenschaftslehre* in its earlier form is that of a primitive act of consciousness; the *Ego*, or I, posits itself—it affirms itself, simply and unconditionally. But in this self-affirmation it necessarily posits a negative—a *Non-ego*—an opposite which is not itself. This *activity* of the *ego* is its very essence, the necessary condition of its existence. It is itself the absolutely productive, which, however, would not attain to consciousness of itself—i.e. of its infinite spontaneous activity, did it not at the same time place in contrast to itself, and as an impediment (*anstoss*) and limit to its activity, the non-ego—i.e. the objective world, or nature. The ego, in so far as it is determined by the non-ego, is the intelligent ego, and, as such, the subject of theoretical science—the science of cognition; the ego, on the other hand, as determining the non-ego, is the subject of practical science—the science of the will. Freedom, absolute, spontaneous activity, for its own sake, is not with Fichte, as with Kant, the condition and presupposition of moral action, but is itself the highest expression of the problem of the moral law. To realise this self-activity, however, the ego requires an external world of objects, in order that in them as limits it may become conscious of its own activity. Generally speaking, Fichte makes that which, from the standpoint of ordinary consciousness, we call the world merely a product of the ego; it exists only through the ego, for the ego, and in the ego. In his later and more popular writings, from 1800 onward, Fichte's transcendentalism assumes a more profoundly religious character, the centre of the system being now an *Absolute Ego*, in whose self-determination all the *Non-ego* is determined—the One Universal Being or God, of whom all finite existence is but a manifestation—the vesture of the Infinite. This transition first appears in his *Bestimmung des Menschen* ('Vocation of Man,' 1800), and is more fully developed in the *Wesen des Gelehrten* and the *Religionslehre;* and it is also set forth in a strictly scientific manner in the *Nachgelassene Werke* (1835), in which his *Speculative Logik* and his revised theory of right and morals are particularly deserving of attention.

Although Fichte never, strictly speaking, formed a school, his influence upon the subsequent development of German philosophy has been very im-

portant; and indirectly, through the writings of Thomas Carlyle, he has exercised a marked and important influence on the course of recent thought both in Great Britain and America. Fichte's doctrine of the Divine Idea of the Universe underlies Carlyle's most impressive teachings regarding human life and duty. His popular works have been translated into English by Dr William Smith; their titles are: *The Vocation of the Scholar; The Nature of the Scholar; The Vocation of Man; The Characteristics of the Present Age;* and *The Way to the Blessed Life, or the Doctrine of Religion* (4th ed. 1889). An American translation of the *Wissenschaftslehre* and the *Naturrecht*, by A. E. Kröger, appeared at Philadelphia in 1868–69 (reprinted London, 1889). An admirable monograph of Fichte, by Professor Adamson, forms one of the volumes of Blackwood's *Philosophical Classics* (1881).

Immanuel Hermann von Fichte, son of the former, was born at Jena, 18th July 1797. Occupied at first as a teacher, he was appointed professor of Philosophy in Bonn in 1836, and from 1842 to 1863 held a chair in the university of Tübingen. He was ennobled in 1867, and died at Stuttgart, 8th August 1879. He wrote works on speculative theology (1847), ethics (1850), anthropology (1856), psychology (1864), the immortality of the soul (1873). In philosophy he occupies the position of a mediator between an extreme monistic and an equally extreme individualistic metaphysic, between pantheism and deism, between Hegel and Herbart. The great aim of his speculations was to find a philosophic basis for the personality of God, and for his theory on this subject he proposed the term *Concrete Theism*, to distinguish it alike from the abstract theism which makes God almost an unreality—a barren aggregate of lifeless attributes—and, on the other hand, from the all-absorbing pantheism of Hegel, which swallows up the human and the divine in its own inapprehensible totality.

Fichtelgebirge, a mountain-system, chiefly situated in the NE. of Bavaria, once covered with pines (*Fichte*, 'pine'), and constituting a watershed between the head-feeders of the Elbe, the Rhine, and the Danube. Roughly speaking, it forms a rhomboid, lying between Hof, Baireuth, and Eger, its intersecting axes being disposed NE.—SW. and NW.—SE. The length of each axis thus measured is about 24 miles. The main chain forms the NW. fringe of the system, and at its SW. extremity wheels round so as to present a NW.—SE. strike, the average elevation of the peaks ranging from 2700 to 3200 feet. The highest summits are Schneeberg (3461 feet) and Ochsenkopf (3334). On the SW. edge the system falls away by steep gradients; but in the opposite direction its descent is much more gradual, the hills in the NE. averaging an altitude of 2000 to 2300 feet. In their northern extremities the Fichtelgebirge are connected by intermediate chains, on the one hand with the Erzgebirge, and on the other with the Thuringian Forest. Geologically they are composed principally of granite and primitive crystalline slates, with which are conjoined bands and intrusions of gneiss, micaceous slates, basalt, and some strata of the Tertiary age (*Oligocene*). The climate of the region is decidedly raw and cold; snow lies on the summits as a rule from October to May. Owing to the extensive forest tracts and the moory soil, mists are of common occurrence. The only industries carried on by the inhabitants are those connected with mining (chiefly iron and stone quarries), with the exploitation of the forests, and with the manufacture of glass. Of recent years the Fichtelgebirge have come much into vogue with tourists. See Schmidt's Guide.

Fici'no, Marsilio, an illustrious philosopher of the Italian Platonic school, was born at Florence in 1433. The son of the principal physician of Cosmo de' Medici, he was appointed by that prince in 1463 president of a classical academy (founded 1440) having for its aim the diffusion of the Platonic doctrines, which Ficino held to be the basis and confirmation of the Christian system; and at his suggestion he undertook the translation of Plotinus, Iamblichus, Proclus, and Porphyry, besides a Latin but by no means literal version of Plato. On the death of Cosmo, Ficino found a no less munificent patron in this prince's grandson, Lorenzo de' Medici; and having, at the mature age of forty, decided on entering the church, he was endowed by Lorenzo with the rectorship of two churches in Florence, and a canonry in the cathedral. His theological doctrines, while undoubtedly sincere, present a strange medley of incongruous views, the natural result of his attempt to fuse the philosophy of Plato with the Christian creed. He died in 1499. His collected works were published at Basel (1491, and in 1561–76), and consist of translations from the Greek philosophers, and original metaphysical and theological compositions, of which may be named *Theologica Platonica seu de immortalitate animorum ac æterna felicitate.* See R. L. Poole's *Medieval Thought in Theology* (1884), and the books named at Medici.

Fick, August, an eminent philologist, was born at Petershagen, near Minden, 5th May 1833, studied philology under Benfey at Göttingen from 1852 to 1856, and taught in the gymnasium until his appointment as professor of comparative philology in the university there in 1876. In 1887 he was called to a chair at Breslau, and he retired in 1891. *Vergleichendes Wörterbuch der Indogermanischen Sprachen* (1870; 4th ed. 1890 *et seq.*), his greatest work, is a stupendous monument of learning, albeit its value is somewhat impaired by the over-audacity of its reconstruction of the primitive parent-speech. Other works deal with Greek personal and place names, the language of Homer, and the Indogermanic language.

Fiction. See Romances, Novels.

Fiction, Legal, a supposition of law that a thing is true, which is either certainly not true, or at least is as probably false as true. Fictions have existed in all legal systems. They have served many useful purposes, by enabling individuals who by the strict letter of the law would have been excluded from obtaining redress of evils to procure that remedy by a pious fraud. There are two general maxims which regulate the application of fictions—viz. that no fiction shall be allowed to operate a wrong, and that no fiction shall be admitted which in the nature of things is impossible. The Roman form of judicial procedure abounded with fictions, by which alone, in many cases, a party aggrieved could enforce his right. Thus, an heir, unjustly disinherited, by the *querela inofficiosi testamenti* feigned that his father had been mad. A stranger in Rome who had been robbed could not in early times obtain restitution without the *fictio civitatis*, whereby he feigned himself a citizen. Many of the fictions existing in Rome have found a counterpart in modern systems; thus, the *fictio longæ manus*, whereby lands at a distance were feigned to be delivered, resembles an English feoffment at law. In like manner, the *fictio traditionis symbolicæ* of keys of a warehouse to give possession of the articles contained therein, and of a deed in confirmation of the covenants contained therein. The 'fiction of the unity of the persons' was the original of the Scottish fiction that 'the heir is the same as the deceased.' But in no system of laws have fictions

been so liberally adopted as in that of England. It was by means of fictions alone that the original limited jurisdiction of the courts of King's Bench and Exchequer was extended to ordinary suits. In the latter court every plaintiff assumed that he was a debtor to the crown, and was debarred from discharging his obligation by the failure of the defendant to satisfy his demand; in the former it was assumed that the defendant had been arrested for some supposed trespass which he had never in fact committed. The fictitious characters of John Doe and Richard Roe long contributed to make the action of Ejectment (q.v.) famous. And though these fictions have disappeared before the ruthless hand of modern legislation, yet to this day in England, in an action at the instance of a father for the seduction of his daughter, damages can only be awarded on the assumption that she was his servant, and that he has suffered pecuniary loss by deprivation of her services. In the law of Scotland fictions of law are not of frequent occurrence. For the benefit of creditors the principle that the heir is 'the same person as the deceased' is admitted; and in an action of 'Reduction-improbation' of a deed it is assumed that the document was false, whether the fact be so or not. The legitimation of natural children by the subsequent marriage of their parents is an instance of a 'retroactive fiction.' See Maine's *Ancient Law*, and Colquhoun's *Summary of the Civil Law*.

Ficus. See FIG; also CAPRIFICATION, INDIA-RUBBER.

Fiddle. See VIOLIN.

Fideicommissum, in the Civil Law, was a conveyance of property in trust to be transferred to a third person named by the truster. *Fideicommissa*, when first introduced, were not supported by the law. The performance of them depended, therefore, on the conscience of the party intrusted, and consequently they were frequently not carried out. They were originally adopted for the purpose of conveying property either where a party, from the circumstances of the case, as inability to procure the proper number of witnesses, was prevented from executing a will, or where he desired to benefit those who by law were precluded from taking the property. To effect this purpose an actual conveyance was made to a friend, coupled with a request that the property should be transferred to another. Fideicommissa, having thus been introduced for a special purpose, were by degrees extended to conveyances of the whole inheritance, and finally were used for the purpose of settling estates in a particular order of succession, forming the earliest instance of Entails (q.v.). Fideicommissa first received the sanction of positive law in the reign of Augustus, by whom authority was given to enforce the performance of these fiduciary obligations. A special prætor was afterwards appointed for the enforcement of trusts, and the Emperor Claudius subsequently extended this authority to the consuls and presidents of provinces. Fideicommissa were either *particular* or *universal*, the former being a bequest of a particular subject, or a part only of the inheritance; the latter comprehended the whole estate. The Senatus-Consultum Trebellianum enabled a person profiting by a universal succession of this kind to sue or be sued as heir.

In Holland the principles of the civil law as to fideicommissa form an important branch of the law in regard to landed estates. An heir may be required to transfer either the whole or a portion of his inheritance. The provisions of the Senatus-Consultum Trebellianum also have been adopted. Children who have received their legal portions, and are required to transfer to a stranger the rest of the inheritance, are entitled to retain a fourth part for themselves. Similar provision may be found in the legislation of other countries which follow the civil law. See Hunter's *Roman Law*, and the Dutch and German manuals of Civil Law.

Fidei Defensor. See DEFENDER OF THE FAITH.

Fief. See FEUDALISM.

Field, in Heraldry, the whole surface or continent of the escutcheon or shield. See HERALDRY.

Field, DAVID DUDLEY, an American jurist, the eldest son of a Congregational minister (1781–1867), was born in Haddam, Connecticut, in 1805, and was admitted in 1828 to the New York bar, at which he practised until 1885, distinguishing himself especially by his labours in the direction of a reform of the judiciary system. In 1857 he was appointed by the state to prepare a political, civil, and penal code, of which the last has been adopted by New York, and all have been accepted by some other states. In 1866, by a proposal brought before the British Social Science Congress, he procured the appointment of a committee of jurists from the principal nations to prepare the outlines of an international code, which were presented in a report to the same congress in 1873. This movement resulted in the formation of an association for the reform of the law of nations, and for the substitution of arbitration for war, of which Field was the first president (see INTERNATIONAL LAW, CODE). An LL.D. of Edinburgh, he presided over the London Peace Congress in 1890. He died 13th April 1894. His *Speeches and Papers* fill 3 vols. (1884–91).

His brother, STEPHEN JOHNSON FIELD (1816–99), born in Haddam, was for some time a partner in Dudley's firm, and settled in 1850 in California, where he was instrumental in forming the laws of the state, and was judge of the Supreme Court in 1857–59. Appointed chief-justice in 1859, he was raised to the supreme bench of the United States in 1863, and voted with the Democratic minority of the electoral commission in 1877. In 1880 he received 65 votes on the first ballot for the presidential candidate.

Another brother, CYRUS WEST FIELD, was born in Stockbridge, Massachusetts, in 1819, and at the age of fifteen entered the employment of A. T. Stewart, in New York. In the twelve years preceding 1853 he built up a prosperous paper-manufacturing business, from which he then partly retired, only to engage with great enthusiasm in the promotion of the Atlantic telegraph. For this he secured a charter from the colonial government of Newfoundland for fifty years; and, being joined by Peter Cooper and other American capitalists, he organised two great companies for the purpose. Devoting himself entirely to the work of 'mooring the New World alongside the Old,' he crossed the ocean repeatedly in order to arouse public interest; and after the final success in 1866 he received from Congress a medal and the thanks of the nation. He helped to develop the elevated railways of New York, but died in straitened circumstances on 12th July 1892.

Field, EUGENE (1850–95), born at St Louis, Missouri, was a journalist at twenty-three, and gave much of his best work to the columns of a Chicago paper, his column of 'Sharps and Flats' being for years a characteristic feature. His work in prose and verse varies from tender pathos and delicate humour to the broadly farcical; he is best known as humorist and as poet of childhood. His best verses for children are those in *With Trumpet and Drum* (1892); *A Little Book of Western Verse* may fairly represent another type of work; and his humour is perhaps best illustrated in *The Love Affairs of a Bibliomaniac*. See his *Poems* (1911).

Field, JOHN, musician and composer, commonly known as Russian Field, was born in Dublin, 26th July 1782. A pupil of Clementi, he accompanied him in 1802 on a continental tour, but, settling in St Petersburg as a teacher of music, remained there from 1804 till 1823, when he proceeded to Moscow; in 1832 he returned to London. Nevertheless in the following year he once more started on a long continental tour, which terminated with his death at Moscow on January 11, 1837. Although Field wrote seven concertos, three sonatas, and numerous pianoforte pieces, he is to-day only remembered as the author of about half-a-dozen *Nocturnes*, which were Chopin's models. Liszt wrote an essay on Field, prefixed to Schubert's edition of the *Nocturnes*, and Spohr in his *Selbstbiographie* (vol. i.) gives some account of him. See Memoir by Grattan Flood (1921).

Field, MICHAEL, is the pseudonym of Katharine Harris Bradley (d. 1914) and her niece, Edith Emma Cooper (d. 1913), who, from 1884, wrote in collaboration several remarkable poetic dramas and some beautiful lyrics; notable are *Callirrhöe* (1884), *Fair Rosamund* (1884), *The Father's Tragedy*, *Canute the Great*, *Long Ago*, *The Tragic Mary*, *Sight and Song*, *Wild Honey*, *Poems of Adoration*, *Mystic Trees*, *In the Name of Time*. See Life by Mary Sturgeon (1922).

Fieldfare (*Turdus pilaris*), a species of thrush, common in Britain as a winter visitor. It is a native of North Europe, breeding and spending the summer in Scandinavia and other northern countries, but migrating southwards in winter as far at least as the Mediterranean. It is very abundant in Norway, and, contrary to the ordinary habit of thrushes, is social in its nest-building,

Fieldfare (*Turdus pilaris*).

numerous nests being often seen on one spruce-tree. There are no authenticated instances of the fieldfare nesting in Britain. As a winter visitor it has familiarised us with its harsh call-note, but its true melodious song is mostly reserved for the northern summer. The fieldfare is about the size of a blackbird, but has longer wings. The head, neck, and some other parts are grayish; the tail is black, with a white line on the outer feathers; the general upper surface is chestnut brown; the under surface is white, with a reddish-yellow breast streaked and spotted with black. In Britain the fieldfare feeds on worms, snails, and such like, or in severer weather on haws and other available fruits and seeds. It is sometimes tamed as a songster. See THRUSH.

Field-glass. See OPERA-GLASS.

Fielding, ANTHONY VANDYKE COPLEY, water-colour painter, was born in 1787. He came of an artistic family, for his father, T. N. Fielding, was a portrait-painter residing near Halifax, his mother became a member of the Water-colour Society, and three of his brothers were painters in the same medium. He received his early instruction at home before being placed under John Varley; and, like Turner and Girtin, he worked in the house of Dr Monro. In 1810 he began to exhibit with the Water-colour Society, of which he was successively treasurer and secretary; and in 1831 he succeeded Cristall as president. In one year he contributed to the exhibition of the society no fewer than 56 subjects, occasionally, in addition, sending an oil-picture to the Royal Academy. His early works show breadth, freedom of treatment, and a fine sense of atmosphere; but in later life the quality of his art deteriorated, greatly in consequence of the facile methods and mannerisms into which his practice as a fashionable teacher of painting had betrayed him. He died 3d March 1855.

Fielding, HENRY, born at Sharpham Park, Glastonbury, April 22, 1707, was the son of Lieutenant Edmund Fielding, afterwards a general, belonging to the younger branch of the Denbigh family (whose connection with the Hapsburgs, set to his credit by Gibbon in the *Autobiography* and alluded to in *Esmond*, was proved by Mr Round to be purely apocryphal). He went to Eton, which he left before November 1725; in which month took place at Lyme Regis his attempt to abduct his first love, a relative and an heiress, Miss Sarah Andrew. At Leyden University, where he was admitted a student of literature (not civil law) in March 1728; he was there in 1729, but had left before 8th February 1730. His first comedy, *Love in Several Masques*, was produced at Drury Lane in February 1728, just before he started for Leyden—perhaps the money required was thus raised. *The Temple Beau* appeared in 1730. From this date until February 1735 he wrote a number of comedies and farces, the best of which are *The Author's Farce* (1730), the burlesque of *Tom Thumb*, afterwards *The Tragedy of Tragedies* (1730), *Don Quixote in England* (1734), *The Mock Doctor* (1732), and *The Miser* (1733), two adaptations from Molière, and *The Intriguing Chambermaid* (1734), an adaptation from Regnard. His dramatic works in general bear signs of haste and carelessness. A brief interval in their rapid manufacture was filled by his marriage (28th November 1734) to Miss Charlotte Cradock, a Salisbury beauty and his acknowledged model for the 'Sophia Western' of *Tom Jones*.

For a year or more Fielding appears to have led the life of a country gentleman at East Stour in Dorsetshire, where he had resided as a boy. But his wife's fortune of £1500 was not inexhaustible, and early in 1736 (probably with what remained of it) he took the Little Theatre in the Haymarket, where he brought out two very successful burlesques —*Pasquin* (1736) and the *Historical Register* (1737). The bold satire on the ministry contained in these pieces led to the precipitate passing of the Licensing Act of 1737, which made the consent of the lord chamberlain necessary to the representation of any play. This effectually closed Fielding's theatre, and in November 1737 he became a student of the Middle Temple. He was called to the bar in 1740, and travelled the western circuit. But, though he does not seem to have neglected law, he did not relinquish literature. During his studentship he edited (with James Ralph) the *Champion*, a paper of the *Spectator* type. His real *début*, however, came in 1742, not long after Richardson published his popular *Pamela*. Apt at burlesque and eminently manly, Fielding's genius saw at once how effectively ridiculous the feebler side of Richardson's morality might be made by transferring his heroine's difficulties to a male hero. Designing at first no more than raillery, his plan

grew under his hand, and *Joseph Andrews* became a novel of life and manners, with a group of characters, of which one, Parson Adams (based on the writer's friend, William Young) is immortal. His success probably revealed to him a power he had scarcely suspected, and opened a wider perspective of fiction. But for the moment his precarious means prompted no more than the publication by subscription of three volumes of *Miscellanies*, made up mainly of early work. They included another play, *The Wedding Day*, an old comedy revised for Garrick, and produced at Drury Lane without success in February 1743, some essays, some youthful verse, a clever Lucianic fragment called *A Journey from this World to the Next*, and the surpassing study in irony known as the *History of the Life of the late Mr Jonathan Wild the Great*. Despite its maturity, it had probably been written before *Joseph Andrews*, as it seems unlikely that after so signal a success its writer would have essayed a line so different.

From the preface to the *Miscellanies* it is clear that Fielding's circumstances at this date were far from good. His means were uncertain, his health already broken (he was a martyr to gout), and his beautiful wife an invalid. She seems to have died at Bath, and was buried in London, 14th November 1744. Fielding was so heart-broken by her loss that his friends feared for his reason. From the preface to his sister's novel of *David Simple* (2d ed. 1744) he still appears to have hoped for success at the bar. But in 1745 he again drifted into journalism as the author of the *True Patriot*, a government organ, succeeded in 1747 by the *Jacobite's Journal*. In November 1747 he married his wife's maid, Mary Daniel, who had remained in charge of his surviving child, Harriot; and a year later, by the interest of his schoolfellow Lyttelton, he became a justice of the peace for Westminster, moving into a house in Bow Street belonging to the Duke of Bedford. Thence in February 1749 he put forth a second novel, his famous *Tom Jones*, the 'labour,' he says, 'of some years.' Less than three years later came a third novel, *Amelia*. The remainder of his life was a continued struggle with ill-health and a harassing vocation, which he nevertheless followed most assiduously. His further literary efforts are confined to a few pamphlets, philanthropic and professional, and a fresh periodical, the *Covent Garden Journal* (1752). In 1754, sinking under a complication of disorders, but gallantly struggling with his magisterial duties to the last, he quitted England for Lisbon in search of health. After a voyage of many vicissitudes, narrated with the most touching and manly cheerfulness in his posthumously printed *Journal*, he reached the Portuguese capital, where he died two months later, 8th October 1754, aged forty-eight. He was buried in the English cemetery. *Luget Britannia gremio non dari fovere natum*, says the inscription on his tomb.

The only portrait of Fielding is a sketch from memory by his friend Hogarth, whose works he greatly admired. Representing him in later life, it exhibits little more than the shadow of that handsome Harry Fielding who at twenty-two rushed upon London from Leyden in all the ardour of health and animal spirits. He paid the penalty of his youthful appetite for pleasure by a broken and laborious middle age, endured with a courage and fortitude which command respect. Of his work his three novels now chiefly survive. His plays were hasty and ill-considered productions; and he is best in pure burlesque, or when he takes his plot ready-made. His essays and journalism are hack-work. But he is fairly what Scott calls him, the 'Father of the English Novel.' In *Joseph Andrews* he first felt his feet; in *Tom Jones* he perfected his method and put forth his full powers. When Coleridge extravagantly praised its plot, the modern novel was yet young, and the dictum now needs qualification. But the skill and variety of the book, its close characterisation, its happiness of illustration, and the wealth of wit, wisdom, and irony cannot be contested. There are—and it is to be regretted—pages which show an artistic insensibility, and an over-indulgence to certain forms of masculine frailty which even the manners of the time cannot wholly excuse; but apart from this there is no reason to doubt the sincerity of the moral purpose proclaimed. *Amelia*, a shorter, more subdued, and less elaborated work, has also its admirers. But Fielding put his best 'criticism of life' into *Tom Jones*.

His biography has been written by Murphy (1762), Watson (1807), Lawrence (1855), Austin Dobson (1883; new ed. 1907), Miss Godden (1909), and W. L. Cross (1919). Thackeray's sympathetic lecture and Sir Leslie Stephen's introduction to the *édition de luxe* of 1882 are valuable.

Field-madder (*Sherardia arvensis*, order Rubiaceæ), a small purplish weed, common on cultivated lands, of which the root is a substitute for the closely allied true Madder (q.v.).

Field-marshal is now the highest rank of general officer in the British and most foreign armies. In the former it is a special honour only conferred on the ground of distinguished service or royal birth. The etymology of the word *marshal* and the date of the introduction of the rank Field-marshal into the British service are given at MARSHAL. A field-marshal has no higher pay than any other general, except when commanding an army. The insignia of the rank is the baton.

Field-mouse, a name popularly given to certain species both of Mouse (q.v.) and of Vole (q.v.). See also SHREW.

Field-officers, in the Army, are always mounted officers—viz. majors, lieutenant-colonels, and colonels. They command, in the infantry, half-battalions (or wings), battalions, and regiments (see COLONEL) respectively; whilst the captains, lieutenants, and second-lieutenants are called company officers. In the cavalry, artillery, engineers, and other corps, officers bearing the same titles are called field-officers, but their duties and commands are different from those of the infantry.

Field of the Cloth of Gold, the place of a splendid, but fruitless, diplomatic meeting of Henry VIII. (q.v.) of England and Francis I. of France, near Calais, in 1520.

Fields, JAMES THOMAS, American publisher, was born in Portsmouth, New Hampshire, in 1817, and from 1839 to 1870 was a partner in the publishing firm of Ticknor, Reed, and Fields in Boston. He edited the *Atlantic Monthly* in 1862–70, and for many years lectured on literary subjects; and he wrote some books of verse, besides interesting volumes on Hawthorne and Dickens. He died in Boston, 24th April 1881.

Field-train, formerly a department of the Royal Artillery responsible for the custody and supply of artillery ammunition in the field. The duties are now performed by the Ordnance Store Department.

Field-works are intrenchments and other temporary fortifications thrown up by an army in the field, either as a protection from the onslaught of a hostile force, or to cover an attack upon some stronghold. Field-works will be more particularly described under the article FORTIFICATION.

Fi'eri Fa'cias, WRIT OF. The judgment or order of an English court of law, directing the payment of *money* or *costs*, may be enforced by a

writ of execution called the writ of *fieri facias*—often contracted to *fi. fa.* It is, in form, a command by the sovereign to the sheriff of the bailiwick in which execution is to be levied, to 'cause to be made' (*fieri facias*) out of the goods and chattels of the debtor the amount of the judgment entered against him, together with interest thereon, as agreed between the parties, or at the rate of 4 per cent. from the day of the judgment or order, or the day from which interest is directed to run. A judgment creditor may sue out this writ immediately after entry of judgment in his favour, except where a time is limited for payment of the judgment debt which has not yet expired, or where the court has ordered a stay of execution. As between the original parties to a judgment or order, execution may issue at any time within six years from the recovery of the judgment or the date of the order.

In regard to the execution of a writ of *fieri facias*, the sheriff must seize such quantity of the goods and chattels of the debtor within his bailiwick as will, if sold, be reasonably sufficient to pay the judgment debt and interest. Seizure is effected by the sheriff or his officer taking actual possession of the debtor's movable property. In entering upon the premises where the goods and chattels are, the sheriff *must request admission*, and is liable to an action of damages if he breaks open an outer door of the judgment debtor's house. But, having once effected an entry, he may break open inner doors and chests, if necessary to his purpose. Possession of the debtor's property must be retained after seizure; and the sheriff may—and, where there is any risk of injury or rescue, ought to—remove the goods for safe custody. If the debtor do not at once satisfy the judgment debt, the sheriff may proceed to sell a sufficient quantity of the debtor's property to meet it; and then, as a matter of practice, he hands over the amount to the judgment creditor without bringing or paying it into court. The Bankruptcy Act of 1883 provides that, where the sheriff sells the goods of a debtor under an execution for a sum exceeding £20, the sale shall be by public auction, and shall be publicly advertised by the sheriff on and during the three days next preceding the sale. Seizure and sale of a debtor's goods under a writ of *fieri facias* amounts to an act of bankruptcy. An execution creditor may levy the poundage fees and expenses of execution over and above the sum recovered.

The property legally available for seizure and sale under a writ of *fi. fa.* may consist of (1) goods and chattels in the ordinary sense of the term, such as furniture belonging to the debtor; (2) money, bank-notes, bills of exchange, and other securities; (3) chattel interests in land, such as leaseholds; (4) growing crops, subject to the rent accruing due; (5) shares in ships (the only legal method of selling such shares is by bill of sale).

If goods are removed from lands or premises let on lease, the sheriff must levy sufficient to pay to the landlord the sum due for arrears of rent, provided such arrears do not amount to more than one year's rent. A sheriff may not take in execution (1) manure, hay, &c., where by the covenants of the lease the tenant is restricted from removing them; (2) the wearing apparel or bedding or tools of the debtor, where the value of the whole does not exceed £5; (3) such fixtures as the judgment debtor himself has no right to remove. At common law the writ of *fieri facias* 'bound' the debtor's goods from the *teste*, or date of issue; the Statute of Frauds provided that no purchaser should be prejudiced till the writ had actually been delivered to the sheriff for execution; while the Mercantile Law Amendment Act, 1856, enacts that a writ of *fieri facias* shall not prejudice the title to goods acquired *bonâ fide* and for value by any person before the actual seizure thereof under the writ.

Where it appears by the return of a writ of *fi. fa.* that the debtor is a beneficed clerk not having any lay fee within the sheriff's bailiwick, the plaintiff may sue out a writ of *fieri facias de bonis ecclesiasticis*, directed to the bishop of the diocese, commanding the debtor to enter upon and hold the benefice till he shall have satisfied the plaintiff's judgment debt out of the rents, tithes, and profits thereof.—In Scotland the corresponding process for seizing and selling a debtor's goods is termed Poinding (q.v.).

Fiery Cross, an ancient summons to arms used in the Scottish Highlands, sent by swift messengers from place to place. It was a small cross of light wood, one extremity of which was set on fire, and the other dipped in the blood of a goat. See Wade's report in *Historical Papers* (ed. Allardyce, New Spalding Club, 1895–96), and for a similar usage among the Goths, Olaus Magnus.

Fieschi, COUNT GIOVANNI LUIGI DE', a member of one of the most illustrious houses of Genoa, was born about the year 1523. In addition to the lustre of ancestral fame, his name has attained a tragic historical celebrity in connection with a remarkable conspiracy of which he was the chief. Andrea Doria, the famous admiral, sprung from a race hereditarily at feud with that of Fieschi, having expelled the forces of Francis I. from the state, had restored the republican form of government, but at the same time, by his vigorous administration, effectually held in check the ambition of the nobles. Count Fieschi organised a plot for the overthrow of Doria (who was supported by the Emperor Charles V.) and the establishment of an oligarchic form of government. Instigated by the approval of France and Rome, Fieschi speedily enrolled a formidable array of accomplices, his three brothers among the foremost. Three galleys, under the pretext of an expedition against the Turks, were fully equipped and filled with mercenaries; and, all being in readiness, the attempt was fixed for the 2d of January 1547. Doria, in spite of repeated warnings, refused to ascribe treacherous or subversive designs to Fieschi. Complete success seemed at first to crown the conspirators; the gates of the city were forced, the fleet captured, Gianettino assassinated, Doria in flight. Fieschi had but to appear and dictate, but he was nowhere to be found. In stepping from one galley to the other in the darkness of night he had stumbled, and, falling overboard, been borne down by his ponderous armour, and miserably drowned in the harbour, or, according to some, stifled in the slime. The scheme ended here, and Doria returned. See DORIA, GENOA; and the monographs of Brea (1863) and Celesia (1864).

Fieschi, JOSEPH, known by his attempt on the life of King Louis-Philippe, was born in Corsica in the year 1790. He served in Russia in 1812, and on Murat's expedition suffered imprisonment as a thief, but in 1830 got a small government appointment at Paris. Dismissed for fraudulent conduct, he secured accomplices in an audacious plan, and invented an infernal machine with twenty-four barrels, which was fired while the king and his party were passing the house, 28th July 1835. Eighteen people were killed, among whom was Marshal Mortier, but Louis-Philippe himself escaped with a mere scratch. Fieschi was immediately seized, and, along with his accomplices, was tried, condemned, and executed on 16th February 1836. See Ducamps, *L'Attentat Fieschi* (1877).

Fie'solé (Lat. *Fæsulæ*), one of the most ancient of Etruscan cities, is situated on the crest of a hill, about 3 miles NE. of Florence. Here the Gauls

defeated the Romans in 225 B.C.; and here Hannibal encamped after crossing the Apennines. The city was made a military colony for Sulla's veterans, who twenty years later lent warm support to Catiline. The place was seized by the Goths, and was not captured by Belisarius until after a long siege. Its decay began in the middle ages with the rise and growth of Florence, and it has now only about 10,000 inhabitants, chiefly occupied in straw-plaiting. The sole vestige of Etruscan architecture remaining is the cyclopean wall. The amphitheatre and other remains belong to the Roman age. The town has several buildings dating antecedent to the 15th century, amongst them the cathedral, built in 1028 and restored in 1256; a pretorian palace of the 13th century; and a Dominican (1406) and a Franciscan (1350) monastery.

Fiesole, GIOVANNI DA. See ANGELICO, FRA.

Fife, a smaller variety of the flute, usually with only one key. Fifes were at one time generally used in the army and navy in conjunction with drums, for playing marches and other simple melodies. They are usually pitched in the key of B♭ or C. Originally the fife was made with a cylindrical bore throughout, but this was many years ago superseded by the conical instrument. It is rather curious that the ancient cylindrical bore superseded as unsuitable in the fife should have been resuscitated and perfected in the modern Flute (q.v.). See BAND (MILITARY).

Fife, a maritime, almost peninsular, Scottish county, washed on the N. for 21 miles by the Firth of Tay, on the E. for 24 by the German Ocean, and on the S. for 55 by the Firth of Forth. Its extreme length is 42 miles, its extreme breadth 21, and its area 513 sq. m. The surface offers a succession of cultivated vales and hills, the most prominent eminences being the East and West Lomonds (1471 and 1713 feet), Largo Law (965), and Burntisland Bin (632). Almost the only streams are the Eden (30 miles long) and the Leven (16); whilst of lakelets the chief are Loch Gelly, Loch Fitty, Kilconquhar Loch, and Lindores Loch. Fife rests on the Old Red Sandstone, with trap rocks in the north, Carboniferous strata and trap in the south. Its mineral wealth includes coal (which is largely mined), shale, ironstone, limestone, and freestone. The soil is some of it very fertile, especially in the Howe of Fife, or Stratheden; and whilst barely one-fourth of the whole of Scotland is in cultivation, in Fife the proportion is nearly three-fourths. 'A gray cloth' mantle with a golden fringe,' said James VI. of Fife, referring to the many towns and fishing-villages that skirt its ancient sea-margin—Rosyth, Inverkeithing, Aberdour, Burntisland, Kinghorn, Kirkcaldy, Dysart, Wemyss, Buckhaven, Methil, Leven, Largo, Elie, St Monans, Pittenweem, the Anstruthers, Kilrenny, Crail, St Andrews, Ferryport, Newport, and Newburgh. Inland lie Cupar, Dunfermline, Falkland, Lochgelly, &c. Under those towns are noticed the manufactures, the chief antiquities, the illustrious natives, and the outstanding points in the peaceful history of the 'Kingdom of Fife,' which took so leading a part in the Scottish Reformation. Here, then, we need mention only the fine Romanesque church of Leuchars; the ruined abbeys of Balmerino and Lindores; Magus Muir, the scene of Sharp's murder; Cults, the birthplace of Wilkie; and Balcarres, of Lady Ann Barnard. Fife, excluding two groups of burghs, returns two members to parliament. It is sixteenth in size among Scottish counties. Pop. (1801) 93,743; (1841) 140,140; (1881) 171,931; (1911) 267,739; (1921) 292,902; mainly in the 28 burghs. See the history by Sir Robert Sibbald (1710); Æ. J. G. Mackay, *History of Fife and Kinross* (1890 and 1896); A. H. Millar, *Fife Pictorial and Historical* (2 vols. 1895); E. S. Valentine, *Fifeshire* (1910); J. Wilkie, *History of Fife* (1925).—The county has since 1759 given the title of Earl to the family of Duff. The sixth earl (1849–1912) married in 1889 the Princess Louise, and became Marquis of Macduff and Duke of Fife.

Fifth-monarchy Men, an extreme sect of the time of the Puritan revolution, strongly represented in Cromwell's army, who looked on the establishment of his power as the commencement of a new reign of Christ on earth, in succession to the four great monarchies of Antichrist marked out by the prophet Daniel. Cromwell crushed their rebellious intrigues with his soldiers and their plot to murder himself, and in 1657 flung their leaders, Venner, Grey, and Hopkins, into prison. In 1661 Venner headed another rising, for which he and sixteen others were executed.

See Louise Fargo Brown, *The Political Activities of the Baptists and Fifth-Monarchy Men* (1913).

Fig (*Ficus*), a genus of trees and shrubs belonging to the order (or sub-order of Urticaceæ) Moraceæ, characterised by the remarkable inflorescence in which that normal checking of the flowering axis which reduces the elongated spike to the flat capitulum has gone so far as to render this positively concave, the apex thus coming to be at the bottom of a cup (see INFLORESCENCE). This axis almost closes upon the small internal flowers, save for a small opening at the apex, and becomes succulent and fruit-like. It is always monœcious or diœcious. The male flowers, which in the monœcious species develop round the opening of the fig, have three or five stamens, and the female, which arise on the sides and bottom, a bilobed stigma, but the ovary contains only a single seed, which becomes stony. For fertilisation, see CAPRIFICATION, and FLOWERS. There are about 600 species, some of them very large trees. Almost all belong to tropical and subtropical countries, of the vegetation of which they often form a most important feature. They abound in India, in every jungle and hilly situation, to the most northern Himalaya, and some of them are cultivated about every village. Both *F. religiosa* (the Peepul) and *F. Rumphii* are held in veneration by the Hindus. The most notable species are the Common Fig (see below); the Banyan (q.v.); the Peepul (q.v.), Bo Tree, or Sacred Fig of India; the Sycamore (q.v.); and the India-rubber Fig (*F. elastica*). See INDIA-RUBBER. The leaves of some species are entire, those of others are lobed. Several species of fig exhibit the character, for which the banyan in particular has become celebrated, of sending roots straight down to the ground from their spreading branches, and thus multiplying the apparent stems, by which a vast canopy of branches and foliage is supported. The East Indian Caoutchouc or India-rubber Tree is remarkable for the exposure of its main roots, which rise in masses above ground, extending on all sides from the base like great writhing snakes. Some figs are creeping or trailing shrubs, with slender stems, covering heaps of stones, or ascending trees like ivy. Besides the common fig, many species yield edible fruits, although none of them are nearly equal to it in value. The milky juice of several species is bland and abundant, as of *F. Saussureana*, which has therefore been ranked among Cow-trees. In other species the milky juice is very acrid. That of the common fig produces a burning sensation on the tongue. That of *F. toxicaria*, a native of the Malayan islands, is used for poisoning arrows. Lac (q.v.) is gathered from some species. The leaves of *F. politoria* are so rough that they are used for polishing wood and

ivory in India. The juice of the fruit of *F. tinctoria* is used in Tahiti to dye cloth: the colour is at first green, but being acted on by the juice of a Cordia it becomes bright red. The bark supplies cordage, of which fishing-nets are made.

The Common Fig (*Ficus carica*) is a native of the East, as the specific name (from *Caria*) imports; but it is now cultivated throughout the whole of the south of Europe, and is even found naturalised there. Its cultivation has also extended to many warm countries. In North America it is seldom to be seen farther north than Philadelphia; and it is not sufficiently hardy to be a common fruit-tree in Britain, although even in Scotland figs

Common Fig (*Ficus carica*):
a, fruit; *b*, section of fruit.

may occasionally be seen ripened on a wall; and in the south of England fig-trees are sometimes grown as standards, and a few small fig orchards exist. It seems to have been grown in England by the Romans, but was not reintroduced until 1525, when Cardinal Pole brought several trees to Lambeth from Italy. Protection is given in some way during winter. Near Paris, and in some other parts of the continent of Europe, fig-trees are so trained that the branches can be tied in bundles and laid along the ground, when they are covered with litter and earth, or, as in the case of the celebrated fig-tree of Roscoff (Finistère), the branches are trained over a vast area of pillared framework. The fig is a low deciduous tree or shrub (15–25 feet), with large, deeply-lobed leaves, which are rough above and downy beneath. The branches are clothed with short hairs, and the bark is greenish. The fruit is produced singly in the axils of the leaves, is pear-shaped, and has a very short stalk; the colour in some varieties is bluish-black; in others, red, purple, yellow, green, or white. The varieties in cultivation are numerous. In warm climates the fig yields two crops in the year—one from the older wood (midsummer shoots of the preceding year), and a second from the young wood (spring shoots of the same year); but in colder regions the latter never comes to perfection. Fig-trees are propagated by seed, by suckers, &c.; very frequently by layers or by cuttings. In Britain they are often to be seen in greenhouses, and grow well in pots. If the soil of the open border is too rich, root pruning must be adopted, although liquid manure may be given while the figs are swelling. Figs may be eaten 'green' (i.e. ripe) or dried, and the latter form an important article of food in the Levant; in more northern regions they are used for dessert, or for medicinal purposes, being applied to gumboils and other sores, and also administered in pulmonary and nephritic affections, and to relieve habitual constipation. The pulp contains about 62 per cent. of grape-sugar. Figs are either dried in the sun or in ovens built for the purpose. Great quantities are annually imported into Britain from the Mediterranean. The best are mostly brought from Smyrna. Greece and various parts of Italy also export figs. The finest kinds are tightly packed in boxes; others are crowded into sacks of matting, or strung, by a hole in the middle, on strings of bast. In the Levant, Portugal, and the Canaries a spirit is distilled from fermented figs. In some places figs roasted and ground are used to produce the so-called fig-coffee; the excellence of the Vienna coffee is sometimes attributed to an admixture of ground figs.

The fig has been reckoned among the most valuable fruits since the earliest times; thus, it is mentioned with corn, wine, and oil as one of the leading riches of the promised land. The Athenians, too, seem to have largely subsisted upon figs, especially before the culture of cereals became general; and a fig-tree was the device of the city. It appears that special officers were appointed to denounce illicit export or engrossing of figs, the 'sycophants,' whose title came to acquire such different meaning. The word, however, in this sense is not found in any ancient author. See Solms-Laubach, *Domestikation des Gewöhnlichen Feigenbaums* (1882); Ravasini, *Die Feigenbäume Italiens* (1911); Bicknell, *The Common Fig-tree* (1912).

Fi'garo, a dramatic character introduced on the Parisian stage in 1775 by Beaumarchais (q.v.) in his *Barbier de Séville* and his *Mariage de Figaro*, is first a barber and then a valet-de-chambre, and has become a type of cunning, intrigue, and dexterity. Mozart and Rossini made Beaumarchais's plays the basis of classic operas. The name has been adopted by a well-known Parisian newspaper (founded 1854).

Figeac, a town in the French department of Lot, is situated in a valley surrounded by finely wooded hills, 32 miles ENE. of Cahors. Irregularly built, with a medieval aspect, it possesses two beautiful Gothic churches, and owes its origin to a Benedictine monastery founded by Pepin the Short in 755. Figeac has cotton manufactures, dye-works, and a trade in cattle. Pop. 5500.

Fighting-fish (*Betta pugnax*), a small fresh-water fish, especially at home in Siam, where it is reared on account of its curious pugnacity. It belongs to the family Labyrinthici, which includes other interesting fishes, such as the Climbing Perch (Anabas), the beautiful Paradise-fish, the well-flavoured Gourami. When two fighting-fish are brought together they often rush immediately to combat; or it is even enough to introduce a looking-glass into the water, when the fish hastens to attack its own image. Fish-fights are a favourite amusement of the Siamese; the license to exhibit them yields a considerable annual revenue; and an extraordinary amount of gambling takes place in connection with them—not merely money and property, but children and liberty being sometimes staked. When the fish is quiet its colours are dull; but when it is excited they glow with metallic splendour, and its projected gill-membrane waves like a black frill round its throat.

Figig, or FIGUIG, an oasis 6 miles square in the south-east of Morocco, occupied by France in 1893. There are some 12,000 inhabitants in seven villages, mainly Berber in origin, who recognised only a shadowy suzerainty in Morocco.

Figueira da Foz, a Portuguese watering-place, 23 miles W. by S. of Coimbra; pop. 40,000.

Figue'ras, a town in the north-east of Spain, 25 miles N. of Gerona, with a few manu-

factories. Overlooking the town is the strong frontier fortress of San Fernando, constructed by Ferdinand VI. In the vicinity of the town are gold and copper mines. On three occasions (1794, 1808, 1823) Figueras has been taken by the French. Pop. 13,000.

Figueras, Estanislao, a Spanish statesman, was born at Barcelona, 13th November 1819. Although he joined the republican party in 1840, he was not elected to the Cortes until 1850. For taking part in republican plots in 1866 he was in the following year cast into prison; but after the expulsion of Queen Isabella he became a member of the republican committee of government. Finally the abdication of King Amadeus, in 1873, opened the way for Figueras, and he became president of the Spanish republic; but, owing to differences with his colleagues in power, he was constrained to resign office after only about four months' exercise of authority. Retiring from public life, he died at Madrid on 11th November 1882.

Figuier, Louis, writer, was born at Montpellier, 15th February 1819. His first appointment as professor was at the Montpellier school of pharmacy in 1846; seven years later he removed to Paris to occupy a similar post there. Amongst his books are several on the wonders, inventions, and discoveries of modern science and modern industry, a volume on alchemy, and one in defence of the immortality of the soul. Many of these have been translated into English (*The Ocean World, The World before the Deluge, The Day after Death, The Vegetable World, Reptiles and Birds*, &c.). From 1856 he edited an annual, *L'Année Scientifique et Industrielle.* He died 8th November 1894.—His wife, Juliette Bouscaren (1829–79), also made a name for herself by novels and interesting sketches.

Figurate Numbers. The nature of figurate numbers will be understood from the following table:

	1,	2,	3,	4,	5,	6,	7,	&c.
I.	1,	3,	6,	10,	15,	21,	28,	&c.
II.	1,	4,	10,	20,	35,	56,	84,	&c.
III.	1,	5,	15,	35,	70,	126,	210,	&c.
		&c.				&c.		

The natural numbers are here taken as the basis, and the first order of figurate numbers is formed from the series by successive additions; thus, the fifth number of the first order is the sum of the first five natural numbers. The second order is then formed from the first in the same way; and so on. If instead of the series of natural numbers whose difference is 1, we take the series whose differences are 2, 3, 4, &c., we may form as many different sets of figurate numbers. The name *figurate* is derived from the circumstance that the simpler of them may be represented by arrangements of equally distant points, forming geometrical figures. The numbers belonging to the first orders receive the general name of *polygonal*, and the special names of *triangular, square, pentagonal*, &c., according as the difference of the basis is 1, 2, 3, &c. Those of the second orders are called *pyramidal* numbers, and according to the difference of the basis are triagonally, quadragonally, or pentagonally pyramidal. The polygonal numbers may be represented by points on a surface; the pyramidal by piles of balls.

Figure, in Music. See Motif; for Figured Bass, see Accompaniment.

Figure-head, the ornamental figure or bust on the head of a ship, immediately under the bowsprit. Where the vessel's name cannot be represented by such a figure, a piece of timber, finished off in the form of a volute or scroll, often takes its place on sailing-ships; on steamships the bow is usually plain. The huge figure-heads of several historical old line-of-battle ships are still carefully preserved at Millwall, including that of the 'fighting Téméraire.'

Figure-stone. See Steatite.

Figwort, a name sometimes applied to *Scrophularia nodosa* (see Scrophularia), and sometimes to *Ranunculus Ficaria*, the lesser Celandine (see Celandine).

Fiji. The Fiji or Viti Islands are a British dependency in the South Pacific Ocean, situated in 15°—22° S. lat. and 176° E.—178° W. long. Their nearest neighbours are the Tonga or Friendly Islands, between 200 and 300 miles to the south-east; they are about 700 miles from the French colony of New Caledonia, 1100 miles from Auckland in New Zealand, 1700 from Sydney in New South Wales, 1800 from Tahiti, and 4700 from the great American port of San Francisco. They have regular communication with Auckland, Sydney, Tonga, Honolulu, and Vancouver. The island of Rotumah (discovered 1793), about 250 miles distant, a little to the west of north, has been since 1881 included in the colony.

The islands were sighted in 1643 by Tasman, the great Dutch sailor, whose name is borne by Tasmania. Turtle Island (or Vatoa), in the extreme south-east of the group, was discovered and so named by Captain Cook in 1774; but, like most of the South Sea islands, the Fiji Archipelago was little known before the 19th century. Since that date its history has been the not uncommon one of native dissensions, gradual European intrusion, and finally European protection. In 1804 some escaped prisoners from Australia are said to have settled in the islands. In 1835 Wesleyan missionaries first came over from Tonga to begin their wonderful work of conversion to Christianity; and trade, which had begun with dealings in such articles as bêche de mer and sandalwood, gradually led to a small white settlement.

In 1849 some damage was done to the property of the American consul; a heavy claim was in consequence preferred by the United States government against the leading chief Thakombau, which he was wholly unable to meet, and in 1858 he offered the sovereignty of the islands to Great Britain, on condition that he retained his rank and that his debt was paid. As a set-off to the payment he offered to make over, if required, to the British government the ownership in fee simple of 200,000 acres of land. Upon receipt of this offer a special commissioner, Colonel Smythe, was sent to Fiji, charged to report especially upon its prospective advantages as a naval and coaling station and as a place for cotton-growing. On his advice the offer of sovereignty was in 1862 rejected. The following years brought a considerable increase to the white population of the islands, cotton-planting being stimulated by the American civil war. About 1868 a company was formed in Australia, under the name of the Polynesia Company, to take over Thakombau's debt, and with it the 200,000 acres referred to above. In 1871 a kind of constitutional government was set up by the European advisers of King Thakombau, but the cession of the islands to Great Britain was again pressed on, and, after further inquiry in 1873, Sir Hercules Robinson, then governor of New South Wales, was sent to Fiji, and on the 10th of October 1874 formally accepted the sovereignty of the group on behalf of the British crown.

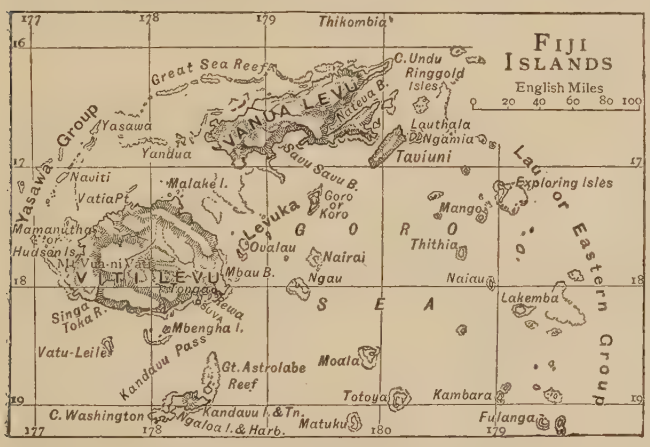
Fiji was constituted and remains a crown colony, with governor, who is also High Commissioner for the Western Pacific, an executive council of official and unofficial nominated members, and a legislative

council comprising the governor, not more than twelve nominated members (one Indian), seven elected members, and two native members. The natives have village, district, and provincial councils (there being seventeen provinces), and a special system of taxes, paid mainly in kind.

The islands, from 200 to 250 in number, lie in a ring, open on the southern side in a manner resembling the West Indies. On the west and north are the two large islands of Viti Levu and Vanua Levu, with a group of small islands and reefs outside them; and on the east there is a long string of islands of small size, answering to the Leeward and Windward groups in the West Indies.

The total area of the colony (including Rotumah) is given at 7083 sq. m., being about the same size as Wales. The area of Viti Levu is over 4000 sq. m., rather smaller than Jamaica, and the area of Vanua Levu is about 2100 sq. m. Since 1882 the capital of the colony has been Suva, on the south coast of Viti Levu, where there is a fine harbour; before that date Levuka, on the little island of Ovalau, off the east coast of Viti Levu, also possessing a good harbour, was the European capital. Municipalities have been established at both places.

The Fiji Islands are of volcanic formation, the shape of the mountains (the highest of which rise to some 4500 feet) and the existence of hot springs testifying to volcanic agency; and they are surrounded by coral reefs, which act as natural breakwaters. They are singularly favoured by nature, being well supplied with harbours, and equally well



with rivers, having an abundant water-supply, a rich soil, and a climate which, though tropical and somewhat enervating to Europeans (who are subject to dysentery), is not unhealthy or extreme. They suffer, however, from the ravages of hurricanes, and earthquakes occasionally occur. The temperature varies from about 60°–90°, November to April being the warm season. The rainfall, abundant in the warm season, is greatest and the land is most heavily timbered on the south-eastern—the windward—side of the islands; on the leeward side the face of the country is more that of open grass-land. With the exception of the bêche-de-mer and pearl-shell industries, the resources of Fiji are almost purely agricultural. In addition to timber and fruit-trees, and coconut palms, the vegetable products of the islands include sugar, grown with the help of imported Indian and Polynesian labour, rubber, maize, cotton, tea, and coffee. There are hardly any indigenous mammals. Iron in considerable quantities, and traces of gold, silver, tin, antimony, manganese, &c., are found, but none of these minerals are worked.

The population of Fiji in 1921 amounted to 154,584, of whom some 3800 were Europeans, over 84,000 native Fijians, and over 60,000 Indians. The native population was larger in former years, and was much reduced by an outbreak of measles in 1875. The death-rate among the natives is high, being about twice the rate for England. They are in race akin to the Papuans, being the easternmost members of that family, but an admixture of the lighter Polynesians has been brought in from Tonga and elsewhere, and has, especially in the eastern islands of the group, leavened the native Melanesian breed. In language and polity the natives of Rotumah differ entirely from the Fijians. The Fijians were, prior to the introduction of Christianity, notoriously ferocious cannibals, but religious after their kind, and possessing a strong belief in a future life. At the present time the Christian religion (Roman Catholic and Wesleyan) is almost universal in the islands. Education is carried on in government schools and in mission schools, which on complying with certain conditions are entitled to government aid. Of government schools the chief are at Suva (one for boys, one for girls), Levuka, and Rarawai. The Queen Victoria Memorial School at Nasinu, also state aided, is for the higher education of natives. The revenue, derived mainly from customs duties and native taxation, has not always covered the expenditure. Sugar is far the most important export, though a scarcity of labour and an acute economic unrest, the outcome of the ending, in 1916, of the importation of Indian contract workers, and of the cancellation, in 1920, of all the indentures of Indian labourers, have greatly hampered the industry's growth. Next in importance as exports come copra and fruit, especially bananas and pine-apples. Rubber is also an established industry. Drapery, machinery, hardware, coal, breadstuffs, meats, and rice are the principal imports. Goods are imported mainly from Australia, while the bulk of Fijian produce goes to New Zealand. There are no railways in Fiji, but the tram-lines of the sugar plantations are sometimes open to public use. Fiji has become British by the force of circumstances, and not on account of its natural advantages; but it has considerable agricultural resources, and is a station from which British influence can be exercised in the South Pacific. In 1920 a prolonged strike of Indian labourers culminated in rioting, which was quelled by show of naval and military force from Australia and New Zealand.

See parliamentary report of 1862 and the annual Colonial Office List; also C. F. Gordon Cumming, *At Home in Fiji* (1882); B. Thomson, *Fiji for Tourists* (1897), and *The Fijians* (1908); W. A. Chapple, *Fiji* (1921); W. Deane, *Fijian Society* (1921); and A. B. Brewster, *The Hill Tribes of Fiji* (1922).

Filament, in Botany, is the stalk of the stamen which supports the pollen-containing *anther*, and stands to the anther as the petiole to the leaf-blade. See FLOWER, LEAF, STAMEN.

Filaria, Filariasis. See the articles GUINEA-WORM, ELEPHANTIASIS ARABUM.

Filbert. See HAZEL.

Fildes, SIR LUKE, figure-painter, was born at Liverpool in 1844. He studied in the South Kensington Schools and in the Royal Academy, and became known first of all as a woodcut designer, contributing to *Once-a-Week*, *Cornhill*,

and *The Graphic*, and illustrating Dickens's *Edwin Drood*. He began to exhibit in the Academy in 1868, with his 'Nightfall,' and in 1874 produced a very popular picture, 'Applicants for Admission to a Casual Ward'—originally a *Graphic* woodcut—followed in 1877 by the powerful 'Widower,' and in 1892 by 'The Doctor.' Other subjects have been portraits and figure-pictures of Venetian life, in which he has developed a stronger colour-sense than his earlier works gave any indication of. He was elected an A.R.A. in 1879, R.A. in 1887, knighted in 1906, and made K.C.V.O. in 1918. See D. C. Thomson in *Art Annual* (1895).

File, a steel tool, having its surface covered with teeth, and used for smoothing and shaping metals, &c. Files are classified and named according to their shape, size, and fineness of cut, and the purpose for which they are made. Thus, in shape they may be flat, square, round or *rat-tail*, triangular, half-round, feather-edged, &c., besides being variously bent, in order to get at intricate work. Most files are made thicker in the middle, or 'bellied,' a form which best suits the hands in the act of filing. Files generally are made of the best crucible steel, the forged and shaped blanks when ready for cutting being held upon an anvil by means of a long loop of leather-strap, into which the cutter places his foot. The face of the anvil is covered with a flat piece of pewter, the softness of which preserves the teeth on one side of the file when those on the opposite face are being struck. The cutter forms the teeth by striking with a hammer a short, stout chisel, held obliquely at an angle of about 12° or 14° from the perpendicular. If the chisel were perpendicular, a furrow like the letter V would be indented, and an equal burr struck up on each side; but as a cutting tooth somewhat like that of a saw is required, this is effected by the oblique stroke of the chisel, by which a burr is thrown up on one side only—viz. towards the tang. The cutting is commenced at the point of the file; the chisel is then drawn backwards, laid upon the blank, and slid forwards till it reaches the burr raised by the last cut; the blow is now struck, and another tooth and burr produced, which serves as a guide for the next cut; and so on. The distance between the teeth thus depends on the force of the blow and the obliquity of the cut; for the heavier the blow, the greater the ridge or burr, and the obliquity determines the distance of the cut from the burr. The skill of the workman consists, therefore, in the precise regulation of the blows.

Files are either single cut—i.e. made with a single series of parallel cuts—or, more commonly, double cut—i.e. they have two series or *courses* of chisel-cuts, which are oppositely inclined at an angle of about 55° to the central line of the file. The second course is made in the same manner as the first, but with lighter blows, and is usually somewhat finer than the first. This angular crossing converts the ridges into pointed teeth. Files used for soft metals which are liable to clog the teeth are single cut—i.e. they have but one course of cuts. Taper files have the teeth finer towards the point. Rasps for wood or horn, &c. are cut with triangular punches, each tooth being an angular pit with a strong burr, instead of a long furrow. The rapidity with which the blows are struck varies with the fineness of the file: sixty or eighty cuts are commonly made per minute. Classified according to fineness of cut, files are known as rough, bastard, smooth, and superfine. A superfine file of small size may have as many as 216 cuts per inch, while a large rough file may have not more than twenty-one cuts to the inch. The sharpness and abrading effect of files is greatly improved by subjecting them after cutting to a sand-blast, whereby a slight recurvature of the burr, which is always present as the file leaves the cutter, is corrected, and the edge is rendered very keen.

Files have to be very carefully hardened and tempered. If heated too strongly, or made too hard, the steel is so brittle that the teeth tear off; if too soft, they wear down rapidly, and the file soon becomes useless. Great care is also required in keeping them straight, as the sudden cooling necessary for hardening is very apt to warp the steel.

Files are also cut by machinery, but attempts long met with only partial success; the chief difficulty arises from the necessity of modifying the force of the blow to suit the hardness of the steel. It is practically impossible to supply a large number of blanks all of exactly the same hardness; and if the machine be adjusted to suit the hardness of one blank, it may strike too heavy or too light a blow for the next; whereas the workman *feels* at once the hardness of the steel he is working upon, and adjusts his blows accordingly.

File (Fr. *file*, 'a row,' from Lat. *filum*; Ital. *fila*, *filo*), in a military sense, is used to signify any line of men standing directly behind each other, as rank refers to men standing beside one another. In ordinary two-deep formations, a file consists of two men, one in the front rank and one in the rear rank. *Single-file* formation signifies one man from a single rank followed by the men on his right (or left) in succession. *Rank and file* is a term often used to mean the private soldiers of a regiment only, but it really includes also the corporals, who are therefore sometimes called rank and file non-commissioned officers.

File-fish. See BALISTES.

Filey, a rising watering-place on the east coast of Yorkshire, 9 miles SE. of Scarborough by rail, occupies a picturesque site on cliffs overlooking Filey Bay. It has a spa, an ancient cruciform church, a safe harbour protected by Flamborough Head, and a sea-wall and promenade. Pop. 4500.

Filiation. See AFFILIATION.

Filibusters (Span. *filibustero*, apparently derived through the Fr. *flibustier*, formerly *fribustier*, from the Dutch *vrijbuiter*, 'freebooter'; possibly influenced in form by English *flyboat*, Dutch *vlieboot*, Fr. *flibot*, Sp. *flibote*, a fast sailing vessel of not more than 100 tons), originally another name for Buccaneers (q.v.). Later the term came to be applied to those adventurers who, between 1850 and 1860, organised expeditions from the United States in violation of international law, for the purpose of revolutionising certain states in Central America and the Spanish West Indies. The most noted was William Walker (q.v.). See Roche's *Story of the Filibusters* (1891). The term is now general, signifying persons engaging in unauthorised and irregular warfare, while in the United States the word also means an obstructionist in Congress.

Filicaia, VINCENZO, lyrical poet, was born at Florence, 30th December 1642. The publication of his six odes celebrating the deliverance of Vienna in 1683 by John Sobieski from the besieging forces of the Turks attracted the notice of Queen Christina of Sweden, who relieved him from harassing pecuniary embarrassments. Ultimately he obtained a post from the Grand-duke of Tuscany, and he died at Florence, 25th September 1707. Some of his patriotic sonnets are famous; but his verse, though not without beauty and spirit, is disfigured by the rhetorical tricks and false conceits of the period. An edition of his works appeared at Florence in 1864.

Filices. See FERNS.

Filigree (through Span. from Lat. *filum*, 'a thread,' and *granum*, 'a grain'), so called because composed of fine wire of silver or gold, often ornamented with small beads. The wire used is twisted into spirals and other convoluted forms, which are united and partly consolidated by soldering; and these spirals, &c. are combined to form a sort of metallic lace-work, which is shaped into brooches, ear-rings, crosses, head-ornaments, card-cases, trays, and other objects of a light and elegant character. Filigree-work is also employed for the ornamentation of articles having a solid metallic base of precious metal, or of copper, the wires being soldered down in definite patterns to the supporting plate. That filigree, as a style of jeweller's work, is of great antiquity is evidenced by remains found in ancient Egyptian tombs. That a knowledge of the art was very widespread is also manifest from the fact that it was largely practised by the ancient Greeks, the Etruscans, and the Romans. We know further that from remote ages it was practised in Central Asia and in India, where to this day it has continued in unbroken succession, and it is now a most characteristic style of work in the Central and the United Provinces. Among the Celtic and Scandinavian tribes of early times filigree was also a favourite method of ornamentation. The Quigrich (see FILLAN, ST), and the Hunterston Brooch (see BROOCH) are magnificent examples of early northern metal-work in which filigree ornamentation on a solid basis is a prominent feature. In the jewelry of the Scandinavian races filigree still occupies an important place. The manufacture of filigree jewelry is so characteristic of Malta that the style has come to be popularly known as Maltese work.

Filioque. See CREEDS.

Fillan, ST, was the son of Feredach, a prince of Munster, and of St Kentigerna, who in 734 died on Inchcailloch in Loch Lomond. He succeeded St Mund as abbot of the monastery on the Holy Loch, but presently withdrew to Upper Glendochart (Strathfillan), 3 miles SSE. of Tyndrum, where he died on 9th January 777. In 1318 Robert Bruce re-established here an Augustinian priory; and here too was the 'holy pool of Fillan,' in which, not a century since, sick people bathed, and lunatics were plunged. The latter were afterwards left all night, bound hand and foot, in a stone coffin; and if in the morning the knots were untied there was hope of recovery. Two relics of the saint have, after strange wanderings, been reunited at Edinburgh in the Antiquarian Museum. One, his square-shaped bell of cast bronze, 12 inches high, lay in the churchyard, and was employed in that lunatic 'rope-trick,' till in 1798 an English tourist bore it off to Hertfordshire, whence in 1869 it was recovered through Bishop Forbes of Brechin. The other relic is the Quigrich (Gael. *coygerach*, 'stranger')—the bronze head of a pastoral staff (fig. 1), adorned with niello, and inclosed in a beautiful outer case of silver (fig. 2), 9 inches high, gilt, and ornamented with chased work and filigree. Both are undoubtedly of Celtic workmanship; but the case is naturally the later of the two, and seems partly assignable to the 14th and 15th centuries. Possessed of both thief-finding and healing properties, the Quigrich from Bruce's time and earlier was in the hereditary custody of a family named Jore, Doire, or Dewar, who enjoyed certain privileges therefor. James III.'s charter of confirmation (1487) to Malice Doire was presented for registration among the public records of Scotland so recently as 1734. In 1818 the Dewars emigrated from Balquhidder to Ontario, taking with them the Quigrich, which in 1876 was, through Dr Daniel Wilson, bought for £100 by the Scottish Society of Antiquaries. St Fillans, at the foot of Loch Earn, is associated with an earlier saint, called *an lobar*, 'the leper,' whose feast fell on 20th June. See Dr John Stuart's 'Historical Notices of St Fillan's Crozier,' in *Proc. Soc. Ant. Scot.* (xii. 1877), and Dr Joseph Anderson's *Scotland in Early Christian Times* (i. 1881).

Fig. 1.—Quigrich of St Fillan.

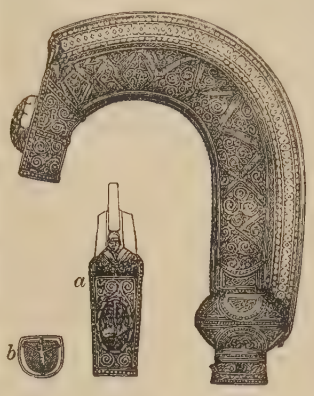
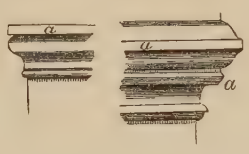


Fig. 2.—Silver Case of the Quigrich: *a*, front part; *b*, terminal plate.

Fillet, in Architecture, a small space or band, like a narrow ribbon, used along with mouldings. *a*, *a*, *a* (see fig.) are examples of fillets, both in classic and Gothic architecture.



Fillmore, MILLARD, thirteenth president of the United States, was born on 7th February 1800, at Summer Hill, New York, where his education was limited to the very imperfect instruction furnished during three months of the year by a primitive frontier school. At the age of fourteen he was bound apprentice to a wool-carder; and during the five years he laboured at this occupation he used every means at his disposal to cultivate his mind. In 1819 he began the study of law, receiving his board in return for his work in the office of a country lawyer; and during part of this time he also taught school, until in 1823 he was admitted to the Buffalo bar, where he built up a solid reputation for sound legal knowledge and sterling probity. In 1828 he began his political career, being in that year returned by Erie county to the state legislature of New York, where he joined the Whig party, and was mainly instrumental in procuring the abolition of imprisonment for debt in the state of New York. In the period 1832–42 he was four times elected member of congress; in 1844 he was defeated in a contest for the governorship of the state; in 1847 he was elected to the post of comptroller of New York; and in the following year he was made vice-president of the United States. The unexpected death of President Taylor in July 1850 left the chief magistracy vacant, and Fillmore succeeded to that office, which he held till 1853. He proved an able statesman, and his presidency was marked by the passing of some very salutary measures, notwithstanding that his party were in the minority; but his signing of and attempt to enforce the fugitive-slave law rendered him unpopular in the North. In 1856 he was nominated for the presidency by the American party, but the struggle lay be-

tween the republican and the democratic candidates, and he received the electoral vote of Maryland only. He visited Europe in 1855 and 1866. He took no active part in the civil war, although he gave his influence to the cause of the Union. After his retirement from political life he resided at Buffalo, where he died 7th March 1874. See Chamberlain's *Biography of Fillmore* (1856); Buffalo Historical Society's publications, vols. x.–xi. (1907); Life by Griffis (1915).

Filmer, Sir Robert, an extreme advocate of the theory of the divine right of kings, was born at East Sutton in Kent, in the end of the 16th century. He matriculated at Cambridge in 1604, and died 26th May 1653. The germ of his theory is the proposition that the father of a family is the divinely ordained type of a ruler, and that his power is absolute. Accordingly, Filmer taught, a king's acts should be subject to no check or control whatsoever; his will is the only right source of law. Hence he is not in any sense answerable to his subjects for his doings; for them either to depose him or even to criticise his conduct is criminal and immoral. These views are expounded with most fullness in his *Patriarcha*, published in 1680 after his death, and were critically examined in Locke's *Treatise on Government*. Filmer's *Freeholder's Grand Inquest* (1648) is an exposition of his ideas as to the relations that ought to obtain between the king and the houses of parliament. See Divine Right.

Filmy Ferns (*Hymenophyllaceæ*), an order of Ferns (q.v.), including only two (or three) genera, but over two hundred species. They grow in large, spreading, mossy masses on rocks and tree-stems in moist places, are chiefly tropical, rare in the southern hemisphere, still rarer in the northern. A British species of the large genus Hymenophyllum (*H. tunbridgense*), despite its apparently local name, is one of the most widely distributed of plants, being found not only over Europe, but in South America, at the Cape, and in New Zealand. Trichomanes has ninety species, mostly tropical, only one ranging as far as southern Europe. Although chiefly distinguished by systematists on account of the minute structure of their sporangia, they are more remarkable for the exceptionally simple structure of their moss-like leaves, which consist usually of only a single layer of uniform parenchymatous cells. More rarely several layers are present, but there is never a distinct epidermis; moreover, as the plants grow in very wet places—often, for instance, in the spray of waterfalls—and as the leaves are so hygroscopic as to be constantly saturated, even when not absolutely covered with moisture, the usual air-spaces, and with them the stomata of ordinary leaves, are not developed. From this saturation with water instead of air the thin, wet, filmy foliage is thus peculiarly transparent, and so seems singularly dark-green by reflected light. To the exceptional yet beautiful appearance thus accounted for their interest to fern-growers is due.

Filter. When solid matter is suspended in a liquid in which it is insoluble, it may be separated by various means (see Clarification), one of which is filtration. The process of filtration consists in passing the liquid through some porous substance, the interstices of which are too small to admit of the passage of the solid particles, the principle of the action being the same as that of a sieve. One of the simplest forms of filter is that commonly used in chemical laboratories for separating precipitates, &c. A square or circular piece of blotting-paper is folded in four, the corner where the four folds meet is placed downwards in a funnel, and one side is partly opened, so that the paper forms a lining to the funnel. The liquid passes through the pores of the paper, and the solid matter rests upon it. The chief advantages of this filter are its simplicity and the ease with which the solid matter may be removed and examined.

A simple water-filter for domestic purposes is sometimes made by stuffing a piece of sponge in the bottom of a funnel or the hole of a flower-pot, and then placing above this a layer of pebbles, then a layer of coarse sand, and above this a layer of pounded charcoal three or four inches in depth. Another layer of pebbles should be placed above the charcoal, to prevent it from being stirred up when the water is poured in. It is obvious that such a filter will require occasional cleaning, and renewal of the charcoal. By a small addition to this a cottage-filter may be made which, for practical use, is quite equal to the most expensive filters of corresponding size. It consists of two flower-pots, one above the other; the lower one is fitted with the sponge and filtering layers above described, and the upper one with a sponge only. The upper pot should be the larger, and, if the lower one is strong, the upper one may stand in it. The two pots thus arranged are placed upon a three-legged stool with a hole in it, through which the projecting part of the lower sponge passes, and the water drops into a jug placed below. The upper pot serves as a reservoir, its sponge stops the coarser impurities, and thus the filtering layers of the lower one may be used for a long period without being renewed, if the upper sponge be occasionally cleaned. Care must be taken to wedge the upper sponge tightly enough, to prevent the water passing from the upper pot more rapidly than it can filter through the lower one.

A great variety of filters are made on a similar principle to the above, but constructed of ornamental earthenware or porcelain vessels of suitable shape. In purchasing a filter, the buyer must not be satisfied with merely seeing that the water which has passed through it is rendered perfectly transparent—this is so easily done by a new and clean filter—but he should see that the filter is so constructed as to admit of being readily cleansed, for the residual matter must lodge somewhere, and must be somehow removed. When large quantities of water have to be filtered this becomes a serious difficulty, and many ingenious modes of overcoming it have been devised. In most of these water is made to *ascend* through the filtering medium, in order that the impurities collected on it may fall back into the impure water. Leloge's ascending filter consists of four compartments, one above the other; the upper part, containing the impure water, is equal in capacity to the other three. This communicates by a tube with the lowest one, which is of small height. The top of this is formed by a piece of porous filtering-stone, through which alone the water can pass into the third compartment, which is filled with charcoal, and covered with another plate of porous stone. The fourth compartment, immediately above the third, receives the filtered water, which has been forced through the lower stone, the charcoal, and the

Leloge's Filter:
1, 2, 3, 4, the four compartments; *ab*, the first porous stone of third or filtering compartment; *cd*, the exit filtering stone of *d*; *e*, the plug to remove for cleaning out second compartment; *f*, a loose sponge at entrance of communicating tube.

upper stone. A tap is affixed to this, to draw off the filtered water, and a plug to the second or lowest compartment, to remove the sediment.

A large number of other ascending filters have been patented. Siphon filters are cylindrical pewter vessels, containing the filtering media, to which is attached a long coil of flexible pipe. When used, the cylinder is immersed in the water-butt or cistern, the pipe uncoiled, bent over the edge of the cistern, and brought down considerably below the level of the water. It is then started by applying the mouth to the lower end, and sucking it till the water begins to flow, after which it continues to do so, and keeps up a large supply of clear water. This, of course, is an ascending filter, and the upward pressure is proportionate to the difference between the height of the water in the cistern and that of the lower end of the exit tube (see SIPHON). Filtering on a large scale is effected by using several tanks or reservoirs, in the first of which is coarse material such as gravel, the water passing from this to a second, and from there through a finer filter to the main receptacle, where the filtered water is stored and drawn off for use.

Various means of compressing carbon into solid porous masses have been patented, and filters are made in which the water passes through blocks of this compressed carbon. Most of these are well adapted for the purpose, but their asserted superiority over filters composed of layers of sand and charcoal is doubtful. A very convenient portable filter for soldiers, travellers, and others who may require to drink from turbid ponds and rivers is constructed of Ransome's filtering-stone, and is also made of the compressed carbon. A small cylinder of the stone or carbon is connected with a flexible india-rubber tube in such a manner that the cylinder may be immersed in a river, the mouth applied to a mouthpiece at the other end of the tube, and the water drawn through the filtering-cylinder.

It has been questioned whether soluble matter, such as common salt, is in any degree removed from water by filtration. Theoretically it was assumed that this is impossible, since the filter only acts mechanically in stopping suspended particles; but the results of experiments show that from 5 per cent. of soluble salts may be separated by sand-filters such as above described. Another most important matter is to ascertain to what extent soluble organic matter may be decomposed by filtration, especially by charcoal filters, and to ascertain how long charcoal and other porous matter retains its property of acting on organic matter in watery solution (see CHARCOAL). This is of the highest importance, as it sometimes happens that water of brilliant transparency, and most pleasant to drink, on account of the carbonic acid it contains, is charged with such an amount of poisonous organic matter as to render its use as a daily beverage very dangerous. A filter of animal charcoal will render London porter colourless. Loam and clay have similar properties. The separation from drinking-water of pathogenic microbes (microscopic sources of pestilence) is very difficult, on account of their extreme smallness; but it has been effected by using porous unglazed earthenware as the filtering medium, filtration usually being hastened by putting the apparatus under pressure or by creating a vacuum in the receiving vessel. It is, however, rather troublesome in practice, as pressure is demanded, and the very fine pores are soon clogged. They may be cleansed by raising the filter material to a red heat. A duplicate is therefore required.

When a liquid contains mucilaginous or other matter having viscous properties, there is considerable difficulty in filtering it, as the pores of the medium become filled up and made watertight. Special filters are therefore required for syrups, oils, &c. Such liquids as ale, beer, &c. would be exceedingly difficult to filter, and therefore they are clarified by the admixture of albumen, gelatin, or some substance with clarifying properties. Oil is usually passed through bags made of horse-hair or twilled cotton cloth (Canton flannel). Syrups are filtered on a small scale by confectioners, &c. by passing them through conical flannel bags, and on a large scale in *creased bag-filters*, made by enclosing a large bag within a smaller one. Thick syrups are clarified with white of egg, and then they may be filtered through a coarse cloth strainer. A recent theory is that the efficiency of filters, so far from depending on the cleanness of the medium, is largely owing to the multitudes of microbes at work in the substance through which the liquor passes. For the treatment of vegetable juices, see BEER, WINE, SUGAR, &c.; and for filtering on the large scale, see SEWAGE, WATER. The simple laboratory filter has to be modified when strong acid or alkaline solutions, &c. require filtration. Pure siliceous sand, a plug of asbestos, pounded glass, or clean charcoal are used for this purpose.

Air Filters.—The extraordinary powers of charcoal in disinfecting the gaseous products evolved from decomposing animal and vegetable matter have been made available in constructing an apparatus for purifying air that is made to pass through it. A suitable cage, containing charcoal in small fragments, is fitted to the opening from which the deleterious gases issue, and is found to render them perfectly inodorous, and probably innocuous. Mechanical impurities suspended in air may be filtered out by forcing the air through a plug of cotton-wool, as in firemen's respirators.

Fimbria, GAIUS FLAVIUS, Roman soldier of the party of Marius, in 86 B.C. encompassed the death of Valerius Flaccus, whose legate he had been. He then made war on Mithridates. By treachery he massacred the people of Ilium, and burned the town. Sulla attacked him in 84, and being deserted by his troops he committed suicide.

Fimbriate, Fimbriated, in biology fringed; in heraldry, having a narrow border.

Fin. See FINS.

Final, in the ecclesiastical modes of music, the fundamental note—the modern tonic or keynote.

Finale, the name given to that part of a musical composition which finishes the act of an opera; also to the last movement of an instrumental composition, as in the symphony, quartette, quintette, sonata, &c. The instrumental finale varies greatly in form, from the lively rondos of Haydn to the gigantic vocal finale, in variation form, of Beethoven's 9th Symphony. The operatic finale, as usually understood, is a concerted piece, sometimes extending to a considerable number of different movements, for one, two, or more single voices, with or without chorus. The best type is to be found in Mozart's operas. In Wagner's works there are no finales separable from the preceding parts of the acts; each act is a continuous whole.

Finance. See NATIONAL DEBT, BUDGET, &c,

Finch, a name applied to many Passerine birds included in the family Fringillidæ, but generally used with some prefix, as in the familiar names bullfinch, chaffinch, and goldfinch. A finch is usually small, has a hard conical beak, and generally lives upon seeds. The distribution is almost world-wide, excepting Australia; but the majority inhabit the palæarctic region. The Buntings (Emberizidæ) and the Weaver-finches (Ploceidæ) of the Ethiopian and Australian regions are usually kept distinct. The limits of the family Fringillidæ are vague; among the more familiar members are the

Chaffinch (*Fringilla cælebs*), the Brambling (*F. montifringilla*), the Canary (Serinus), the Crossbills (Loxia), the Linnets (Linota), and the Sparrows (Passer).

Finch, Heneage, first Earl of Nottingham and Lord Chancellor of England, was born in Kent, probably at Eastwell, on 23d December 1621. He was the nephew of Finch, the lord-keeper of Charles I. Educated at Westminster and Christ Church, Oxford, he was called to the bar in 1645. At the Restoration Charles II. made Finch solicitor-general; in this capacity he took an active part in the trial of the regicides, publishing an account of the trial in 1660. In 1670 he became attorney-general, and five years later lord chancellor. As high steward he presided at the impeachment trial of Stafford in 1680. He died in London, 18th December 1682, having gained a high reputation as a graceful orator, and as a lawyer of great integrity, wisdom, and skill. Several of his speeches were published during his lifetime.

Findhorn, a beautiful Scottish river, rising among the Monadhliath Mountains at an altitude of 2800 feet, and running 62 miles north-eastward through the counties of Inverness, Nairn, and Elgin, and past the town of Forres, till it enters the Moray Firth at Findhorn village by a triangular lagoon, 2 miles long by 2⅝ wide. Its waters abound in salmon and trout. Its basin consists of gneiss in the upper part, and of old red sandstone in the lower. At one place it rose nearly 50 feet in the disastrous floods of August 1829, known as the 'Moray Floods.'

Finding of Goods. See Lost Property.

Findlater, Andrew, editor of the first edition of this Encyclopædia, was born in December 1810 near Aberdour, in Aberdeenshire. He was the son of a small farmer, and was bred to farm-work; but he early resolved to go to the university, and in spite of having to do daily a full day's work on the farm, he contrived to qualify himself for entering Aberdeen University. There he graduated in arts, and began theology with a view to becoming a minister; but changing his intention, became a schoolmaster at Tillydesk in the parish of Ellon, and for seven years (1842–49) was head-master of Gordon's Hospital in Aberdeen. After a short residence in Canada, he came in 1853 to Edinburgh to superintend for Messrs W. & R. Chambers a new edition of the *Information for the People* (1857). His next task was the chief work of his life; he devoted himself to the preparation of *Chambers's Encyclopædia*, and ere long was its editor. A scholar of wide and varied learning, equally at home in the physical sciences, in the history of ancient religions, and in modern comparative philology, he turned his acquirements to good account, not merely in directing the Encyclopædia as a whole and fixing its form and scope, but in contributing to it many of its most important articles; and after its completion (1861–68) he superintended a revised issue (1874). He saw through the press a new edition of the *Miscellany* (1869–71) and of the *Etymological Dictionary* (1882); and wrote short but admirable manuals on Astronomy, Language, Physical Geography, and Physiography. In 1864 Aberdeen University gave him its degree of LL.D.; and J. S. Mill, while rector of St Andrews University, made him his assessor in the University Court. Many of the articles in the review columns of the *Scotsman* were from his pen. He was associated with J. S. Mill, Mr Grote, and Professor Bain in editing James Mill's *Analysis of the Phenomena of the Human Mind* (1869); and he counted Thackeray, Littré, and Dr John Brown amongst his friends. His health failing, he withdrew from active work in 1877, and died 1st January 1885.

Findlay, capital of Hancock county, Ohio, 37 miles SW. of Fremont by rail, with foundries, flour and saw mills, &c. Pop. 17,000.

Findon, a village of Kincardineshire, on the coast, 6 miles S. of Aberdeen. *Findon, Finnan,* or smoked haddocks were originally cured not here but on the Findhorn, and were long called *Findrams.*

Finds. See Treasure-trove.

Fine in feudal law was a final agreement between lord and vassal as to the conditions on which lands were to be held by the latter, or between other persons as to rent. The *fine of lands* was a fictitious proceeding formerly in use in order to transfer or secure real property by a mode more efficacious than an ordinary conveyance. The party to whom the land was to be conveyed commenced a fictitious suit against the vendor; and leave being obtained, a covenant was entered into whereby the vendor or defendant recognised the right of the plaintiff to the lands wrongfully kept from him. The fine was registered; and the business was concluded by what was called the *foot* of the fine, setting forth the parties, the time and place, and before whom the fine was levied; the whole was embodied in indentures commencing *hæc est finalis concordia.* A fine was also one of the methods of barring an Entail (q.v.), till the Fines and Recoveries Act of 1833 substituted a disentailing deed. Fine is also a name for a money payment imposed for an offence by a judicial authority. In some offences imprisonment may be imposed, in minor cases with, in more serious cases without, option of paying a corresponding fine.

Fingal's Cave. See Staffa.—For Fingal himself, see Fenians, Ossian.

Finger-and-toe. See Anbury.

Finger-prints taken on paper by means of printing-ink or other medium show in every individual peculiar markings, which remain unchanged through life. Such finger-prints have been used as a means of signing or certifying documents in China and Japan from a remote antiquity. The use of finger-prints for criminal identification was first officially sanctioned in England in 1901, following work by Sir F. Galton, Sir W. J. Herschel, and Sir E. R. Henry. By means of radiography extraordinarily accurate representations may now be obtained. See Galton, *Finger-Prints* (1892).

Fingers. See Hand.

Fingos, or Amafingu, a Bantu people in the south-east of the Cape Province. See Kaffirs.

Finial, an ornament, generally carved to resemble foliage, which forms the termination of pinnacles, gables, spires, and other portions of Gothic architecture. There are traces of foliated terminations, both in stone and metal, on the pediments of classic buildings (see Acroterion), but it was not till the 12th century that the finial proper was introduced. During the latter part of that century and the whole of the 13th century, finials of the most perfect form and of infinite variety were used as the crowning ornaments of every salient point in the buildings of the period (see fig. 1). The architects of the 14th century in finials, as in other ornaments, imitated more closely the forms of natural foliage; but their finials had neither the variety of design nor the vigour of outline of those of the preceding century (see fig. 2).

In the 15th and 16th centuries the finials became more and more meagre in form, and are frequently only four crockets set upon a bare pyramidal terminal. Some variety of effect is often obtained during this period by surmounting the finial with a gilded vane. This is common in Tudor and in continental domestic architecture (fig. 3). Finials

were carved both in stone and wood, and in the latter material with great delicacy and minuteness. In connection with metal-work finials of metal were used, and, whatever the material adopted, its natural capabilities were made a source of special beauty.

The finial is one of the most effective ornaments of Gothic architecture, and when that style was succeeded by the Renaissance, in the reign of Queen Elizabeth, our forefathers could not persuade themselves to part with the finials to their buildings.

Finials:
1, from Bishop Bridport's Monument, Salisbury Cathedral; 2, York Minster; 3, Maulbronn, Germany; 4, Crew Hall, Cheshire; 5, Augsburg.

We thus find in Elizabethan architecture a great variety of finials; they are, however, almost entirely of a geometric form, and without foliage (fig. 4), and are frequently, especially when terminating wooden gables, combinations of finial and vane, partly wood and partly iron (fig. 5). In the stricter classic style which succeeded the Elizabethan, some traces of the favourite finial still remain in the balls, obelisks, &c. used as terminations, and also in the shields and supporters (themselves a remnant of feudal times) which form the crowning ornament of gate-piers, pedestals, &c.

Fining, the process of clearing turbid liquors, such as beer and wine. See CLARIFICATION, BEER, WINE, SUGAR, FILTER, &c.

Finistère (Lat. *finis terræ*, 'land's end'), a department at the western extremity of France, comprehending a part of the former duchy of Bretagne, and washed on three sides by the English Channel and the ocean. Area, 2585 sq. m. Pop. (1872) 642,963; (1921) 762,514. It is traversed from east to west by two low but picturesque chains of hills, clad with fir-trees and heath, and forming fruitful valleys of meadow-land between. Its coast is very rugged and broken, its shores bristling with dangerous granite rocks, and fringed with many islands. The most dreaded headland is the Pointe de Raz, rising over 260 feet above the sea, near which, in the 16th century, were still visible the ruins of Is, the ancient capital of Cornouaille (q.v.). The temperature in general is low, the climate very humid: rain and mist are of almost daily occurrence. There are a number of coast streams, including the Odet, the Elorn, and the Aune, which forms part of the great line of communication between Brest and Nantes. The department raises more grain than even its dense population can consume, and vegetables, flax, and cider also are exported; it is noted for its small, hardy horses; and cattle, swine, and bees are largely reared. Its argentiferous lead-mines are no longer worked, and its manufactures, which include rope-spinning, weaving, and some shipbuilding, are of little importance; its sardine-fisheries, however, are extensive. The department is divided into five arrondissements — Brest, Châteaulin, Morlaix, Quimper, and Quimperlé—with Quimper as chief town. See BRITTANY.

Fi'nisterre, CAPE, a promontory at the north-western extremity of Spain, off which Anson (q.v.) defeated Jonquière, and Sir Robert Calder cut off two vessels of the Franco-Spanish fleet in 1805.

Finland (Finnish *Suomi* or *Suomenmaa*, 'the land of fens and lakes'), a republic of northern Europe lying between 60° and 70° N. lat., and 20° and 33° E. long., and bounded on the N. by Norway, on the E. by Russia, on the W. by Sweden and the Gulf of Bothnia, on the S. by the Gulf of Finland. Its greatest length is 717 miles, its average breadth about 185 miles. Its total area is about 144,000 sq. m. (or rather larger than Great Britain and Ireland). The surface consists of hard crystalline rocks, granite, gneiss, and schist, covered in most parts with a thin layer of infertile sands and clays. The drainage is bad, and the soil is soaked with water during most of the year.

The coast of Finland is extremely indented, and studded with thousands of small islands, forming a perfect archipelago (Swedish *skärgård*), whilst the interior of the country, apart from the low coastal plains, and more especially in the southern as distinct from the northern or Lapland plateau, is covered with countless lakes. Some 12 per cent. of the total area is held to be so covered, while about 30 per cent. is occupied by marsh and bog, the quantity of which latter is, however, gradually being diminished by the united efforts of nature and man. The largest of the lakes—besides Lake Ladoga, of which part belongs to Russia—are Lakes Saima, Enare, Kemi, Oulujärvi, and Päijänne. The Saima consists of 120 large lakes and several thousand smaller ones, all connected, and having a natural outlet into Lake Ladoga, over the famous Imatra Falls—more correctly rapids—the finest in Europe from the point of view of scenery and the greatest in volume of water.

The interior of Finland forms a tableland of from 300 to 400 feet above the level of the sea, and there are no mountains worthy of the name, the highest being Haldefjäll, in Lapland (Lapp *Haldischok*), 4126 feet high, near the frontier of Norway. The highest hill in the south is Türismaa, and this does not exceed 754 feet above sea-level. The principal rivers of Finland are the Kemi and Uleå in the north, and the Kymmene, the Kumo (Kokemäki), and the Vuoksen in the south. Owing to rocks and rapids they are usually navigable only for a part of their length, but they are well suited for floating logs from the forests of the interior to the coasts, and are also rich in fish; more important, they provide, as at the Imatra (Vuoksen) and Anjula (Kymmene) Falls, a valuable source of water-power, a power, however, which is often severely curtailed by frost in winter and by drought in summer.

Relatively Finland is the most wooded country of Europe, more than half her land surface being under forest; even as regards absolute extent of forest area only Russia and Sweden exceed her. About two-fifths of Finland's woods are owned by the state, the remainder by private enterprise. The management of state forests is carefully regulated, and by a law of 1917 the reckless felling of timber by private individuals was prohibited. The Scots pine (*Pinus sylvestris*) and Norway spruce (*Abies* or *Picea excelsa*) are the most widespread and

most profitable; then come the birch, alder, ash, oak, &c., of which the three first mentioned alone grow far north, the others being found only in the centre and south of Finland. Among the fruit-trees which have been successfully acclimatised in Finland are the apple, pear, cherry, &c., but they produce no fruit in the north of the country beyond lat. 63°; currants, raspberries, strawberries, &c., thrive almost everywhere. The potato flourishes as far north even as lat. 69°, and of cereals, oats, rye, barley, and wheat are grown. The fauna of Finland is very rich. Among wild animals are the bear, wolf, fox, lynx, ermine, otter, elk, and hare; but the wild reindeer and beaver, formerly abundant, are now extinct. Seals are plentiful along the coast, as also in the Saima and Ladoga lakes. All domestic animals, replaced by reindeer in the far north, thrive in most parts of Finland. Of birds there are over 200 species—not counting the domestic sorts—including ptarmigan, blackcock, moorcock, swans, geese, ducks, many varieties of birds of prey, and most of the smaller birds common in Great Britain. There are some 70 species of fish in the rivers, lakes, and seas of Finland. Of these, a kind of herring (Swedish *strömming*) is very abundant on the south and south-west coasts. Salmon, trout, perch, pike, gwyniad, &c., abound in most of the rivers. Fish forms an important element in the food of all classes, large quantities, both smoked and salted, being stored for winter use.

Climate.—The climate of Finland is very rigorous in winter, even on the south coast, where 20° and 25° below zero (Fahrenheit) are often registered; but it is generally healthy, and, owing to the proximity of the sea, it is far milder than North Russia or any other region in the same latitude except Sweden and Norway. The summer, though short, is occasionally very hot in June and July. The ground is generally covered with snow from the middle of November till April; then follows a brief spring, accompanied by a rapid growth of vegetation. Autumn is likewise short, September being often very fine and October wet. The long summer days, when the sun only goes below the horizon for an hour or two, have a peculiar charm. At Helsingfors the mean temperature of the year is 39° (Fahrenheit), varying from an average of 17° in February to 62° in July. In the north and north-east of Finland, of course, the winters are longer and more severe, the mercury frequently freezing in the thermometer. The annual rainfall at Helsingfors is 20 inches, the prevailing winds being south and south-east. The country formerly suffered severely from occasional famines—the last was in 1868—owing to short or wet summers; but these disasters have now been obviated by means of railways, canals, and improved agriculture.

Industry.—Finland, though no more than a tenth of its area is under cultivation, is essentially an agricultural country. Thus about 65 per cent. of the inhabitants are engaged in agriculture, being for the most part peasant-proprietors with holdings of from 10 to 30 acres. The cultivated grounds lie for the most part along the coasts. Of cereals, oats is the most grown, then rye, barley, and a little wheat. Hay is an important crop, and the potato forms, after rye, the staple food of the inhabitants. Cattle and dairy farming are, however, the principal branches of Finnish agriculture. In addition to cattle—sheep, goats, and pigs are reared, while Finnish horses have long been remarkable for their speed, hardihood, and docility. Round the coasts fishing is an extensive industry, while river-fishing in the interior is also important. Apart from agriculture, lumbering and the production of wood-pulp and paper are the leading industries. Textile, leather, iron, and engineering works are also of considerable value. Industrial development generally, however, is greatly hampered through lack of minerals. Copper, tin, and gold exist, but iron is scarce, and there is no coal.

Commerce.—From the close of the 19th century the commerce of Finland as a Russian grand-duchy showed continuous and rapid expansion; and so also in the first years of the republic, exports in its fourth year, for the first time in the history of the country, definitely exceeding imports. Prior to this expansion the exports of Finland flowed eastwards by land to Russia, but their direction since has been increasingly westwards by sea to Europe (United Kingdom, Sweden, Denmark) and the New World (United States). Of exports, timber, pulp, and paper, and agricultural products (cattle, butter, cheese, hides, &c.) are the chief, while grains, colonial products (tea, coffee, sugar), metals, machinery, textile materials, and oils and fats are the principal imports.

Communications.—The harbours of Finland, peculiarly important in view of the increasingly westward character of her commerce, are many, but for the most part poor, both in themselves and in their equipment, while all, for some portion of the year at least, are icebound, with the exception of Pechenga, a port situated on a bay in the Arctic Ocean. In internal communications, however, Finland is probably better supplied that any other country in the world, her countless lakes being almost all connected with each other and with the Gulf of Finland either by nature or by canal. The Saima canal (36 miles), built in 1845–56, and linking the Saima lake basin with the Gulf of Finland, is reckoned a triumph of Finnish engineering. Railway building in Finland began about 1860, and some 2700 miles have been constructed, all, with the exception of one short line, belonging to the state. The telegraph, and especially the telephone, system is well developed, the first state owned, the second partly so.

Population.—The population of Finland, which was less than 1,000,000 in 1809, rose to 1,634,915 in 1850 and to 3,364,807 in 1920; it is densest on the coastal plains, especially of the south and south-west, the interior being but sparsely inhabited. In Helsingfors (Helsinki), the capital, there are 197,848 inhabitants, while in Åbo (Turku) there are 58,367; in Tammerfors (Tampere), 47,830; in Viborg (Viipuri), 30,071; in Vasa (Vaasa), 23,957; in Uleåborg (Oulu), 21,332. Of the population of Finland about 88 per cent. are of the native Finnish race, 11 per cent. Scandinavians (Swedes dwelling mostly along the southern and western coasts), the rest being Russians, Lapps, and Jews. Between Finns and Swedes racial feeling continues strong. The Finns are a Finno-Ugric people belonging to the great Ural-Altaic family. Physically they are a strong, hardy, athletic race, with round faces, square shoulders, fair hair, and blue eyes, though intermarriage with Scandinavians and Russians has in many cases caused variations. They are of a somewhat phlegmatic temperament, but are honest, hospitable, clean, and strictly moral. They were once distinguished by a love of strong drink, but since 1920 total prohibition has been in force. They possess many of the characteristics of the Mongolian races, to which they are ethnically related, and have a keen sense of independence and personal freedom, serfdom never having existed in the country except in the county of Viborg when it was in Russian hands.

Religion.—The Finns have long been famed as a religious people, and have been likened in this respect to the Scots. Of church members almost all belong to the national (Evangelic-Lutheran) church, though in the eastern parts of the country there are some 60,000 Greek-Catholics. Baptist, Methodist, Episcopal, and Roman Catholic churches

have quite insignificant followings. By law of 1922 religious toleration is complete.

Education.—The educational standard of Finland has always been very high, and to-day the percentage of illiteracy is almost negligible. As early as the end of the 17th century ability to read was made obligatory on all members of the church, and since 1866 a popular system of education has been in force. Instruction is given both in Finnish and Swedish. There are three universities, one at Helsingfors (Finnish-Swedish) and two at Åbo, one Finnish, one Swedish, while the technical (Finnish-Swedish) and commercial (2 Finnish) high schools at Helsingfors are all three of university standard. Secondary education is given in lyceums, high and middle schools, while in this category are also various institutions for the training of elementary and infant school teachers. Since 1920 elementary education has been compulsory, and here, apart from primary schools of the ordinary kind, there are also numerous navigation, commercial, trade, technical, arts and crafts, agricultural, dairy, cattle management, horticultural, and forestry schools.

History.—About the end of the 7th century or the commencement of the 8th the Finns, driven as is supposed by the Bulgarians from their settlements on the Volga, took possession of the country they now occupy; but they found inhabitants there already, whose memory popular tradition has handed down under the names of Hiidet, Jättiläset, Jatulit, and Jotunit. Probably the modern Lapps are the descendants of those primitive inhabitants. In the 12th century the Swedes turned their attention to Finland, seeking especially to introduce Christianity; but the struggle with paganism was long and obstinate, and lasted for nearly 200 years. Three separate crusades (1157, 1249, 1293), however, finally gave victory to Sweden and to the Christian religion. The first of these crusades was led by King Erik the Holy, accompanied by Henrik, Bishop of Uppsala, an Englishman by birth, who later, as Henrik the Martyr, became the patron saint of Finland. For over 600 years Finland was united with Sweden, and thus received the incalculable advantages of Christianity, civilisation, a constitution, and liberal laws. The Reformed religion was introduced into Finland by Gustavus Vasa in 1528, and King John III. raised the country to the dignity of a grand-duchy. The theatre of frequent bloody struggles between Russia and Sweden from the middle ages onwards, Finland was ultimately ceded to Russia in 1809, and became an autonomous grand-duchy with the emperor of Russia as grand-duke. Alexander I. promised the Finns that their constitution, religion, and laws should be faithfully preserved, and though the parliament or diet of nobles, clergy, burghers, and peasants, which the Finns had enjoyed from the days of Swedish rule, did not after 1809 reassemble till 1863, the promise was virtually kept till near the end of the century, autonomy being all but complete except in foreign affairs. But in 1898 imperial decrees altering the military system, and invading the privileges of the parliament, caused bitter discontent, the more so as throughout the century the tide of national and democratic feeling had been steadily rising. In 1899 the Finnish constitution was suspended, and under General Bobrikoff a military dictatorship established. In 1901–3 various ordinances further destroyed the autonomy of Finland, and reduced it to the condition of a province. The assassination of Bobrikoff in 1904 brought certain concessions and the restoration of some old privileges, but in 1909 a Russifying policy was resumed, and more markedly, if anything, after the commencement of the Great War in 1914. On the first outbreak, in 1917, of revolution in Russia, Finland recovered all her former rights, but complications ensued with the advent and triumph of bolshevism. Divided against herself as to the acceptance of soviet doctrine, and seeking escape from entanglement in Russian affairs, independence was proclaimed in December 1917. But civil war ensued, in which the revolutionary Red Guards, supported by men and materials from Russia, were eventually defeated in May 1918 by the constitutional White Guards, supported by men and materials from Germany. P. E. Svinhufvud became for the time being regent, and a monarchical form of government being subsequently definitely determined on, the crown was offered to Prince Frederick Charles of Hesse. On his refusal, however, General C. G. Mannerheim, who had led the White Guards to victory, became regent, and continued so till, following elections in 1919, a republic was proclaimed with Professor K. J. Ståhlberg as first president. In 1920, by the treaty of Dorpat, Finland established peace with Russia, and also secured the territory of Pechenga, so extending her boundaries to the Arctic Ocean. In the same year she was admitted to the League of Nations, and in 1921 was confirmed by the League in her retention of the Åland Islands, which, on the plea of self-determination, had demanded annexation to Sweden.

Constitution.—Finland is a sovereign republic. Ultimate power resides in the people as represented in a House of Representatives or Diet, a single chamber assembly of 200 representatives chosen directly by universal (male and female) suffrage on a system of proportional representation. A president elected for six years by vote of the citizens is head of the state. He possesses the highest executive power, and along with the Diet the right of initiative.

Language and Literature.—Swedish was formerly the official language of Finland, but since 1883 Finnish and Swedish have been placed on a footing of equality, and now the importance of Swedish is steadily decreasing. Finnish, held by some to be one of the most sonorous and harmonious of tongues, is of the Ugro-Finnic branch of the Ural-Altaic family, which comprises Ugro-Finnic, Manchu, Mongol, Turkish, and Samoyede (see ASIA). The group includes (1) Finn and Esthonian (q.v.), (2) the tongue of the Lapps, (3) of the Finns of Perm, (4) of the Finns of Vologda, and finally (5) that of the Ugrian Finns, to which last belong the Vogul and Ostiak dialects in Siberia, and the Magyar in Hungary (see HUNGARY). The most highly cultivated language of the group is that spoken by the Finns proper, the Suomi of Finland. The Finnish dialects are all agglutinative forms of speech, with tendencies towards true inflection, so that occasionally the difference between agglutination and inflection is somewhat obscure. The nouns are not inflected, an additional word being used to denote the variations of case, number, and sex, whilst the prepositions and pronouns are suffixed to the words they modify. The verbs have only a present and past tense, another word being required to indicate the future.

The founder of Finnish literature is the Bishop of Åbo, Michael Agricola (d. 1557), who, besides translating the New Testament (1548) and parts of the Old, wrote also a primer and a prayer-book. His followers were mostly men of the church, makers of manuals and books of devotion, and writers of spiritual verse. In the 16th and 17th centuries, however, the output of Finnish literature was small, Latin or Swedish being preferred as literary languages. But in the 18th century new tendencies came into being, and H. G. Porthan (1739–1804), by stimulating interest in history and popular poetry, prepared the way for great de-

velopments in the century following. In 1822 was published by Z. Topelius, whose son of the same name was later to become a distinguished author, a collection of scattered songs, while in 1831 an association for the promotion of Finnish literature was established. But the great event of the time was the appearance in 1835 (in greatly extended form in 1849) of the *Kalevala*, an epic poem formed by E. Lönnrot (1802–84) out of a collection of popular songs taken down from the lips of the peasantry as they from time immemorial had heard them from their *Runolainen* or singers. The poem, which is a singular monument of the earlier culture of the Finns and of the utmost value philologically, gave a new impetus to the study of Finnish in Finland, and became, along with the *Kanteletar* (1840), a collection, also by Lönnrot, of national lyrics, the source and inspiration of a rich and very remarkable literature. An idea of the form and metre of the poem may be obtained from Longfellow's *Hiawatha*, known to be in imitation of the epic. The work, which has been translated into many languages, has been favourably compared with the *Iliad*, and has been placed fifth among the national epics of the world. As writers of original Finnish poetry A. Oksanen (A. E. Ahlqvist, 1826–89) and Suomio (J. Krohn, 1835–88) must be considered the first representatives in modern times, but in the lyric and patriotic songs of J. H. Erkko (1849–1906) the work of both was surpassed. K. Kramsu (1855–95) is a melancholy tragic lyrist singing of freedom and the rights of the oppressed, while P. Cajander (1846–1913), though also a prominent lyrist, is mainly distinguished by his translation into Finnish of all the dramas of Shakespeare. The first noted novelist and dramatist is A. Kivi (1834–72), whose novel *Seitsemän Veljestä* ('Seven Brothers') and comedy *Nummisuutarit* ('The Shoemakers from the Moor') are still without rivals in Finnish literature. About 1880, largely through the influence of modern Scandinavian writers, Ibsen and Björnson in especial, a powerful realistic tendency appeared, and revealed itself in the novels of M. Canth (1844–97), the first noted woman writer of Finland, of J. Aho (1861–1921), of A. Järnefelt (b. 1861), of T. Pakkala (b. 1862), and of others. From time to time self-taught men from the peasantry of Finland have devoted themselves with success to letters. In his verse J. Linnankoski (1869–1913) reflects the influence of Byron, while in his prose he is unsurpassed in Finnish literature. Amongst prominent novelists of to-day are S. Ivalo (b. 1866), J. Lentonen (b. 1882), F. E. Sillanpää (b. 1881), M. Talvio (b. 1871), M. Jotuni (b. 1880), and A. Kallas (b. 1878), the last three women; while foremost amongst poets are V. A. Koskenniemi (b. 1885), L. Kyösti (b. 1873), and O. Manninen (b. 1872), who has also translated the *Iliad*. Apart from H. G. Porthan, already mentioned, Y. Koskinen (born G. Z. Forsman, 1830–1903) is the greatest name in Finnish historical research, while, as a sociologist, E. A. Westermarck (b. 1862) enjoys a European reputation.

From the days of Swedish dominion much of the greatest literature of Finland has always been written in Swedish. J. Frese (*c.* 1690–1729) was a prominent lyrist, and G. F. Creutz (1731–85), in his *Atis och Camilla*, a pastoral idyll in the rococo style, produced one of the most exquisite creations in Swedish verse, but greater than both was the poet F. M. Franzén (1772–1842). J. L. Runeberg (1804–77) is, however, the most brilliant name by far in the Swedish literature of Finland; his greatest achievements are in the epic form, and his *Elgskyttarna* ('The Elk Hunters') left deep traces on the literature of both Finland and Sweden, while his *Fänrik Ståls Sägner* ('The Tales of Ensign Stål') earned for him the title of 'Finland's national poet.' The journalist J. W. Snellman (1806–81), the poet F. Cygneaus (1807–81), and the poet and prose-writer Z. Topelius (1818–98), whose *Fältskärens berättelser* ('The Tales of the Surgeon') has achieved a classic value, were all contemporaries of Runeberg, and all with him leading inspirers of Finnish national sentiment. Of representatives of modern realism K. A. Tavaststjerna (1860–98), lyric poet, and writer of drama and romance, is the chief, while of living Swedish authors of note in Finland are the poet and prose-writer M. Lybeck (b. 1864) and the lyrists H. Procopé (b. 1868), B. Gripenberg (b. 1878), A. Mörne (b. 1876), J. Tegengren (b. 1875), and J. Hemmer (b. 1893).

Fine Arts.—The engraver and miniature painter E. Brenner (1647–1717), the religious painter M. Toppelius (1734–1821), and the portrait painter, N. Schillmarck (d. 1804) are among the first of Finland's artists; but it is not till after the founding, in 1846, of the Finnish Association of Art that a specific Finnish art may really be said to exist. R. W. Ekman (1808–73) was the pioneer, but the landscape painter W. Holmberg (1830–60) was the first Finnish artist who could be judged according to European standards. A product of the school of Düsseldorf, he was followed by many in like style, most noticeably H. Munsterhjelm (1840–1905) and B. Lindholm (1841–1914). A. Edelfelt (1854–1905), illustrator, portraitist, and genre painter, was the first Finnish artist to come altogether under the influence of France, and later, through the power of his work, he completely established the French conception of art in Finland. A. Gallen-Kallela (b. 1865), figure and landscape painter, is to-day the most powerful artistic personality of Finland, while among his distinguished contemporaries are E. Järnefelt (b. 1863) and P. Halonen (b. 1865). Among the younger generation of Finnish painters, impressionist and neo-impressionist schools are fully represented. In M. Wiik (b. 1853), E. Danielson-Gambogi (1861–1920), and H. Schjerfbeck (b. 1862), Finland has produced three prominent woman-painters.

Finland's first sculptor was E. Cainberg (1771–1816), but C. E. Sjöstrand (1828–1906), a Swede, was the real pioneer. Among his disciples of note, W. Runeberg (1838–1920), son of the poet, and J. Takanen (1849–85) are to be numbered. Since 1870 the influence of France has been supreme, as is clearly to be seen in the work of V. Vallgren (b. 1855) and E. Wikström (b. 1864), and in the sculpture of the younger school, which has turned in especial to Rodin. The architecture of Finland is really a product of the 19th century, and, in so far as it is represented in Helsingfors, is mostly neo-classical and new-renaissance in style.

The Finns are a musical people, and earlier than any of the other arts music was purposely pursued amongst them, a musical society having existed at Åbo as early as 1790. In B. Crusell (1775–1838) Finland found her first composer, but the German, F. Pacius (1809–91) and his successor R. Faltin (1835–1918) were the real initiators of the musical life of the country. Among earlier composers, K. Collan (1828–71), F. von Schantz (1835–65), K. Moring (1832–68), and G. Linsén (1838–1914) are the chief. After 1880 the activity of M. Wegelius (1846–1906) and R. Kajanus (b. 1856), both as composers and as conductors, produced epoch-making effects on Finnish musical life, and later, amongst others, appeared J. Sibelius (b. 1856), a composer of genius and international fame, and a true interpreter of the real Finnish spirit in music. The drama and opera both flourish in Finland, and there is a national theatre at Helsingfors.

See J. Abercromby, *The Pre- and Proto-historic Finns* (1898); Y. S. Koskinen, *Finnische Geschichte* (1874); H. S. Mechelin, *A Précis of the Public Law of Finland* (1889); *Peace Handbook XLVII.* (issued by the British Foreign Office, 1920); *The Baltic and Caucasian States* (in 'Nations of To-day,' ed. J. Buchan, 1923); works by W. C. Frederiksen (1902), G. Renwick (1911), and A. Reade (1915); and Wainemann, *Heroine from Finland* (1902); also C. N. E. Eliot, *Finnish Grammar* (1890); Swan and Granström, *English and Finnish Dictionary*; B. F. Godenhjelm, *Handbook of the History of Finnish Literature* (1896); D. Comparetti, *The Traditional Poetry of the Finns* (1898); and the *Kalevala* (trans. 1907).

Finland, Gulf of, the eastern arm of the Baltic Sea, between 22° and 30° E. long., and between 59° and 61° N. lat. It receives the waters of the great lakes Onega and Ladoga. The water of the gulf is not deep, and only very slightly salt. The topography of the Gulf of Finland, which has been thoroughly elucidated by Struve, forms an interesting part of the great work of the Russian survey of the Baltic. The navigation on the northern or Finnish coast is very dangerous, on account of the numerous islands and shoals.

Finlay, George, the historian of Greece, was born of Scottish parents at Faversham, in Kent, where his father, Major John Finlay, was inspector of the government powder-mills, 21st December 1799. After his studies at Glasgow and Göttingen, Philhellenism carried him to Greece, where he met Lord Byron, and devoted himself with patient enthusiasm to the study of Greek history and antiquities. With the exception of a short period of residence in Rome, and of study at Edinburgh University, the whole of his life was spent in the land of his adoption, which he continued to love, spite of the unworthiness of its leaders and of the miserable failure of his own generous schemes for promoting agricultural progress. For relief he turned to the task of writing its history. 'Had the hopes with which I joined the cause of Greece in 1823 been fulfilled,' he wrote in 1855, 'it is not probable that I should have abandoned the active duties of life, and the noble task of labouring to improve the land, for the sterile task of recording its misfortunes.' The first portion of his great work, *Greece under the Romans*, appeared in 1844, and was followed by the following instalments: *The History of Greece from its Conquest by the Crusaders to its Conquest by the Turks, and of the Empire of Trebizond, 1204–1461* (1851); *History of the Byzantine and Greek Empires from 716–1453* (1854); *History of Greece under Ottoman and Venetian Domination* (1856); and *History of the Greek Revolution* (1861). Finlay devoted the remaining years of his laborious life to revising and partly rewriting his history, but his death at Athens, 26th January 1875, prevented his completing the work, which was issued by the Clarendon Press, under the care of the Rev. H. F. Tozer, with the title, *History of Greece from B.C. 146 to A.D. 1864* (7 vols. 1877; vol. i. contains an autobiography). Freeman declares his history the greatest English historical work since Gibbon's *Decline and Fall.*

Finmark, the most northern province of Norway, consists of a narrow strip of rocky coast-land, cleft by numerous bays and fjords. The area is 18,295 sq. m., of which three-fourths belong to the continent, the rest to the numerous islands which skirt its shores. The chief sources of wealth are fishing and reindeer breeding. Only very scanty crops of barley, potatoes, and a few other vegetables are raised. Population 44,000, principally Lapps. Hammerfest, the capital (70° 40′ N. lat.), with near 3500 inhabitants, is the most northern town of Europe. See Du Chaillu's *Land of the Midnight Sun* (1881).

Fins, a term vaguely applied to outgrowths and limbs in aquatic animals; the paired fins of fishes being true limbs. See Fishes.

Finsbury, a parliamentary borough of London, consisting in 1885–1918 of three one-member divisions, Holborn, Central, and East. In 1899 the two latter were formed into the metropolitan borough of Finsbury, which in 1918 became a one-member parliamentary borough; pop. 76,000.

Finsen, Niels R. (1861–1904), discoverer of the curative power of the chemical rays of light (sunlight, electric light, Röntgen rays, &c.) and founder of phototherapy, was born in the Faeroe Isles, and taught anatomy at the university of Copenhagen, where he had studied.

Finsteraarhorn, the highest peak (14,026 feet) of the Bernese Alps. See Alps.

Finsterwalde, an old town of Prussia, 71 miles by rail S. by E. of Berlin, with manufactures and coal-mines; pop. 14,000.

Fiord. See Firth, Norway.

Fir, a name applied in a comprehensive sense to the true Pines, the Larch, and certain other conifers, but more properly used to denominate the Norway Spruce, the Silver Fir, and their congeners. These two species—now the types respectively of the genera Picea and Abies—were included in the Linnæan genus Pinus; thus, the Norway Spruce was *P. Abies*, and the Silver Fir was *P. Picea.* By these specific names the trees were known to Pliny and other ancient writers, but by inadvertence on the part of Linnæus they were misapplied so that each bore the other's name. This confusion was perpetuated when the species were removed from the genus Pinus, and set up as representatives of distinct genera. As kindred species were discovered and introduced, nomenclature became more confounded. Continental botanists endeavoured for long with only partial success to restore the names Picea and Abies to their ancient use. The point, however, was at length conceded in the *Genera Plantarum* (1862–76) by Bentham and Hooker; but amateurs and students of coniferæ will still be confronted with the confused nomenclature of the species in works on the subject published prior to the adoption of this change of the generic names. Their difficulty will, however, be lessened by their bearing in mind that species ranged in old books under Abies must now be named Picea; thus, for instance, the Norway Spruce is no longer Abies but *Picea excelsa*, and the Silver Fir is *Abies pectinata*, not Picea of that designation.—It should also be noted that some trees commonly called fir are really pines; thus, the so-called Scotch Fir (*Pinus sylvestris*) is a pine. See Pine.

The genus Abies comprises somewhere about twenty species, which are easily distinguished from the Spruce Firs by their erect, cylindrical or but slightly tapering cones, the scales of which are deciduous and fall away in maturity from the axis, which adheres to the branch; and by their flattened leaves being always more or less distinctly arranged in two ranks on each side of the branches, and generally in a horizontal direction. The genus Picea consists of about twelve species, the cones of which are pendulous, and the scales persistent, opening only when mature to shed the seeds. The leaves are arranged spirally, scattered around the branches, needle-like and quadrigonal or almost round. These are the broad essential distinctions of these two genera of firs, but they have some features in common. They are all evergreen-trees, mostly of spiral or pyramidal habit, their branches spring from the stem in whorls—a characteristic of certain other conifers—and the scales of the cones are thin or almost scarious at the apex, a point

which distinguishes them from the true pines. The species of both are widely distributed over the extra-tropical regions of the northern hemisphere, and the Norway Spruce even penetrates within the Arctic circle.

The last-named species, *Picea excelsa*, is one of the noblest and most useful of European firs, attaining the height of from 80 to 150 feet, but with no proportionate diameter of trunk, which is usually rather slender compared with its height. It is a native of the north of Germany, Russia, and Norway, where it forms immense tracts of natural forest. Since its introduction into Britain about 1540, it has been extensively planted, chiefly as a nurse for more tender and slower-growing trees, for which purpose its evergreen character and hardy constitution adapt it well. It does not succeed in windy, exposed situations, nor in thin, dry soil, but in moist, alluvial soil it attains its highest development. It is the *Fichte* of the Germans, called also *Rottanne* or *Schwarztanne*.

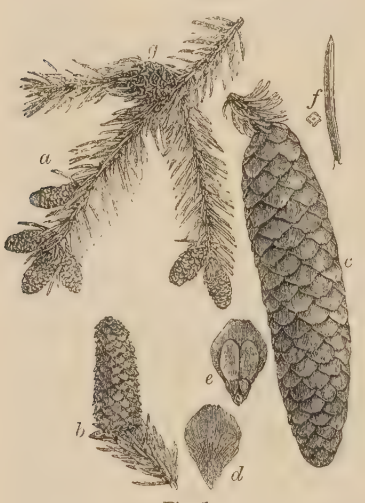
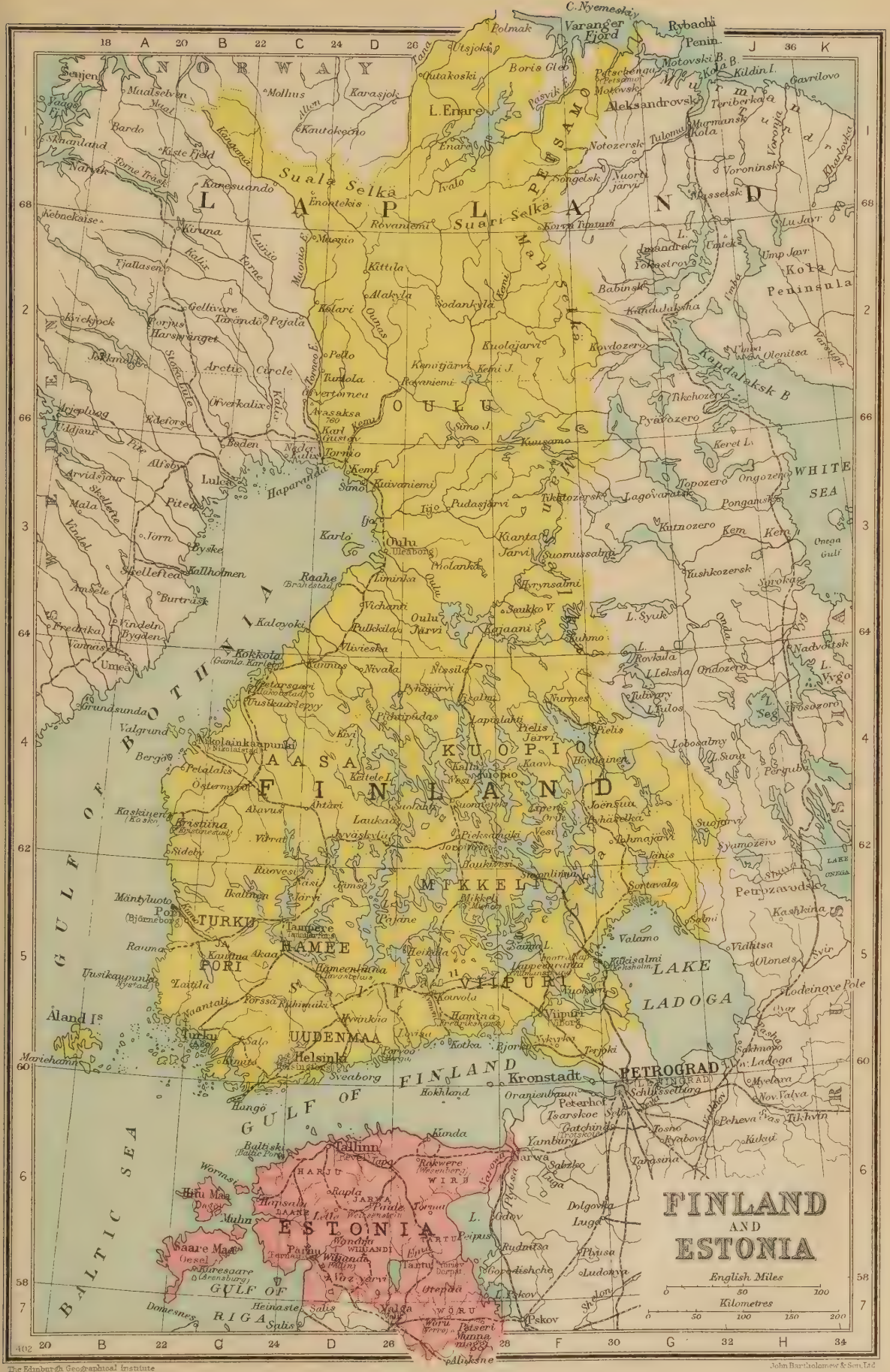


Fig. 1.
Norway Spruce Fir (*Picea excelsa*):
a, branchlet with male flower; *b*, branchlet with female flower; *c*, mature cone; *d*, one of the scales of cone, outside; *e*, one of the scales of cone, inside, showing seeds; *f*, a leaf with cross section; *g*, gall, caused by punctures of *Cocus abietis* and other insects.

It yields the same products as the Scots Pine—resin, turpentine, tar, and lamp-black (see these heads); but more resin than turpentine. The true Spruce Resin flows spontaneously from the bark. The purest pieces are whitish or pale yellow, are sold under the name of Common Frankincense, and used for ointments and plasters, and when melted yield the common Burgundy Pitch (q.v.). The bark of the spruce is a good and cheap non-conductor of heat; the cones are an excellent substitute for tanners' bark. In Sweden and Norway the inner bark is made into baskets; and the long and slender roots, split and boiled with alkali and sea-salt, are dried, and twisted into cordage, which is used both for shipping and by farmers. The wood is used for fuel and for house-building; it also supplies masts and spars for ships. It is the White Christiania deal and Danzig deal of the market, and is very largely imported into Britain from Norway and the Baltic. It is whiter, lighter, less resinous, and more elastic than the timber of Scots Pine. The sap-wood, whilst still in a gelatinous state, is sweet, and is eaten fresh in Sweden and Lapland; and the inner bark, in times of scarcity, is mixed with a little flour or meal of some kind and baked into bread. The young shoots, still covered with their bud-scales, are in many parts of Europe used for fumigation. The leaf-buds are also employed medicinally in cases of scurvy, rheumatism, and gout. The pollen is often sold by apothecaries instead of the dust of the Clubmoss or Lycopodium.

A very superior variety of this fir is known as the Red Norway Spruce. Dwarf varieties are cultivated amongst ornamental shrubs. The Black Spruce (*Picea nigra*), of which the Red Spruce (sometimes called *P. rubra*) is regarded as a mere variety caused by difference of soil, and the White Spruce (*P. alba*) form great woods in North America. The Black Spruce is found as far north as 65° lat. Both these species are now common in plantations in Britain. Both have quadrangular leaves; those of the Black Spruce are of a dark glaucous green, those of the White Spruce are of a lighter colour. The cones of the Black Spruce are short, ovate-oblong, obtuse, and pendulous, with rounded scales ragged at the edge; those of the White Spruce are oval, and tapering to a point, with entire scales. The Black Spruce is a valuable timber-tree, supplying yards of ships, &c.; but its planks are apt to split. The White Spruce is smaller, and the timber inferior. From the Black Spruce the *Essence of Spruce* is obtained, which is held in estimation as an antiscorbutic, and is used for making spruce-beer. Spruce-beer is also made by adding molasses or maple-sugar to a decoction of the young branchlets, and allowing the whole to ferment. From the fibres of the root of the White Spruce, macerated in water, the Canadian Indians prepare the thread with which they sew their birch-bark canoes; and the seams are made watertight with its resin. From the twigs of the Oriental Fir (*P. Orientalis*), a native of the Levant, a very fine clear resin exudes, which is known by the name of Sapindus' Tears. This fir has very short quadrangular leaves, densely crowded and uniformly imbricated. The Sitka Spruce (*P. Sitchensis*) and Patton's Spruce (*Tsuga Pattoniana*) are now prized as ornamental trees in pleasure-grounds in Britain: both are natives of Western America, the former covering wide areas at from 7000 to 9000 feet elevation. It makes rapid growth in Britain, and apart from its ornamental value it has been suggested that it should be planted more extensively for its timber, which is described as very durable, though rather coarse grained. In southern California Patton's Spruce attains the height of from 200 to 300 feet, with a circumference of trunk of from 12 to 14 feet; but in northern California, where it is also found in great abundance at elevations of from 4000 to 6000 feet, it reaches the height of 150 feet as its maximum dimensions, towering above the rest of the forest at the lower levels, but dwindling as it ascends the mountains to the proportions of a shrub a few feet high. It is a slow-growing, but very handsome tree in Britain, with light-green, rigid, thickly set leaves having a glaucous tint below, which enhances its beauty. The Himalayan Spruce (*P. Morinda*) is a remarkably graceful tree found at elevations of from 6000 to 12,000 feet on the Himalayas. Where it succeeds well in Britain, it is one of the most beautiful of pleasure-ground trees, but should not be planted in cold districts. The leaves are longer than those of most other Spruce Firs, and densely clothe the branches, which assume a graceful pendulous outline. The Korean Spruce (*P. polita*) is a comparatively recent introduction to Britain. It forms vast forests on the mountains of Korea, and is indigenous also to Japan. In England it is a slow-growing tree, and should be planted only in sheltered situations.

The Hemlock Spruce of North America (*Tsuga canadensis*) forms great part of the forests of Canada and of the northern states, extending northwards as far as Hudson's Bay. Its timber is not much esteemed, as it splits very obliquely, and decays rapidly in the atmosphere; but the bark is valued for tanning. The leaves are two-rowed, flat, and obtuse. The cones are scarcely


FINLAND
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PETROGRAD
Kronstadt
Helsinki
Tallinn
Pskov
Narva
LAKE LADOGA
GULF OF FINLAND
GULF OF BOTHNIA
GULF OF RIGA
BALTIC SEA
WHITE SEA
Aland Is
Kola Peninsula
Suala Selka
Suari Selka
Enontekis
Rovaniemi
Kemijarvi
Kuolajarvi
Kajaani
Oulu
Uleaborg
Kemi
Tornio
Pudasjarvi
Kuusamo
Suomussalmi
Kiantajarvi
Nurmes
Lieksa
Pielisjarvi
Joensuu
Iisalmi
Kuopio
Jyvaskylan
Suojarvi
Ilomantsi
Sortavala
Valamo
Kexholm
Viipuri
Kouvola
Hamina
Fredrikshamn
Lappeenranta
Heinola
Hameenlinna
Tavastehus
Lahti
Jamsa
Tampere
Nasijarvi
Mikkeli
Savonlinna
Nyslott
Rantasalmi
Joutsa
Jyvaskylan
Suolahti
Laukaa
Ahtari
Kaskinen
Kristina
Nykarleby
Jakobstad
Vasa
Nikolaistad
Kokkola
Gamla Karleby
Brahestad
Raahe
Uleaborg
Oulu
Ijo
Karlo
Torneo
Haparanda
Kemi
Sumo
Kuivaniemi
Tijo
Pudasjarvi
Kiantajarvi
Suomussalmi
Ulvila
Bjorneborg
Mantyluoto
Rauma
Raumo
Nystad
Uusikaupunki
Laitila
Turku
Abo
Aland Is
Mariehamn
Hango
Ekenas
Tammisaari
Helsinki
Helsingfors
Sveaborg
Kotka
Fredrikshamn
Hamina
Viipuri
Koivisto
Terijoki
Kronstadt
Oranienbaum
Peterhof
Schlusselburg
Petrograd
Ladoga
Sakkimo
Nov. Ladoga
Myelava
Nov. Valya
Tikhvin
Peheva
Tosno
Ryabova
Kukui
Tarasova
Yambura
Narva
Sabzlep
Luga
Dolgovka
Lugo
Gdov
Peipus
Rudnitsa
Pskov
Pleusa
Ludokva
Gorodishche
L. Pskov
Orepaa
Wolga
Jelgava
Salis
Heinaste
Domesness
Worms I.
Hiiu Maa
Muhu
Saare Maa
Oesel
Moonsund
Arensburg
Haapsalu
Parnu
Pernau
Wilianda
Fellin
Wesenberg
Rakwere
Kunda
Baltisk
Baltic Port
Hangö
Hokkland
Oranienbaum
Ingria
Karelia
Savolax
Tavastland
Nyland
Abo-Bjorneborg
Wiborg
Kexholm
Nyslott
Kuopio
Vasa
Uleaborg
Lapland
Finmark
Varanger Fjord
Vardo
Vadsoe
Hammerfest
Alten
Kautokeino
Karasjok
Mollus
Mualselven
Seijen
Jaure L.
Bardo
Nahaland
Kiste Fjeld
Narvik
Bone Trask
Ranesuando
Kebnekaise
Kiruna
Kalix
Lainio
Torne
Kaliz
Tjallasen
Gellivare
Tarendo
Pajala
Kiickjock
Porjus
Harsvanget
Arctic Circle
Stora Lule
Overkalix
Kalix
Torneo
Avasaksa
Karl Gustav
Boden
Nadd
Alfsbyn
Arvid Saur
Skellefte
Lulea
Pitea
Mala
Vindel
Jorn
Byske
Skellefteaa
Kallholmen
Ansele
Burtrask
Fredrika
Vindeln Tryden
Umea
Vannas
Grundsunda
Valgrund
Bergo
Petalaks
Ostermyra
Kaskinen
Kristina
Sideby
Mantyluoto
Rauma
Nystad
Uusikaupunki
Laitila

longer than the leaves. The young trees are very graceful, but the older ones are generally much disfigured by remaining stumps of their lower branches.—The Douglas Fir (*T.* or *Pseudotsuga Douglasii*) is a noble tree attaining a height of 250 feet, which forms immense forests in the north-west of America, from 43° lat. to 52° lat. The bark, when the tree is old, is rugged, and 6–9 inches thick. It abounds in a clear, yellow resin. The timber is heavy, firm, and valuable, the growth very rapid. Experimental plantations of this extremely rapid-growing tree laid down in 1860 by the Earl of Mansfield on his Scone estates, Perthshire, encourage the expectation that it will rival and perhaps surpass the larch in value as a timber tree.

Fig. 2.—Cone of Douglas Fir (*Pseudotsuga Douglasii*).

The Mount Enos Fir (*A. cephalonica*), a native of Cephalonia, attaining a height of 60 feet and a diameter of 3 feet, yields durable and very valuable timber.—All these species have been introduced into Britain, and many of them are now common in our plantations, as well as others from the north-west of America and from the mountains of Asia, and are apparently quite suitable to the climate. The Common Silver Fir (*Abies pectinata*) has erect cylindrical cones, 5–6 inches long, and two-rowed leaves, with two white lines upon the under side. It forms considerable woods upon the mountains of Central Europe and of the north of Asia, and attains a height of 150–180 feet and an age of 300 years. It is not a native of Britain, but large trees are now to be seen in very many places. The wood is white, contains little resin, is very soft and light, and is employed for the ordinary purposes of coopers, turners, and joiners, and in ship and house carpentry, also for making boxes and for many fine purposes, especially for the sounding-boards of musical instruments. The same resinous and oily products are obtained from the Silver Fir as from the Spruce and Scots Pine, but of superior quality. It yields the beautiful clear turpentine known as Strasburg Turpentine. Very similar to the Silver Fir, but generally of much smaller size, and indeed seldom much above 30 feet in height, is the Balm of Gilead Fir (*Abies balsamea*), a native of North America from Virginia to Canada. The wood is of little value, but the tree yields Canada Balsam (q.v.).

Fig. 3.
Common Silver Fir (*Abies pectinata*):
a, branchlet with male flowers; *b*, branchlet with female flowers; *c*, a scale of cone, outside; *d*, a scale of cone, inside, showing seed; *e*, male flower undeveloped; *f*, male flower fully developed; *g*, leaf with cross section.

Besides these, a number of other species of Abies are found in the western parts of North America and in the Himalayas, some of which are trees of great magnitude, and yield excellent timber, as *A. grandis*, a Californian tree of 170–200 feet in height; *A. amabilis*, a species much resembling it; *A. nobilis*, a majestic tree, which forms vast forests on the mountains of northern California; *A. bracteata*, a Californian species remarkable for its slender stem, which rises to a height of 120 feet, and yet is only about 1 foot in diameter at the base, and likewise for the manner in which the middle lobe of each bract of its cones is produced so as to resemble a leaf; *A. Webbiana*, the Himalayan Silver Fir, which in its native regions fills the upper parts of mountain-valleys, and crowns summits and ridges at an elevation of upwards of 10,000 feet, a tree of great size, 35 feet in girth, and with a trunk rising 40 feet before it sends out a branch. Most of these have been introduced into Britain with good prospect of their succeeding well in our climate, and other species, as *A. Sibirica*, a native of the Altai Mountains, very nearly resembling the Silver Fir, *A. Nordmanniana*, *A. Fraserii*, &c. *P. religiosa* is a tall and elegant tree, a native of the mountains of Mexico, with slender branches, which are very much used by the Mexicans for adorning churches; and its cones are shorter than those of any other Silver Fir.

Fig. 4.
Cone of *Abies bracteata*:
a, scale of cone, showing bract.

Fig. 5.—Branchlet with cones of *Abies Nordmanniana*:
At *a* the scales are supposed to have fallen away, showing the axis.

Firbolgs, the name given in the fabulous history of Ireland to one of the races who successively invaded that country in what was probably the bronze age. The various tribes of the Firbolgs seem to have been Britons, and were said to have landed in Ireland under the command of five principal chiefs in three separate divisions, one in the river Slaney, the second in Mayo county, and the third in Ulster. Their chief stronghold, called Dind Rig, was near the Barrow, in Carlow. The Firbolgs were in their turn defeated and almost exterminated by a new race of invaders, the Tuatha Dé Danann, in a battle fought at Moytura, in Mayo. Nevertheless, the race did not wholly perish, for there long continued to be Firbolg kings of Connaught, and in the time of St Patrick it was in all probability the Firbolgs who constituted the bulk of the population of Ireland.

Firdausí, or FIRDUSÍ, the *takhallus* or *nom de guerre* (the term signifies both 'garden' and 'paradise') of Abú-'l Kásim Mansúr, the greatest of Persian poets, was born about the year of the Flight 328 (939–940 A.D.), at Shadáb, a dependent township of Tús, in Khurásán, of a stock of *dihkans*, or petty landholders. He spent the greater part of his life on the paternal estate, wedded to his studies. From his grand epic, the *Shah Náma*, or Book of Kings, he has been styled by European *savants* 'the Homer of Persia.' Among the spoils gained by the Arabs at the downfall of ancient Irán was a complete history of Persia, compiled by order of Yazdajird, the last of the Sassanian dynasty, by the most learned historians, which was presented as a valuable gift to the Calif Omar—the reputed destroyer of the famous Alexandrian library. The calif caused this work to be rendered into Arabic, and luckily did not order its destruction, but left it to its chance among the general plunder, when it fell into the hands of a common soldier. The history of this Pahlaví work for some centuries is obscure, but at length it came into the possession of Mahmúd, sultan of Ghazní, whose court was crowded with the most eminent men of learning from all quarters. Mahmúd ordered Dakiki, the most illustrious poet at his court, to render the work into Persian verse, but he had not proceeded far with his task when he came to a tragic end. In his fifty-eighth year Firdausi resolved to visit the court of Mahmúd, but it was not easy to gain admission to the presence; yet, in spite of the resentment of the sultan's favourites at the intrusion of a stranger, he contrived, by means of a friend with whom he lodged, to convey to the sultan a specimen of his epic (he had been for years engaged upon the work which the death of Dakiki had left undone), and the result was an invitation to court. Mahmúd ordered his vazír to pay Firdausí a thousand gold dínars (about £500) for every thousand finished couplets; but the poet, having from early youth had the ambition to construct a canal-dam (*bund*) on his patrimonial estate for the benefit of his townsmen, preferred to receive the accumulated amount when he had completed his poem. The vazír of Mahmúd was secretly inimical to Firdausí, and accused him to the sultan of a decided leaning to the doctrines of Zoroaster; but his efforts as well as those of the other courtiers to undermine Mahmúd's confidence were of no avail, and Firdausí continued to enjoy the royal patronage.

Portions of the *Shah Náma* as they were written were often transcribed and circulated and admired far and wide. It is said that he was offered rich presents from the neighbouring princes, which he constantly declined. The later years of Firdausí's life in Ghazní—he seems to have dwelt some twelve years there altogether—were darkened by the death of his son in early manhood, whom he pathetically laments towards the end of his great epic.

At length, after thirty years' toil, the *Shah Náma* was finished in 398 A.H. (1008 A.D.), and the poet presented his monumental work to Sultan Mahmúd, who at once ordered his vazír to pay Firdausí 60,000 gold dínars—but no copy of the epic extant comprises more than 56,600 couplets, and some of these are evidently interpolations. The envious minister, however, despatched the same number of silver dirhams instead (the value of a dirham is about sixpence) in sealed bags. The poet was in the bath when the messenger arrived. 'On opening the bags, his lofty spirit felt all the indignity which he imagined the sultan intended to load him with. He immediately gave 20,000 to the keeper of the baths (*hammámí*), the same sum to the sherbet-seller, and the remainder to the slave who had brought the money. "I wrote for fame," said he to the slave, "not for the attainment of riches."' When the slave told the whole affair to Mahmúd, he was enraged at the insolence of his vazír, and said: 'This action will not only irritate the poet, but mankind will reprobate a sordid parsimony injurious to my fame. I ordered gold dínars to be sent, and you have substituted silver dirhams.' To this the wily vazír rejoined that whatever the sultan gives confers honour on the recipient, and it was insolent in Firdausí to treat any donation of his majesty with contempt. These and other insinuations ultimately aroused Mahmúd's indignation, and the poet, fearing the consequences, fled on foot from Ghazní, but not before he had composed and left behind him a most scathing satire on the sultan. Tidings of Firdausí's flight and the cause soon spread throughout Asia, and the sultan's conduct was severely condemned by the noble and the learned everywhere. For some time the poet was protected by the Nasir Al-Mutasim of Kohistán, but, he being a dependant of Mahmúd, Firdausí was again compelled to flee, first to Mazandarán and then to Baghdád. The sultan, however, hearing where the poet was residing, ordered him to be sent a prisoner to Ghazní; but the calif, unwilling to deliver Firdausí up to the tender mercies of Mahmúd, and being powerless to withstand the sultan, wrote to Mahmúd to the effect that Firdausí had been at his court and was now gone to El-Yaman; and it was with unspeakable grief that he saw the venerable poet once more become a fugitive. But instead of going to Arabia, Firdausí proceeded to Tús, his native place, where he hoped to pass the remaining years of his life in tranquillity.

The wrath of Mahmúd was at length softened into pity, and he ordered the 60,000 gold dínars to be carried to Firdausí at Tús. 'One day, while the poet was walking in the market-place, as a boy was reciting a verse from his satire on the sultan, he fainted, and was carried to his house, where he expired (411 A.H.: 1020 A.D.), without uttering a word. As his remains were being carried to the grave, the present from the sultan arrived at Tús. It was presented to the poet's daughter, who, contrary to the advice of her aunt, declined its acceptance, saying that, as her father did not receive the present in his lifetime, it would ill become her to accept what he declined.'

The *Shah Náma*, while probably based upon actual historical events, is for the most part composed of mythological and purely fanciful incidents, but these are adorned with all the glowing imagery of the Eastern imagination; while true descriptions of human nature and pathetic scenes are of frequent occurrence—such as, for instance, the fine episode of Rustam (the Hercules of Persia, and the chief hero of the epic) and Súhráb, which is unexcelled in its kind in the poetry of any country. We have an admirable example of fairy lore in Rustam's seven labours to slay the White Demon, in which the hero's horse Raksh ('lightning') plays no unimportant part. The following lines, which occur in the *Shah Náma*—

> Choose knowledge,
> If thou desirest a blessing from the universal Provider;
> For the ignorant man cannot raise himself above the earth,
> And it is by knowledge that thou must render thy soul praiseworthy—

find their very echo in Shakespeare's saying, that

> Ignorance is the curse of God;
> Knowledge, the wing wherewith we fly to heaven.

Besides his immortal epic Firdausí wrote a number of shorter pieces, kasídas, ghazals, &c., which are preserved in several Persian anthologies. He was the first, apparently, to compose a poem on the wife of Potiphar and Joseph, under the title

of *Yúsuf ú Zulaykhá*, a subject which has been a great favourite with many later poets, Turkish as well as Persian.

See Atkinson's epitome of the *Shah Náma*, with numerous passages done into English verse; Sir Gore Ouseley's *Biographical Notices of Persian Poets*; Miss Zimmern's *Epic of Kings*; Browne's *Literary History of Persia* (1902-6); Robinson's *Persian Poetry for English Readers* (1883); the works of Von Hammer, Wahl, Görres, and Ethé.—There are many beautifully illuminated manuscripts of the *Shah Náma* preserved in the great European libraries, and the complete text was edited by Turner Macan (4 vols. Calcutta, 1829). In 1811 Lumsden, of Calcutta, had published a portion of the text. There is a complete French translation by Julius Mohl, with the Persian text on the opposite page (7 vols. Paris, 1838-78). Another edition by Vullers was continued by Landauer (1877-84). There is an Italian translation by Pizzi (8 vols. 1886-88); Rückert's German translation (1890) is incomplete; a translation into English verse by A. G. and E. Warner was published in 1905 and following years.

Fire. Countless stories of fireless men have been retailed by credulous travellers, and there is hardly a primitive mythology which has not woven a web of fable round its origin; not seldom it is ascribed to a special theft from the gods by some greatly daring hero, like the Greek Prometheus or the New Zealand Maui. As far as actual knowledge goes we find that the possession of fire and the art of making it by one method or other have belonged to the vast majority of mankind as far back as we can trace. The original method of finding fire was undoubtedly by the simple friction of two pieces of wood, which was developed by progressive art into more complex and convenient methods. One of the simplest methods in use is what Sir E. Tylor terms the 'stick-and-groove,' in which a blunt-pointed stick is run along a groove of its own making in a piece of wood lying on the ground. By this means a Tahitian can produce fire in a few seconds. Somewhat similar is the Malay process of striking fire by rubbing together two pieces of split bamboo, which has been conveniently fitted by nature with a siliceous coating. Again, the most widespread method is that to which Tylor applies the term 'fire-drill'—a primitive kind of boring instrument, thus described by Captain Cook from his observations of the native Australians: 'They take two pieces of dry soft wood; one is a stick about eight or nine inches long, the other piece is flat: the stick they shape into an obtuse point at one end, and pressing it upon the other, turn it nimbly by holding it between both their hands, as we do a chocolate-mill, often shifting their hands up, and then moving them down upon it, to increase the pressure as much as possible.' Many improvements upon this simple method are found, as that on the principle of the carpenter's brace used by the Gauchos of the South American pampas; the Eskimo method of winding a cord round the drill, so as by pulling the two ends alternately to make it revolve very rapidly; the Sioux bow-drill, in which a bow with a loose cord is substituted for a simple cord; and the pump-drill, familiar in English tool-shops, and used by the Iroquois to generate fire. The Fuegians strike sparks with a flint from a piece of iron pyrites (Gr. *pyr*, 'fire') upon their tinder—a use which the etymology of the word shows to have been known to the ancients. The flint and steel must have come into use soon after the beginning of the iron age, but its origin in the civilised world is wrapped in the mists of antiquity. Among savage peoples it has made its way along with iron, but has often failed to supersede the fire-sticks. The use of the burning-lens to generate fire was known to the Greeks, and we are told by Plutarch was the method of solemnly reviving the sacred fire at Rome. The last phase of fire-making—by lucifer matches—is fast making even the fire-sticks of the South African savage mere curious relics of the past. A strange survival of the ancient methods is the fire-churning still used in India for kindling the sacrificial fire, and the kindling by *wild-fire* alone of the English *need-fire* and German *Notfeuer* through which cattle were driven to avert pestilence down to the 19th century, in spite of the constant opposition of the clergy. The Easter and Midsummer-eve bonfires, so closely connected with ancient sun-worship, were tolerated and even adopted by the church, but the need-fire was disallowed by Rome; while in Russia, on the contrary, it seems to have been practised under the direct sanction of the parish priests.

The religious history of fire is even more obscure than the history of its production, although everywhere we find that a rich mythology has gathered round the subject. Like all the chief manifestations of natural forces, fire was early personified and worshipped, and we see a similar process of personification and divinisation in the names of the first fire-givers—the Greek Prometheus, the *pra-mantha* of the early Aryans, and in his Chinese parallel Suy-jin. The god of fire possesses generally capricious and variable qualities, as in Loki; now severe and cruel like Moloch and Xiuhtecutli; now beneficent like Hestia, Agni, Atar, Ptah, and Baal Hamman. We find among the Greeks, the Phœnicians, the Egyptians, Slavs, and Mexicans the co-existence of several fire-gods who personify respectively the diverse functions of fire; in the Vedas, on the contrary, we have the notion of the identity of Agni alike in the fire, the sun, and the lightning. Again, the essential identity between life, and fire visible in the sky but latent in everything, is an elemental idea among Romans, Hindus, Persians, Slavs, and Red Indians alike. The phenomena of generation are assimilated to the production of fire, whence fire becomes regarded as the author of life, and its worship is appropriately associated with phallic rites. The human soul is of the nature of fire; and fire, the common element of gods and of their creatures, of beings and things, becomes the soul of the universe, and plays a cosmic rôle as universal creator—a conception as akin to the philosophic mind of Zeno as to the primitive worshippers of Ptah and Agni.

Fire has ever been regarded as the great purifying element *par excellence*, not so much from its devouring properties and its incorruptibility as from its power as the dispeller of the demons of darkness. Hence the universality of belief in its power over evil spirits, and the use of lighting fires upon tombs, as well as of ordeals by fire—a pure agent which cannot harm the innocent. Fire puts to flight specially the spirits which cause maladies, whence the philosophy of magical cauterisation, and of the *need-fire* spoken of above. Fire again is considered as the heavenly mediator, which descends in thunder and remounts in flames, devouring the offering and thus answering the prayers of the priest. From this follows naturally *pyromancy*, the interpretation of oracles by fire, and hence the religious character of the cremation of the dead, seen in the outward act of the apotheosis of a Roman emperor. Lastly, fire is considered as the protector of collective existence, whence the perpetual fires of the Roman Vestals, the ancient Peruvians, Mexicans, the Damaras, and the like. Fire was carried by ancient Greek colonists from the sacred hearth of the mother-city, and is still the symbol of union among the red-skins of North America. See Tylor, *Researches into the Early History of Mankind* (1865); Kuhn, *Die Herabkunft des Feuers und des Göttertranks*

(2d ed. 1886); Goblet d'Alviella, *Histoire Religieuse du Feu* (1887); W. Wachter, *Das Feuer in der Natur, im Kultus u. Mythus*, &c. (1904); Bidwell, *History of Fire-making* (1912); also BELTANE, ORDEAL, PARSEES, ZOROASTER.

For physics and chemistry of fire, see COMBUSTION, FLAME, HEAT, LIGHT; see also ELECTRICITY, FRICTION, FUEL. Forest fires and prairie fires occur in some regions very frequently, and are often rapid in their progress and most destructive.

FIRE-BRIGADE.—The first fire-brigade on professional lines was founded in Edinburgh in 1824, when the police commissioners and the principal insurance companies combined and formed the Edinburgh Fire-engines Establishment, under the management of James Braidwood (1800–61), who was appointed Master of Engines. He organised the fire establishment on such efficient methods that his system soon became the model for similar organisations in all parts of the country. He introduced the first systematic method of saving life from fire by his invention of a chain ladder, which was suspended from the roof of a burning building, and enabled the firemen to descend to the floor affected and rescue the inmates. Braidwood introduced the first organisation of a body of men as firemen, and so complete and efficient was the system in Edinburgh that he was invited to go to London, which he did in 1833, and became superintendent of the London Fire-engines Establishment, an association formed and maintained by the principal fire insurance companies. Mr Braidwood was killed, whilst directing his men, at the great fire of Tooley Street, London, in June 1861. The insurance companies' fire establishment existed in London until January 1866. Under an act of parliament of 1865 the Metropolitan Board of Works took charge of the fire establishment and fire protection of the Metropolis, Captain E. M. Shaw, who had succeeded Braidwood, being the chief officer. In 1887, when the London County Council came into existence, the London Metropolitan Fire-brigade was taken over by that body. The personnel of a fire-brigade varies in different localities. Braidwood recruited his men in Edinburgh from slaters and house-carpenters; previous and subsequent to his appointment in London, the firemen were recruited from amongst the Thames watermen. Captain Shaw found sailors made the best firemen, and during his tenure of office as chief of the London Fire-brigade none but sailors of either the navy or the merchant service were engaged. In Glasgow the firemen are principally slaters and house-joiners. In Paris the fire-brigade is composed of a regiment of engineers lent by the government to the municipality. The men engage for their period of military service, which they serve in the Paris Corps de Sapeurs-Pompiers. Only a small percentage re-engage for permanent service, to become experienced firemen. In Berlin the brigade is composed of time-expired soldiers, who are permanently employed. In New York, Chicago, and most American cities the firemen are recruited from all ranks of workers. Owing to the introduction of more mechanical appliances than heretofore, men with mechanical knowledge are now largely employed in the fire service; but the seaman still proves to be the best all-round man.

Fire-engines.—Previous to the beginning of the 19th century practically no organised attempt was made by any authority in the country to deal with the extinction of fire. By an act of Queen Anne, 1708, each parish in London was required to maintain two 'fyre engines' and ladders out of the rates; this was the introduction of the 'parish engine,' which was under the control and management of the parish beadle. At the great fire of London, 1666, the only known 'fyre engine' was a brazen hand-squirt of cast-brass, 30 inches long, which was operated by three men, two holding the squirt by side handles, whilst the third man withdrew the piston, drawing the water in from a leather bucket; the discharging point of the squirt was then raised towards the burning building and the piston pushed in, driving the water out. This 'fyre engine' was the only provision existing to deal with the great fire, its progress being arrested by the efforts of the military, who pulled down the buildings. In the year 1667, following the great fire, the Common Council of the City of London directed that the city should be divided into four districts, each of which was required to provide, 'for the preventing and suppression of fires in the future, brazen hand-squirts and leather buckets.' In 1698 the Hand-in-Hand Fire Office appointed a number of 'firemen' from amongst the river Thames watermen; this is probably the first introduction of the word in this sense. (As gunner or soldier, and as stoker of a furnace, the use is older.) In 1714 Gay, in his *Trivia*, says: 'The fire-man sweats beneath his crooked arms.' In 1703 the city council of Edinburgh passed an act 'appointing a Company for quenching of Fire, and Rules to be observed by the Inhabitants thereanent.' The council decided to appoint twelve firemasters, each of whom should have six assistants to himself. There were, however, no engines provided, the only appliances mentioned being, for each firemaster, a baton, a leather hat, buckets, six shovels, and six mattocks.

In 1672 Van der Heide, Dutch engineer and artist, had a well-organised company of firemen in Holland; he made the first manual fire-engine and flexible leather hose. Previous to the introduction of the flexible hose by Van der Heide, the directing pipe or nozzle was fitted on the top of the engine on a swivel elbow, the fireman directing the water from the top of the engine, which was taken directly in front of the burning building. During the 18th century the work of fire extinction was almost solely undertaken by the fire insurance companies. Each company maintained its engine and company of firemen to protect its own property. When an insurance was effected on a building, the company affixed its 'fire-mark' on the building 'to prevent any fraud in getting any policy by indirect means after a house is burnt. No house is to be esteemed a secure house till the mark has been actually affixed thereon.' The insurance companies' body of uniformed firemen were known by the name of the fire-offices to which they belonged. In 'Rejected Addresses' (1812) on the burning of the old Drury Lane Theatre some verses describing the fire ran:

> Then jacket thick, of red or blue,
> Whose massy shoulder gave to view
> The badge of each respective crew
> In tin or copper traced.
>
> The engines thundered through the street,
> Fire-hook, pipe, bucket, all complete;
> And torches glared, and clattering feet
> Along the pavement paced.
>
> The 'Hand-in-Hand' the race begun,
> Then came the 'Phœnix' and the 'Sun,'
> Th' 'Exchange,' where old insurers run,
> The 'Eagle,' where the new.

As has been said, in most modern British fire-brigades the men are recruited from all classes of mechanics and tradesmen, whilst a large percentage are seamen. In this manner several brigades have fully equipped workshops wherein the men work at their particular trade or calling in making and repairing the fire engines, ladders, fire-escapes, and other plant; this system is not only economical, but it admits of repairs being expeditiously executed on the spot. The manual fire-engine, introduced by

Braidwood in Edinburgh was built by Tilley of London in 1824, and required forty men to work it. When worked at full pressure—viz. about forty strokes per minute—it delivered approximately 140 gallons per minute, at 60 lb. pressure, through two lines of hose with ¾-inch nozzle or jet on each, giving an average altitude for each jet of 65 feet.

Steam Fire-engines were first used in a practical form in 1860 in London. One built by Shand Mason was hired by the London Fire Establishment for two years before being purchased by the authorities. The weight was three tons. It was a horizontal engine of one cylinder, and had a pumping capacity of 150 gallons per minute. The modern fire-engine, known as the 'steamer,' usually has a pumping capacity of either 350 or 450 gallons per minute. In the horse-drawn engine the power and pumping capacity of the fire-engine is limited by the energy two horses are able to exert in taking the engine at a rapid pace to a fire. An engine of a pumping capacity of 450 gallons per minute weighs, when loaded with eight firemen, 3 tons 5 cwt. The boiler is water tubular; the tubes are ⅞ inch internal diameter, and are arranged in rows horizontally, slightly inclined to assist circulation. In the boiler of the 450-gallon size engine there are 160 tubes, affording, in addition to the walls and crown of the boiler, a large steam-generating surface. When the engines are standing in the fire-station the boilers are usually heated by means of steam from a stationary circulating boiler, or a gas-ring placed inside the fire-box. The fire is ready laid, and steam should be raised within from four to five minutes after lighting up. The working steam-pressure is 140 lb., and this pressure should be available by the time the engine has reached a fire and the hose has been laid out ready for work. The engine has two steam-cylinders direct double acting on the pump. The pistons of the steam-cylinders have each two piston-rods passing on either side of a double-throw crank-shaft, and are connected to a crosshead on the pump-rod; from a joint on the crosshead a connecting-rod returns to the pin of the crank-shaft. The cranks being at right angles, the engine may be started from any position. Eccentrics are fitted at the outer ends of the crank-shaft, where are also light-weighted solid fly-wheels about 10 inches diameter. To ensure steady discharge the delivery side of the pump is fitted with a capacious air-vessel. The suction-tube is 5 inches diameter, and connections for four delivery-hose are provided. The altitude and number of the jets depend upon the size of nozzle employed. The following table gives the average altitude of a fire jet or stream under normal atmospheric conditions:

Pumping Capacity of Steamer.	One Delivery.		Two Deliveries.		Three Deliveries.		Four Deliveries.	
	Diameter of Nozzle.	Height in Feet.	Diameter of Nozzle.	Height in Feet.	Diameter of Nozzle.	Height in Feet.	Diameter of Nozzle.	Height in Feet.
	in.		in.		in.		in.	
260 gallons	⅞	100	⅝	100	½	70	—	—
350 "	1⅛	100	¾	80	½	80	⅝	60
450 "	1¼	120	1	110	¾	100	¾	70
450 "	1¼	130	—	—	—	—	—	—

Fire-nozzle.—The nozzle or nose-pipe forms the most important factor in the equipment of a fire-engine. It is used to determine the diameter, altitude, and efficiency of the water-jet or fire-stream. The internal bore of the nozzle requires to be most accurately finished, the surface free from irregularities or scratches. The most minute scratch on the inner surface at the edge of the lip of a nozzle will break the water-column at that point, causing it to spray. The object of the nozzle is to produce a continued, smooth, solid column of water for as great a length from the discharging nozzle as possible. The continuity and solidity of the column of water depends upon the resistance due to the atmospheric conditions. The most favourable conditions are a calm, still atmosphere in which the column of water is only broken by the resistance it makes owing to the velocity with which it passes through the air, and, secondly, by its own weight in breaking away when the velocity decreases as the water reaches the maximum altitude. It is impossible to determine accurately the length a vertical or a horizontal jet of water will attain as an effectual fire-stream owing to the above conditions, the governing factor always being the force of the wind. The following table is taken from *Experiments relating to Hydraulics of Fire-Streams*, published in the United States by J. R. Freeman. The figures are for jets from nozzles of the ordinary fire-brigade working diameters, through 100 feet of ordinary canvas hose of 2½ inches diameter, working under ordinary conditions. Column V shows the vertical and column H the horizontal effective striking distance:

Pressure at Pumps in lb. per square inch.	¾"		⅞"		1"		1⅛"		1¼"		1⅜"	
	V.	H.	V.	H.	V.	H.	V.	H.	V.	H.	V.	H.
40	55	41	54	45	53	42	36	38	37	40	29	33
50	64	47	67	56	68	51	50	50	40	42	34	35
60	67	50	72	60	70	55	59	55	48	47	47	42
70	72	54	75	62	74	60	68	59	57	55	55	49
80	76	58	77	65	80	64	76	66	71	63	67	56
90	79	62	82	68	86	69	84	69	82	70	80	59
100	80	64	90	72	94	73	94	75	100	76	91	62
120	83	68	95	79	97	79	100	79	107	84	110	78
140	—	—	—	—	105	82	109	85	112	86	118	90

Each particular diameter of water-jet reaches its maximum altitude under a certain pressure. If the pressure is increased beyond that particular point, the jet meeting with greater air-resistance breaks at the point of leaving the nozzle, and the altitude is greatly diminished. The maximum pressures giving best results are: ¾ inch, 100 lb.; 1 inch, 110 lb.; 1¼ inches, 140 lb.

Hose-box and Gear Carried.—That portion of the fire-engine which forms the seat for the fireman is known as the hose-box; in it are carried several hundred yards of hose, branch-pipes, nozzles, stand-pipes, hand-pump, canvas buckets, life-lines, hauling-lines, canvas dam or cistern, jumping-sheet, saw, large felling-axe, cold-chisels, hammer, &c.

Automobile Fire-engines were introduced by Merryweather of London, and first came into general use in 1894. They are propelled by steam, the boiler being of the ordinary quick-steaming tubular fire-engine type, fired by oil fuel. The engine consists of two steam-cylinders driving a crank-shaft with link motion reversing gear. The crank-shaft is geared on to a counter-shaft driving two chain sprocket wheels which are connected to the rear road-wheels by steel roller chains. The pumps are placed below the crank-shaft, directly under the steam-cylinders. The pump-pistons, being provided with quick-action couplings, are thereby put into gear with the engine, which is thrown out of gear with the counter-shaft when the pumps are in use. There is accommodation for a large quantity of hose and other appliances. The speed of the engine is from 30 to 40 miles an hour. In order that the engine may be ready to start immediately for a fire, steam is maintained in the boiler by means of a stationary steam-heater boiler in the fire-station. These engines have pumps capable of delivering 500 gallons per minute at 140 lb. pump-pressure.

Petrol Motor-pumping Fire-engines, in general use in fire-brigades, are driven by engines of the heavy commercial vehicle type, having four or six cylinders of 50 b.h.p. or six cylinders of 75 b.h.p. The average

speed is 35 miles per hour, and the pumping capacity is 350 gallons per minute driven by the 50 h.p. engine, and 600 gallons per minute driven by the 75 h.p. engine. There are two types of pumps fitted to the petrol motor fire-engines—viz. the piston or plunger pump, and the centrifugal or turbine pump. The plunger-pump, which requires to run at a low speed—250 revolutions per minute—consists of three pump-barrels in one casting in triangular form, the pump-pistons being driven by a single crank on a shaft running through the centre of the pump-casting, each pump-rod being coupled on to the crank-pin. Each revolution of the crank makes one stroke for each pump-piston. The pump crank-shaft is driven from the motor by means of a silent chain gearing from the first motion shaft through the gear-box. This pump is known as the 'Hatfield' type of reciprocating pump. The centrifugal or turbine pump consists of a centrifugal pump of one or more stages, geared up from the motor to run at speeds varying from 1000 to 2000 revolutions per minute. One of the features of this class of pump is that, the centrifugal pump being unable to create a vacuum, it cannot lift water; consequently a reciprocating air-pump is fitted to the engine, being driven by a separate friction clutch or gearing from the main-pump shaft of the petrol motor. When the pump is required to be brought into operation, the air-pump is first started to create the necessary vacuum in the suction-pipe to bring the water to the level of the main centrifugal pump. When this has been accomplished the main pump is put into gear by engaging the pump clutch on the main shaft. Petrol motor-engines operate through one or more lines of hose as circumstances may require. A 600-gallon capacity engine will give its highest efficiency at a high altitude through one line having a 1¼-inch nozzle, two lines having each 1-inch nozzles, three lines having ⅞-inch nozzles, or four to six lines having ¾-inch to ⅝-inch nozzles. These engines may be operated to pump through 500 to 600 yards of hose, but the longer the length of hose the greater the loss of pump efficiency due to the friction of the water against the walls of the hose.

Hose-tender.—The hose-tender is used in fire-brigades as a vehicle to carry hose, ladders, and general appliances for use at a fire. Being of lighter weight than the fire or pumping engines, it is able to accommodate a larger quantity of appliances and a greater number of firemen. This vehicle is known in America as the 'hose and ladder truck.'

Electric traction for fire-brigade vehicles has been adopted by some British brigades, but is restricted by limited output of portable storage-batteries. The average maximum mileage obtained with a heavy motor vehicle from one set of batteries is 40 miles. The power is thus limited to propulsion, and is not available for pumping-power. In some large cities on the Continent electric-power for traction is largely used for hose-tenders and fire-escapes. Steam pumping-engines are also mounted on an electric chassis, the steam-boiler being used to supply the power for the pump.

Hose.—There are three descriptions of fire-hose in general use—viz. leather, plain canvas, and canvas with a lining of rubber. Until 1880 leather hose was almost exclusively used from the time of its introduction. It was introduced or invented by the Dutch engineer Van der Heide in 1672. It was the first flexible hose used, the strips of leather and joints being sewn together. About 1820 the joints and seams in the leather were riveted together by copper rivets; and this method is still adopted. Leather hose has almost entirely gone out of use for fire-brigade work, but is still largely used on board ship in the navy and H.M. dock-yards. Canvas hose having a rubber lining is used by some brigades, principally owing to the absence of percolation or sweating along the hose when under pressure. Plain canvas hose is woven from the best quality flax of about twelve yarns to the inch in the weft or horizontal yarn, and fifteen yarns to the inch in the warp or longitudinal yarn. Well-made hand-woven canvas hose will stand more hard wear than any other kind of hose, and is more easily repaired. It requires, however, very careful treatment after use; it must be thoroughly cleansed and carefully dried. The average life of a length of hose for fire-brigade work is ten years, and the average cost of plain canvas 2s. 6d. per yard. The hose in general use varies in diameter from 2 to 3 inches, 2½ and 2¾ inches being most generally used. The diameter of hose is an important factor in effective results of the water-delivery of the fire-engine, considerable loss of pressure being due to friction.

3-inch diameter hose absorbs 60 per cent. less by friction than 2½-inch hose.
2¾-inch diameter hose absorbs 40 per cent. less by friction than 2½-inch hose.
2⅝-inch diameter hose absorbs 20 per cent. less by friction than 2½-inch hose.
2⅜-inch diameter hose absorbs 30 per cent. more by friction than 2½-inch hose.
2¼-inch diameter hose absorbs 70 per cent. more by friction than 2½-inch hose.
2½-inch diameter hose absorbs twice as much as 2½-inch hose.
2-inch diameter hose absorbs three times as much as 2½-inch hose.

The loss due to friction is greater in unlined or plain canvas hose than in either rubber-lined or leather. The comparative friction losses are: 30 per cent. in plain canvas hose; 25 per cent. in thin rubber-lined hose; 12 per cent. in leather hose; 10 per cent. in heavy rubber-lined hose. Plain canvas hose is one-fourth the weight of either rubber-lined or leather hose; it is more durable, of much less bulk, and consequently more compact for stowing away in the engines. It is also stronger than either leather or rubber-lined hose, and will stand an average pressure of 250 lb. to the square inch. For these reasons it has been found most suitable for fire-brigade purposes. Plain canvas hose costs one-third that of rubber-lined or leather.

Suction-hose requires to be flexible but non-collapsible. It is usually made of several plies of rubber and canvas, having embedded in the walls of the hose spiral steel wire to keep the walls rigid. The suction-hose must be very carefully made and treated; the slightest leakage on the suction-pipe would entirely disable an engine from drawing water from below the level of the pump. Any mixture of air with the water coming in from the suction side of the pump will cause the engine to work irregularly, and, instead of a steady, solid stream at the nozzle, produce a broken, intermittent, sprayed jet.

Fireplugs.—A fireplug is a conical wooden plug driven into a prepared socket in the street water-main. When the water is required for fire purposes, the plug is loosened by a lever, and the pressure of water drives it out. A stand-pipe with an open valve at the top and a tapered shoe at the foot is inserted in the pipe-socket and driven home, being secured by wooden wedges against the surface-box at the road-level. Fireplugs have been generally superseded by the fire-hydrant, which is enclosed in an iron surface-box on the footpath, and consists of a mechanical valve controlling the water-supply to one or two outlets, which are fitted with a connection to receive the hose or a connecting elbow direct. The water is always under the control of the valve. Another form is the ball hydrant. A special fitting is attached to the water-pipe having an outlet at right angles in the form of a globular box, which contains a vul-

canite or light solid rubber ball larger in diameter than either the water inlet or outlet. The pressure of water forces the ball up and closes the orifice. The special fitting at the road surface has a bayonet attachment which engages with the bottom of the stand-pipe, the latter having a screw-down spindle through its centre; and when the water is required the spindle is screwed down and depresses the vulcanite ball, allowing the water to flow round it and up through the stand-pipe.

Fire-escapes.—Fire-escapes vary in construction according to the requirements of particular districts. Ordinarily they consist of three-section telescopic ladders attached to a two-wheeled base, and carried on the motor fire-engine, from which they are detached and worked separately at the fire. This class of escape has a maximum extension of 55 feet. For higher altitudes mechanically operated ladders are fixed on a motor-propelled base, and are in four telescopic sections, carried horizontally on the motor-truck. When required to be brought into operation, the ladders are operated by a series of clutches driven by the motor-engine. The ladders are first brought up to a vertical position, after which they are extended to the required altitude and angle. These ladders, in addition to being used for saving life, are also used in fighting fire by directing water-jets into the upper floors of buildings. The ladders are extended in front of the building without requiring to rest against the walls for support. The fireman is then able to direct the jet of water from the top of the ladder into the building, the directing position being regulated by turning the ladder at the base to the desired angle. The maximum extension is 85 feet from the ground.

Scaling-ladders are short lengths of ladder about 7 feet each, carried on the fire-engines. Each length is fitted with steel sockets on the outside at the top end and on the inside at the bottom. The ladder is tapered, so that the top of one ladder will fit inside the bottom of the next, by which means several lengths are fitted together, making a ladder as long as may be desired. Hook-ladders, sometimes called 'pompier' ladders, being a French introduction, are made light but strong, and are fitted at the top with a long hook at right angles to the sides of the ladder. One fireman is able to raise the ladder from the ground and hook it on to the window-sill of the first-floor window, pushing the hook through the glass. The fireman then ascends to the window-sill; standing there, he raises the ladder to the next window-sill above; and so on.

Jumping-sheets consist of canvas sheets fitted on the outer edge with a series of rope hand-loops. The sheets are usually 10 feet in diameter or square, and are stretched out and held taut by the hand-loops under the windows, from which persons to be rescued jump and are caught in the sheets.

Methods of obtaining Water.—Each fire-engine carries a collapsible canvas dam or cistern, which is supplied from a connection to a street hydrant. The water from the hydrant flows through an open bore and is collected in the cistern; the suction-pipe of the engine is put into the cistern, and the water is pumped out as fast as it flows in. Another method is to attach several connections from hydrants direct on to the suction-chamber of the engine, the pressure on the gravitation-supply thereby assisting the pumping-power of the fire-engine. This method of direct gravitation-supply cannot always be employed, being governed by the water-supply of the particular district. A third method of supplying the fire-engine is to draw direct from large reservoirs, rivers, docks, or canals by means of the flexible suction-pipe. The recognised all-round maximum vertical lift from the level of the water to the pump is 25 feet, though petrol turbine-engines have been known, on official tests, by the aid of an air-pump on the suction-pipe, to lift water 28 feet.

Chemical Extinguishers are of American origin, and consist of small cylinders of 2 and of 4 gallons capacity. There are two types used for two general classes of fire. Of the first type, what is known as the soda-acid is in more general use. The cylinder is sealed, and is filled with a solution of bicarbonate of soda, and has lodged in a bracket a bottle of sulphuric acid. When the cylinder is required for use, the acid bottle is broken by the compression of a small piston, and the admixture of the acid with a soda solution causes the generation of carbonic acid gas, which is discharged through a ½-inch nozzle under a pressure of approximately 150 lb. to the square inch. There are no extinguishing properties in the liquid, the gas merely acts as the propelling power to discharge the solution on to the fire. The second of this type consists of a similar cylinder, in which the pressure is generated by a cartridge of carbonic gas or air which is punctured by the piston, the liquid being discharged by the air or gas liberated from the cartridge. These extinguishers are used for extinguishing fires of burning material, and are very effective in dealing with an outbreak of fire in the early stages, or to keep a fire in check while the larger appliances are being brought into operation. They are largely used for fire-prevention in private houses and public buildings.

For dealing with petrol fires and inflammable oils or spirits a different type of extinguisher has been found essential. Of the two kinds the first consists of small cylinders containing carbon tetrachloride discharged by a small double-acting pump, the piston of which is operated by being driven in and out in such a way that a tiny jet of the acid is projected on to the burning liquids or material. When the acid is in contact with fire it produces a heavy blanket of carbonic acid gas, which smothers combustion. The second extinguisher of this type consists of a cylinder discharging a foam or thick frothy substance, the bubbles of which are formed by carbonic acid gas. These are most effective for smothering fire on large surfaces or in tanks of oils or petrol. The foam is discharged into the tank, where it floats over the surface of the oil and smothers the fire.

'Fireproof' Construction.—The term 'fireproof' as applied to buildings has so far not yet been justified, as no known method of building construction has been proof against effects of fire. The use of fire-resisting building materials is no protection against the furnishings, fittings, fixtures, or stock of a warehouse taking fire. When the contents of a building take fire a great heat is often very suddenly generated within the walls; consequently the greatest strain upon the structure is to resist effects of sudden changes of temperature on the various metals and minerals forming the component parts of the building materials. Experience of conflagrations in various large cities in different parts of the world has demonstrated that no structural materials can withstand the chemical and physical effects of the great heat generated in an ordinary building on fire. Of all building materials sound timber has the advantage of being the best non-conductor of heat. If exposed to actual flame on all sides the timber will be charred and will slowly burn, but its solidity is not affected until it has almost burned through or at least until its stability has been seriously undermined; whilst properly bonded brick is the least affected of any of the harder materials, and has proved to be the most reliable under all circumstances and conditions of a conflagration.

Structural iron or steel work should be adequately protected successfully to resist the effects of the great heat generated, and it is because the stability of metal-work is seriously affected by the heat, without of necessity coming into contact with actual flame, that it is so much inferior to sound, solid timber, which is only affected when in a state of actual combustion. Well-burned brick of good quality, well laid in mortar, is the best protective covering known for steel and iron members and columns, and has the additional merit of adding to the stability of the structure. Stone is especially susceptible to damage when exposed to great heat. It is unsuitable, from a fire-resisting point of view, for either external work or column supports internally. This is very clearly demonstrated at the early stages of any fire to which it has been exposed; ornamental stonework is destroyed at the very early stages, and forms an element of danger and obstruction to the firemen when attacking the fire. Unprotected steel and iron work also fails at an early stage of a fire, and possesses the added disadvantage of pulling down the walls to which it is tied. Air-spaces in partitions and under floors should be rigidly excluded. Hollow partitions are not only readily destroyed, but form conduits conveying smoke and fire from one portion of the building to another. Large open areas assist the spread of fire, particularly in buildings having highly combustible contents; the larger the area the greater the intensity and severity of the fire. The fire-resisting construction of a building offers no protection in such a case. The report of the chief engineer appointed by the U.S. government on the great conflagration at Baltimore in February 1904 states: 'Stone of every description suffered severely, particularly projecting parts. Terra-cotta facings and ornamental work failed completely. Granite spalled [crumbled] badly, worse than any other stone under moderate heat. Marble spalled badly, but not so much as granite. Of all materials on external walls, properly bonded brickwork was the only thing that was really successful.'

The Fireproofing of Wood and Soft Materials.—The treatment of wood and fabrics by chemical solutions of various qualities renders inflammable materials flameproof, and so retards the spread of fire. It is not sufficient to treat the surface of wood only. The wood is placed in a huge cylinder, wherein the air and moisture are extracted by a vacuum-pump; after which an antipyren, run in in solution, is forced into the open pores. In most theatres the scenery, draperies, &c. are periodically impregnated by a solution of one of the many chemicals, such as borax, boracic acid, salts of ammonia, &c., which tend to check combustion. The treatment of such materials will not prevent their destruction in a conflagration, but it will prevent the scenery from bursting into flame should it come in contact with a naked light or an electric arc, in which case the material would carbonise and burn very slowly at the point of contact only. See various lectures on this subject by Professor Vivian Lewis, of Birmingham University.

Fire-brigade Stations.—Fire-stations consist of a block of buildings in which are housed all the necessary appurtenances of a fire-brigade, including housing of the men with their families, workshops, stores, offices, gymnasium, drill-yard, &c. The engine-room—for horsed appliances—usually has accommodation for four or five engines, with stabling in the immediate rear of the engines. The horses stand in a stall facing the engines; the end of each stall is enclosed by a mechanically controlled door. On the ringing of an alarm the doors are opened either by automatic or electric contrivance. The horses are trained to run forward and place themselves under the harness, which is suspended from spring clip-hooks above the pole of the engine. It is pulled down by one movement, and the horse stands harnessed and ready. Where the engines are automobiles there is of course no stabling. The engines, however, are on the same principle, each having a separate exit door, the engine standing immediately behind the door, ready to move forward when required. The firemen are housed above the engine-room and workshops, their bedrooms being connected with the electric fire-alarm installation. On the ringing of the alarm a light is put on in each bedroom. Simultaneously with the ringing of the fire-bell the men descend from their quarters on the upper floors by sliding down polished steel poles to the engine-room, where they find their fire uniforms and helmets, &c., mount the engines, and away. The average time taken to turn out a fire-engine in a well-equipped station is fifteen seconds by day and fifty seconds by night. Owing to the advances made in the introduction of mechanically propelled engines, one of the essential features of a fire-station is properly equipped workshops, wherein the necessary repairs to engines are expeditiously executed by the firemen.

Fire Prevention.—It is estimated that of the large number of fires which occur in domestic households quite 50 per cent. are due to carelessness, and may be guarded against by the exercise of a few elementary precautions in everyday life. Unprotected gas-jets near dressing-tables and windows are amongst the principal causes of fires. The lighted gas, being required for dressing, is often fitted beside a window which is opened to admit the air. On some one's leaving the room the opening and closing of the door causes a sudden draught to arise between the window and the door, and this draws the window-curtains on to the unprotected gas-flame, thus firing the curtain, which falls on the dressing-table. A gas-globe is a good preventive. Draperies round mantel-boards are similarly dangerous. If the drapery is loosely arranged, the draught from the open door will draw it towards the chimney and into contact with the fire in the grate. Draperies at fireplaces, if not entirely dispensed with, should be securely fastened at the sides to prevent their being blown about by draughts. The airing of linen in front of open fires is the frequent cause of fire, the garments being usually hung on drying-horses, backs of chairs, or high fenders. When they are dry their weight causes them to slip or roll off, inside the fender, or even on to the burning coal; or sparks fly out on to the drying material. Wire fire-guards are a preventive against sparks; and if the clothing be securely fastened to the horses or the chairs, this will effectually keep it from slipping off on to the fire. Carrying live-coal in a shovel from the fireplace of one room to that of another room is also a very dangerous practice. A small piece of burning coal falling from the shovel on to the carpet or the clothing will instantly set it on fire; and in the endeavour to extinguish it the shovel with the remainder of the burning coal is usually dropped, causing at once, it may be, a serious outbreak. Lighted tapers are the frequent cause of domestic fires, owing to carelessness on the part of the person carrying the taper or the candle in lighting up the gas throughout the house for the evening, or when using a lighted taper as a means of illumination at linen-presses, clothes-closets, and the like. Searching for domestic pets under beds and tables with this form of naked light is naturally very apt to set the bedding or the clothing on fire.

Benzine, methylated spirit, petrol, and other highly volatile spirits used for cleaning purposes in close proximity to naked lights or open fires are all of them highly dangerous. The spirit vapour is

wafted about the apartment by the ordinary currents of air, and should the vapour become ignited flame will follow to its source in the cleaning material, with serious consequences. In the case of gas-escapes, explosions can be avoided if care be taken to avoid the use of artificial lights and to empty the house or apartment of the gas. If the presence of the gas interferes with breathing, cover the mouth and nose with a damp cloth, handkerchief, or towel, proceed through the house from the bottom *without a light*, and open the window in every room—up from the bottom and down from the top—allowing the air to enter from the bottom of the window and drive the gas out at the top. No room or cupboard should be left unopened; and it should always be remembered that the gas will be strongest on the top floor and in the attics. Turn off the gas at the meter or the main as soon as possible; and after the house is free from gas and the supply of gas is turned on again, the defect will be easily detected by the smell at the point of escape. Cotton-wool when used for decoration purposes is highly inflammable; and particularly when it is applied to clothing, its use exposes the wearer, should the wool become ignited, to almost certainly fatal consequences. Many serious disasters have been caused by the use of cotton-wool for the above purposes. Silicated cotton is a good substitute, and has a glistening effect when exposed to artificial light. Silicated cotton is impervious to the fire.

Celluloid is another highly inflammable and dangerous commodity which is used largely for decorative articles of wearing apparel. Persons wearing or using celluloid combs should avoid the use of heated curling-tongs. Celluloid will burst into flame at a very low temperature, and does not necessarily require to be in contact with actual flame before igniting. Any article of wearing apparel of this substance should be considered as an element of danger.

Cleanliness and tidiness are essential. Many fires are due to the litter about the floors of workrooms, untidy store-rooms, packing materials, rubbish in cupboards, coal-cellars, &c., all of which are ready for the carelessly thrown or dropped lighted match.

Firearms. The generic term 'firearm' includes Cannon, Rifles, Guns, Revolvers (q.v.), and other weapons in which an explosive is used as an agent for the propulsion of projectiles. Their early history is inseparable from that of Gunpowder (q.v.), and most improvements in firearms have coincided with some development of gunpowder or the discovery of fresh explosive agents. The earliest firearms were probably merely cases for burning highly inflammable mixtures; then something akin to gunpowder was used to propel other less combustible portions of the filling from the case; and still later the mixture was fired simply as the propellant of a stone or weapon.

The knowledge of gunpowder and firearms may be presumed to have extended in a westerly direction through the Arabs, who used them in the 8th century under the name of 'manjaniks,' and introduced them into Spain in the 13th century. Seville was defended in 1247 by cannon throwing stones, a cannon in the castle of Coucy is marked in Arabic figures as having been made in 1258, firearms were used in the defence of Melilla (1259) and at the siege of Sidgil-Messa (1273), and a 'fire-mouth' was made at Amberg in 1301. The English are said to have used firearms at D'Eu in 1310, but the first mention of them in a contemporary record occurs in an indenture of 1338 of the equipment of the king's ships of 'ij canons de ferr . . . un handgone . . . barell de gonpouder.' A little later such words as 'gonness,' 'gunnis,' and 'bombardes' appear in records; whilst Chaucer (1373) mentions 'gonne,' and Barbour (1375) that 'crakys of wer' had been used at Werewater in 1327.

In Europe the early firearms range in size from the small cannon as used at Crécy (1346) and Rouen (1388) to siege weapons of great size, as that sent to Orleans (1428). Cannon were cast at Augsburg in 1378, but in England not until about 1535. In the 15th century many German towns possessed big guns, and the reputation of these weapons sufficed to protect cities from ordinary assault. Mahommed II. procured a gigantic gun to besiege Constantinople. Whilst cannon might be used for sieges and defending fortified strongholds, their general use in battle was regarded as ignoble, and as weapons they were counted of little worth. The English conquered France with the longbow in the 14th century, and early in the 15th were driven out by firearms.

Different countries had different names for these early firearms—in Italy 'bombardo,' in France 'quenon,' in Germany 'buchsen,' in the Netherlands 'vogheleer,' in England 'crackeys' or 'engynnes' of war; but it was not until the 15th century that firearms were classified and named accordingly. *Bombards* were short, capacious vessels, from which stone balls were shot with small charges to a short distance and at considerable elevation; they were essentially the parents of the present bombs or mortars. The *cannon* (*canna*, 'a reed'), on the other hand, were, for some time at least, of extremely small bore, scarcely larger than muskets of the 18th century; they discharged leaden bullets, and would have probably been used as hand-weapons but for their cumbrous and heavy workmanship, which necessitated small carriages. Arms of this description are doubtless those referred to as having been brought by Richard II. to the siege of St Malo, to the number of 400 pieces, where they are said to have kept up an incessant fire day and night on the town *without* success.

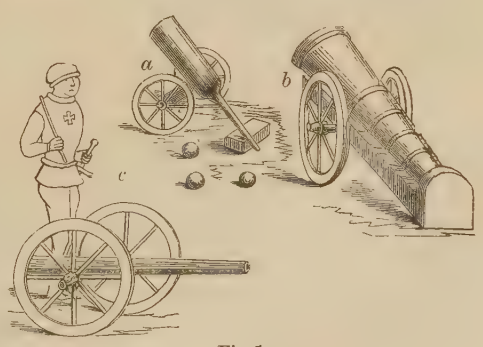


Fig. 1.

a (from the *Chroniques de St Denis*), 14th century; *b*, bombard of the 15th century (from Froissart); *c*, cannon of the 15th century (from *Les Vigiles de Charles VII.*).

All these early firearms were usually loaded to the muzzle, and fired at an extreme angle. Charles V. classed mortars separately, mounted cannon upon carriages, added trunnions, and effected other improvements in his artillery, which consisted of cannon; great, bastard, and small culverins; falcons and falconets. The classification of firearms led to the development of various types to be used for specific purposes, and an invention which effected a great improvement to one type was useless or inapplicable to another. Cannon of 120 tons and pocket-pistols of 4 ounces, although they have a common origin, have not a common history. Cannon were of wrought iron, built up

by the handicraft of the smith, of rods and rings, and were used as they left his forge. Cannon of a copper and tin alloy were cast at Augsburg in 1378; they have since been made of hollowed blocks of stone; or cylindrical holes, bored in the solid cliffs, have been used to fire projectiles, as at Alexandria, Constantinople, and Gibraltar; they have been made of wood, of rope, of leather, and of papier-maché, as well as of almost every pure and alloyed metal it is possible to cast or forge. The early cannon were chiefly used at sieges, as their weight and the badness of the roads, added to the inefficiency of the weapons themselves, precluded their advantageous use as field-pieces, and if utilised in a pitched battle they were fired but once. But on the one hand the development of cannon into small portable weapons produced hand firearms, and on the other the increase of size and weight led to the large weapons so important for the defence of fortifications. Of this type the 'Mons Meg' of Edinburgh Castle is an early specimen; it weighs nearly 4 tons, and fired a stone shot of over 300 lb. The powder-chamber is of a less diameter than the bore of the cannon, in this particular resembling the mortar, and exhibiting the reverse of the principle of enlarged powder-chamber now employed. Such cannon were made at Ghent in the 15th century.

The culverin, a useful size of cannon, was employed generally in England until after the Commonwealth. Culverins fired stone shot, iron balls, leaden bullets, and composite projectiles—a leaden jacketing being cast round uneven stones to make them heavier, and the better to fit the interior of the cannon. Such culverins and projectiles were made by the blacksmiths of Deritend, Birmingham, in the 17th century, and were used at the battle of Worcester.

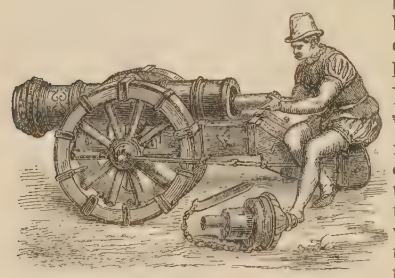


Fig. 2.—German Breech-loading Cannon of the 16th century.

Field-pieces were not greatly developed until the 18th century, when the improved finish of the interior allowed of long and uniform ranges, and a certain definite accuracy being obtained. The breech-loading field artillery are now of a high degree of excellence; but whether firing shot or shell the limit of power will be found in recoil, as is the limit of accuracy in the correctness of the aim.

For defensive purposes, as well as for certain offensive operations, special arms were required and constructed: of these the long-barrelled wall-pieces for defence; the 'petard,' and *mortars* firing bars, oblong and square bullets, for making a breach; explosive shells and grenades for clearing a trench; grape and chain shot for mowing down compact squares of infantry or destroying the rigging of battle-ships, are the best known. From the 'orgue de bombardes,' another type of early firearm, the quick-firing, many-barrelled machine guns have been developed. The earliest form of this weapon is the 'ribaudequin,' of Italian origin, which consisted of a number of small cannon and pikes arranged upon a portable carriage; it was fired but once during an engagement, and was primarily intended as a defence against a cavalry charge. The 'orgue de bombardes' (fig. 3), with more cannon (fired simultaneously) and fewer pikes, succeeded the ribaudequin.

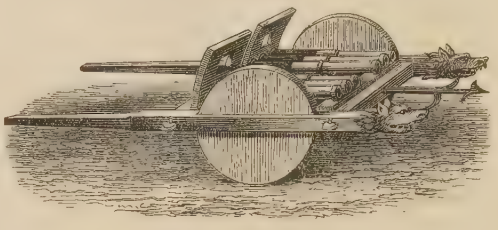


Fig. 3.—French Orgue des Bombardes.

Further developments survived into the era of percussion firearms.

With the cannon and quick-firing machine guns, the improvements have depended less upon the ingenuity of inventors than on the achievements of mechanical science to accomplish accurate workmanship, and work great masses of material as skilled workmen can handle smaller pieces. The improvements in explosives, in the quality of the metal, and in the machinery available, have rendered possible the production of such immense weapons, that the limit of size would appear to be rather in the cost of manufacture and the enormous expenditure risked upon the aim, than in the inability of modern mechanicians to produce still larger and more powerful weapons (see CANNON).

The development of the hand firearm, on the contrary, called for the ingenuity of the handicraftsman, and at first this ingenuity was exercised in the combination of a firearm concealed with some other weapon, so that its firing unexpectedly

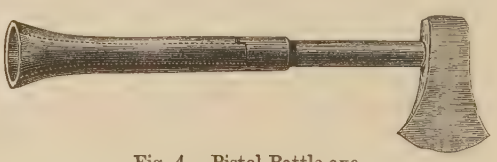


Fig. 4.—Pistol Battle-axe.

should produce a consternation; and for the same reason repeating and double-barrelled weapons were produced. Firearms were incorporated with daggers, swords, pikes, clubs, maces, axes, and shields; and it was the use of these devices by cunning warriors that disgusted the knights and led to their loss of prestige, and hastened the decay of feudalism. The hand firearms owed their success quite as much to the consternation caused by their unexpected discharge as to the execution done by their projectiles: hence Montaigne wrote in 1585, when the muskets in use were much superior to the earlier culverins, that their effect, apart from the shock caused by the report, was so insignificant that he hoped the use of them would be discontinued. It was as a surprise weapon that Neapolitan brigands and French postillions were armed with whips, the handles of which were cunningly devised and well-hidden pistols.

The culverin or hand cannon was a small tube of ½ or ¾ inch internal diameter, fixed to a straight piece of wood or welded to an iron handle. At the close of the 15th century they were extensively used. In 1471 culveriners were in the army of Edward IV. after his landing at Ravenspur, Yorkshire; and hand firearms were used at the siege of Berwick in 1521. The smallest hand-culverins—about 4 feet in length and weighing 15 lb.—were used on horseback; heavier weapons up to 60 lb. weight were used

by the foot-soldiers. The culveriner was attended by a 'varlet' to aid in firing the piece, which was always supported upon a forked rest. The arquebus

Fig. 5.—Early Hand-culverin.

was a smaller and improved culverin, requiring but one man. Grose writes of the equipment of the culveriner: 'He had, in addition to the unwieldy weapon itself, his coarse powder, for loading, in a flask; his fine powder, for priming, in a touch-box; his bullets in a leathern bag, with strings to draw to get at them; whilst in his hand were his musket-rest and his burning match.'

The touch-hole of the culverin was in late patterns placed in the side, instead of on the top as with cannon, a flash-pan was added, and early in the 16th century the serpentin or lever to hold the burning match was invented, and the match-lock quickly followed. In the best *matchlocks* the flash-pan was covered with a hinged lid, and the serpentin was forcibly thrown upon the touch powder in the flash-pan by a spring; but in the ordinary types the burning slow match was made to descend by pulling the lower end of the serpentin towards the stock. From the matchlock arquebus came the hagbut, hackbutt, hackenbuse, and the musket, which was originally a heavier weapon, and carried a double bullet. These early firearms were loaded with difficulty; at Kissingen in 1636, and at Wittenmergen in 1638, the musketeers fired seven shots in eight hours, which is accounted for by the fact that musketeers were harassed by the opposing cavalry

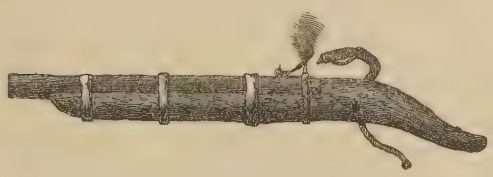


Fig. 6.—Early Matchlock-gun.

and archers, and that the loading had to be effected whilst the forked-rest was attached to the wrist by a short thong, and the soldier 'in skirmish doth charge his musquet afresh, and train his forke or staffe after him.' The matches of slow burning fuse, even when carried in the hat, or in a perforated metal case at the girdle, gave much trouble, especially in wet and foggy weather, and at the battle of Dunbar (1650) the English musketeers were unable to retain their fire on account of the weather. The *wheel-lock* originated from a gun in which pieces of pyrites were placed near the flash-pan, and the igniting spark was produced by the friction of a file rubbed against them. In the wheel-lock the flint is held in the flash-pan by a spring pressing against the opposite extremity of the lever to the one in which the flint is fixed; in the flash-pan is a grooved wheel with serrated edges, which is rapidly rotated by a chain and flat or V spring, or as is the drum of a watch. The wheel was wound up as in a watch, with a movable key, and was released upon the trigger being pulled; its rapid rotation against the flint firmly pressing upon it produced a stream of sparks instantly, and made ignition more certain. The wheel-lock was invented at Nuremberg in 1517, used at the siege of Parma (1521), introduced into England in 1530, and soon firearms were used for sporting purposes.

The *firelock* or flintlock, more common than the expensive wheel-lock, was produced in Spain about 1625, as a cheap substitute for the wheel-lock. In the flintlock the *hammer* or cover-plate to the flash-pan is knocked backwards by the blow of the flint screwed in the jaws of the *cock*, and, uncovering the priming in the flash-pan, exposes the touch powder to the sparks produced by the flint grating against the steel face of the hammer. The early flintlock was clumsy, simple, and inefficient; it is said to have been produced by marauders, to whom the burning match of the arquebus was dangerous as betraying their presence; and, roughly made, it did not answer as a military weapon so

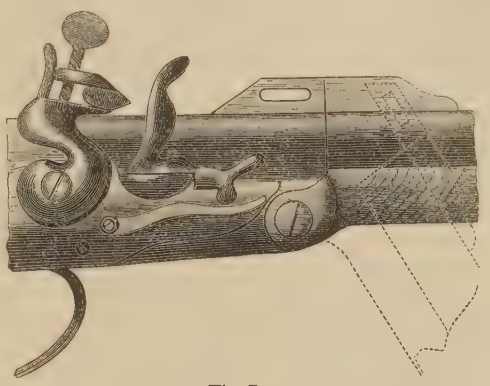


Fig. 7.
French Flintlock Breech-loader, 18th century.

well as the matchlock. Improvements in the latter half of the 17th century caused its more general adoption. It was common in the Netherlands, and was introduced into the English army in the reign of William III., and remained in use until 1840; the last firelocks supplied to the British government were for use abroad, and were made in 1842. The firelock or flintlock musket is still an article of commerce, as it can be used wherever there is a supply of powder and lead. The flint-lock in its highest degree of perfection was manufactured in London as a double sporting weapon at the beginning of the 19th century.

Pistols were developed from the small hand cannon termed 'poitrinal,' and were made in 1540 by Camillio Vittelli at Pistoia. They were used as *concealed* weapons, the German Ritters being the first to adopt them for military purposes. At the battle of Renty in 1554 the Ritters defeated the French through a manœuvre termed 'caracole,' in which the pistols played the most important rôle. The pistols, from having short barrels and heavy, clumsy butts, improved into successful cavalry arms when furnished with wheel-locks, and they were generally adopted as an auxiliary weapon. Double and four-barrelled pistols were common in the 18th century, and the revolving pistol, termed the 'pepper-box,' preceded the introduction of the modern revolver by Colonel Colt (see REVOLVER).

As a triumph of handicraft and exact workmanship the duelling pistol is without a rival, and the twenty-pace pistols firing a large bullet with a small charge of powder, as made in Paris at the present time, are not to be equalled as weapons of precision by any firearm extant. The revolver has superseded the pistol entirely for military and police purposes in civilised countries, but the revolver will in its turn have to make way for a magazine or repeating pistol.

Many of the early cannon hand-forged from rings and bars were breech-loading, the system employed being that of the movable breech-block,

secured in position during the discharge by hammer-driven wedges; or a through pin uniting the block with the breech frame of the cannon. Such weapons date from the 14th century, and similar weapons formed part of the equipment of the *Mary Rose*, which foundered about 1545. Small-arms intended for the use of illustrious persons were occasionally made breech-loading. In the Tower collection is a musket which closely resembles the modern Snider in its breech mechanism, and this remarkable specimen of an efficient breech-loader is said to have belonged to Henry VIII., whilst several other varieties of arms having a movable breech-block were made prior to his reign. Small-arms and cannon with detachable breech-plugs—in which the charge was placed and fired—were made in the 16th century, and before its close breech-loaders with hinged barrels had been introduced. The hinge was usually at the joint, as in the weapon illustrated (fig. 7), and not a couple of inches forward of it, as in the Lefaucheux and other modern developments of the sporting gun. The 17th and 18th centuries were particularly prolific in the production of breech-loading mechanisms, but, owing to the absence of a cartridge containing its own ignition, none were successful until revived after the introduction of the percussion cap.

Amongst the early manufacturers of arms who aided the development by their handicraft or invention the Italian and Spanish smiths deserve mention; the accurately forged barrels of Nicolas Bis, and the fine workmanship on the pistols of the Comminazzo family, cannot be surpassed. Köllner of Vienna, and Kotter of Nuremberg, produced rifling; and Lazarino, Dax, and Nereiter improved the appearance and handiness, and added to the utility of firearms by minor inventions. The wheel-locks were neither manufactured nor used extensively out of Germany and Italy, but the Saxon collection in the Dresden Museum indicates the importance with which the invention was once regarded. The most curious arms were manufactured in Paris, Amsterdam, Hanover, Liége, and Lisbon, and later at the Moscow arsenal.

That necessity is the mother of invention has never been more truthfully demonstrated than by the development of firearms. The wars in Flanders and Germany during the middle ages quickened the genius of their inventors and improved the skill of their armourers; just as the tension in mid-Europe since the war of 1870–71 has given to France and Germany the finest repeating rifles and best artillery; whilst the leisure and taste of the Englishman has called for the finest sporting weapons. The invention of rifling in Germany in the 15th century led to the development of weapons of precision, the highest degree of accuracy being attained by a heavy muzzle-loading small-bore rifle with a high trajectory. The requirements of the military firearm—lightness, ease and quickness of manipulation, extreme range and great velocity, have led to the sacrifice of precision for the advantages possessed by light breech-loading arms (see BREECH-LOADING, and RIFLES).

Of the inventions which have been applicable to all firearms the most important has to do with the *ignition* of the charge of explosive. Fulminating or detonating powders were made by the French chemists of the 18th century; and about 1800 an Englishman, benefiting by their experiments, produced a highly sensitive explosive, composed of fulminate of mercury and saltpetre, which possessed all the requisite qualities of a priming powder for the flintlock firearms. In 1807 Alexander J. Forsyth, a Scottish clergyman, patented the application of the detonating principle for exploding gunpowder in firearms. Many inventors claimed the copper percussion-cap which followed and was first made in England in 1818, its introduction leading to the abandonment of the firelock. The expansive bullet, invented by Greener and improved by Minié, increased the range and accuracy of rifles, and made an accurate breech-loading rifle possible. The cartridge-case containing its own means of ignition, or the percussion-cap, is a French invention improved by Lefaucheux, Lancaster, Needham, Pottet, and others, and to it is due the success of modern breech-loading small-arms, this cartridge-case of solid drawn brass being used for all quick-firing machine guns and some of the smaller cannon. The expansion of the case at the moment of discharge causes it to act as an obturator and block all escape of gas into the breech-loading mechanism, whilst its contraction after firing admits of its being withdrawn with ease.

Sporting firearms consist of the shot-gun and the rifle for large game shooting. The use of hail-shot became general in Germany in the 16th century, and with the introduction of the wheel-lock the use of the arquebus for sporting purposes became more common. The earliest double-barrelled guns were made for military purposes, but sporting guns with two barrels side by side were made in Italy in the 17th century, and the art of shooting on the wing was first practised about 1580. The introduction of better forged barrels in the latter half of the 18th century made a light double-barrelled fowling-piece a possibility, and since then shot-gun barrels made of iron and steel fragments (1798) and twisted scelps (1806) have increased in strength and lightness. Old horseshoe nails and scraps of iron and steel were made into shot-gun barrels; but after 1850 new metal was employed and is now preferred. As the fowling-piece with hand-welded barrels made of twisted rods became more general, the supremacy of continental gun-makers over the English was lessened, and early in the 19th century the improvements made by Manton, Nock, Cook, Egg, and others placed English guns ahead of all competitors. The French invention of composite cartridge-case and breech-loading was turned to practical account by the English, who have unceasingly improved upon the original idea. In addition to the breech-loading mechanism, the shot-gun has been improved in range by the use of choke-boring—i.e. the constriction of the barrel at the muzzle; in safety, by the rebounding lock, which again has been superseded by various hammerless locks, or arrangement of the firing mechanism within the head of the gun; and in self-ejecting mechanism. See BREECH-LOADING; also GUN (Sporting).

The sporting rifle is a type of firearm evolved from the wheel-lock hunting weapons of Germany. Its production is proof of the adaptability of fire-arms to special needs; the desiderata of a weapon for large game hunting include the quick firing of a second shot, and a paralysing effect from the penetration of the bullet. The repeating rifle cannot be twice fired as quickly as the double rifle, and length of range with a light ammunition and continuous quick firing are points sought in a military weapon. Precision is dependent upon the weight of the projectile being sufficient to maintain the direction imparted to it during its passage through the barrel. The bullet is helped to do this by the rifling giving the projectile a rotary motion, which equalises irregularities in the bullet, and lessens its tendency to deflect. The greater the velocity, the less quickly must the rifling turn; but with improved solid bullets, covered with nickel or steel, it is possible to get the bullet to grip the rifling at a velocity of 2000 feet per second, and a complete turn is made in ten inches, in which case the bullet has a double

rotary motion and takes a corkscrew flight. The modern sporting or express rifle, as it is termed, fires a hollow expansive bullet at a high velocity, extreme accuracy and long range being sacrificed for greater force at impact. Firearms are also used for signalling at sea, throwing lines, harpooning whales, and other special purposes.

Modern weapons are conditioned chiefly by the purpose for which they are designed, and further development in any direction is stayed sometimes by one consideration, as increased weight, and in others by the limit of size, cost, or inability to combine with an improvement some essential requirement. Size is usually designated by the calibre, which is the diameter of the bore of the firearm before it is grooved. To obtain the highest results from the full load the length of the barrel must be proportionate to its calibre, and this is usually standardised at 50 calibres. Any hand-firearm must be 100 times the weight of its projectile if recoil detrimental to good shooting is to be avoided ; but with cannon a part can be transferred to the gun-mountings. With big cannon the size is not so often limited by their unwieldiness as by the strength of the material, for the strain at the breech end on firing them causes local expansion, which results in a permanently bent weapon. The weight of a projectile is proportionate to the calibre ; roughly, the cube of the diameter in inches when halved gives the weight in pounds. With rifled small arms, of calibre suitable for the range, it is possible to hit the smallest object visible at any distance, the mean deviation of the bullet being about half the angle at which ordinary eyesight subtends. Standard targets for all distances between 15 feet and 1500 yards are calculated on this basis. Prismatic telescope-sights of low magnifying-power aid vision and render accurate shooting at long distances possible, but military rifles are sighted for shooting up to about 3000 yards. The limit of accurate shooting is ordinarily about a third of the extreme range. Rapidity of fire with machine, repeating, and automatic guns is scarcely limited by the time required for the mechanism to function, but by the heating of the barrel. The multi-barrelled Gatling, a mitrailleuse, has been fired over 1300 times a minute, but the single-barrelled machine-guns when shot at a speed of 500 rounds a minute heat so rapidly that the accuracy of the shooting is impaired, the inner surface of the barrel eroded, and gas escaping into the mechanism causes a jam. In 1912 the Ross-Eley ·280-calibre high-power rifle shot a bullet of 143 grains with a muzzle velocity of 2950 feet per second. A heavier bullet would result in higher pressure, more recoil, and a lower velocity. To get more power the calibre may be increased, but a heavier weapon is then needed. More explosive means a longer cartridge-case or one of greater diameter at the base. With the former, extraction of the fired case would be difficult ; with the latter, extra strain in excess of the present proportion would be transferred from the walls of the cartridge-chamber (barrel) to the breech-bolt, which, together with the whole breech-mechanism, would have to be strengthened and remodelled. In 1915 an explosive was introduced with which in this rifle a muzzle velocity of 3300 feet per second was obtained, and a higher-power weapon resulted. For the capabilities of various weapons, see CANNON, RIFLES, REVOLVERS, &c.

The firearms industry in London dates from 1545, in Birmingham from 1683, but cannon were made there at earlier dates, and at Perugia 500 hand-cannon were made in 1364. Centres of the industry in Europe are Liège, Birmingham, St Étienne, Suhl, Steyr, Brescia, Eibar, and Tula. Sporting weapons are still largely made by hand, military small-arms by machinery on the interchangeable plan originated by Whitney in 1797, followed by Hall in 1818, and in England since 1856. Certain parts are not now made interchangeable, as the breech-bolts of rifles which are 'seated' by pressure.

For the early history of firearms, see *Quellen zur Geschichte des Feuerwaffen* (Leipzig, 1872); Grose's *Military Antiquities;* Wilkinson, *Engines of War* (1841); Greener, *The Gun and its Development* (1910). For modern arms, J. H. Walsh ('Stonehenge'), *Modern Sportsman's Gun and Rifle* (1882-84), and *Weapons of War* (1885). For firearms manufacture, Brandeis, *Moderne Gewehr-Fabrikation;* and Greener, *The Gun.*

PROVING OF FIREARMS, in Law. All weapons manufactured or offered for sale in England must be proved either at one of the government proof-houses in England or at the Banc d'Épreuve at Liége. A royal charter granted in 1637 to the London gunmakers gave them powers to search for and prove and mark all manner of hand-guns, great and small daggs, and pistols. The several statutes of 1813, 1819, and 1855 rendering the proving of firearms compulsory have been superseded by the Gun-barrel Proof Act, 1868 (31 and 32 Vict.), regulating the duties and powers of the proof-houses in London and Birmingham (the only two in England). By this statute the forging or counterfeiting of the proof-marks or stamps is treated as a misdemeanour punishable by imprisonment for not more than two years ; and a fine of £20 is imposed on any person selling or exposing for sale barrels not duly proved, or exporting or importing barrels with forged proof-marks. These penalties are to be levied on conviction before two justices or a metropolitan or stipendiary magistrate. The statute does not extend to Scotland or to Ireland, and arms manufactured for His Majesty are exempted from its operation.

The introduction of new and more powerful explosives and guns of improved types has necessitated changes in the proof-house tests. The most important provides that weapons shall be tested with such explosives and projectiles as those with which they will be charged in actual use. Orders in Council regulate the tests to be applied, and these change as new explosives are introduced.

Fireball is the popular name of projectiles, other than rockets, used for incendiary or illuminating purposes. They are more properly called *carcasses*, or *ground* and *parachute light-balls*. The carcass was a thick shell filled with fiercely burning composition, and having large holes, or vents, out of which it streamed. The ground light-ball was filled with brightly burning composition, and burned on the ground. The parachute shell was fired from a mortar, and fuzed so as to open in the air and support, by means of a parachute packed inside it, a pan of brightly burning composition. The electric light has superseded these last two, and the rocket the first.—For other kinds of fireball, see LIGHTNING, METEORS.

Firebote, the right of a tenant, according to English law, to cut wood on the estate for the purpose of fuel. See ESTOVER.

Fire-brigade. See FIRE.

Fireclay is the variety of clay which is used for the manufacture of firebricks, gas-retorts, crucibles, glass pots, chimney-pipes, and other articles, most of which require to resist the action of high and long-continued heat. Ordinary fireclay is chiefly found in beds not usually much exceeding two feet in thickness, in the coal-measures, interstratified with seams of coal and other rocks. In the British Islands it is most largely worked about Glasgow, Newcastle-on-Tyne, and Stourbridge in Worcestershire, at which last

place it is said to have been discovered about 1555 by some wandering glassmakers from Lorraine. But it occurs, more or less, in most places where true coal is found. It is mined in Germany, Belgium, France, the United States, and other countries. Stourbridge fireclay, owing to its excellent quality, is largely exported to foreign countries, as well as bricks and other objects made of it. Refractory clays are found, though more rarely, in other formations besides the coal-measures. For example, some of Tertiary age found in Dorsetshire and Devonshire are made into firebricks. The following table shows the principal constituents of fireclay:

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Silica	65·10	51·10	59·49	53·52	54·20
Alumina	22·22	31·35	28·95	33·68	33·80
Potash	·18	..	..	trace	trace
Lime	·14	1·46	trace	·76	trace
Magnesia	·18	1·54	..	·14	·02
Oxide of Iron	1·92	4·63	1·05	·52	·01
Water	9·28	10·47	11·05	11·34	10·86
Organic Matter	·58		..	..	·15

No. 1, Stourbridge; No. 2, Newcastle-on-Tyne; No. 3, Gartsherrie, Scotland; No. 4, Poole, Dorsetshire; No. 5, Morgantown, West Virginia, United States. See CLAY.

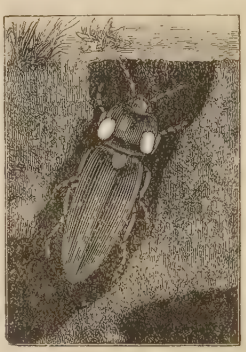
Fireclays from the same locality often differ considerably in their composition and quality. Some of the Newcastle clays, for example, contain from 70 to 80 per cent. of silica with from 9 to 18 per cent. of alumina. A high percentage of silica and alumina together (their relative proportions being comparatively immaterial) and small quantities of alkaline substances and oxide of iron constitute a refractory fireclay. If not small in amount, alkaline bodies in the clay tend to make it easily fusible, so that bricks formed of it are apt to soften and yield in a furnace. Fireclays are generally yellow in colour after being fired in the kiln. No very sharp line of distinction can be drawn between hard infusible clays and softer marly clays used for terra-cotta, garden vases, and some kinds of house bricks. In districts where fireclay is abundant composition bricks for ordinary building purposes are partly made of it. For furnace-building materials which resist the action of a very intense heat, such as dinas and bauxite bricks, see BRICK-MAKING. Powdered flint, as well as chrome iron ore, is likewise used for furnace bricks.

Firedamp is the miners' term applied to light carburetted hydrogen or coal-gas when it issues from crevices in coal-mines (see GAS). These crevices are named 'blowers' by the miners, and are evidently the outlets of gas that exists in a compressed state in pores and cavities in the coal. The issue of the gas is in some cases audible, and on applying a light it burns as a jet of flame. When mixed with air in proportions between $\frac{1}{7}$ to $\frac{1}{16}$ of its volume the mixture is explosive, producing disasters that are too well known. The researches of Galloway and others have shown that the gas is only one of the factors producing the worst catastrophes. A comparatively small explosion of gas stirs up any coal-dust that may be lying on ledges, or on the floor of roads and workings, each particle of dust is fired, and the combined result is like the firing of grains of gunpowder.

Fire-engine, Fire-escape. See FIRE.

Firefly, a name applied to many 'phosphorescent' insects, which are all included within the order Coleoptera, or beetles. Some of them (among the Elaters) give forth a steady light, and these may be distinguished as fireflies proper from the Glow-worms (q.v.) and 'lightning-bugs' (among the Lampyrids), which flash light intermittently. In the phosphorescent Elateridæ, furthermore, the production of light has its seat more anteriorly than in the Lampyridæ, where it is abdominal. As the Lampyrids will be discussed under GLOW-WORM, only the Elaterid fireflies need be noticed here.

The most brilliant fireflies are species of Pyrophorus, most at home in tropical America. One form—*Pyrophorus noctilucus*—common in the West Indies and Brazil, attains a length of about an inch and a half, and has a dark rusty-brown colour. On the upper surface of the first ring of the thorax are two yellowish oval spots, which are brilliantly luminous during the nocturnal activity of the beetle, while on the first ring of the abdomen a still brighter organ is situated. Even the eggs are luminous, and excised portions placed in a damp chamber remain functional for two or three days. The pounded debris of the insect is also luminous. The luminous organs are special modifications of the epidermic (*hypodermis*) cells, which are disposed in two layers, of which the outer alone is luminous, while the inner contains masses of waste products, and is riddled by air-tubes. The luminosity depends on a process of oxidation by a zymase (*luciferase*) in the blood, and the brilliancy varies with the respiratory activity, being apparently only indirectly affected by the nervous system. What the substance oxidised (a protein which Dubois called *luciferin*) really is remains undiscovered. On the sleeping or entirely passive insect a soft light may be observed; the real blaze is only exhibited during active respiration, and may be exaggerated experimentally by blowing in oxygen or supplying an oxidising agent. The function of the light is not understood. It does not seem (as in the Lampyrids) to be sexual.



Common Firefly (*Pyrophorus noctilucus*) in burrow of mole-cricket, showing the two oval phosphorescent organs on the thorax.

The light of these living lamps, or *cucujos*, as the Mexicans call them, has frequently saved a traveller's life; the Indians 'travel in the night with fireflies fastened to their hands and feet, and spin, weave, paint, and dance by their light,' and they are often used for decorative purposes. A few of them in a glass vessel give light enough to read by, and when not wanted for any such purpose they may be set to catch mosquitoes in the house. In Vera Cruz, according to C. F. Holder, the Pyrophori are so commonly used as toilet ornaments that they form an important article of trade. The natives lure them by means of lights waved on the end of sticks, and catch them in nets. 'They are then placed in a box covered with a wire netting, bathed twice a day in tepid water, and at night fed with sugar-cane.'

See GLOW-WORM, PHOSPHORESCENCE; C. F. Holder, *Living Lights* (Lond. 1887); R. Dubois, *Les Élatérides lumineux* (Meulan, 1886); F. F. Moore, *Fireflies and Mosquitoes* (Lond. 1888); K. G. Blair in *Nature*, Dec. 1915; papers quoted by Holder. For a detailed account of the anatomy and physiology of Pyrophori, see C. Heinemann, *Archiv. f. mikr. Anat. XXVII.* (1886), pp. 296–382.

Fire-insurance. See INSURANCE.

Firelock. See FIREARMS.

Firenzuola, AGNOLO, Italian writer, was born at Florence, 28th September 1493. Having studied law at Siena and Perugia, he began to practise as an advocate in Rome. But in a few years he enrolled himself in the monastic order of Vallombrosa.

On the death of Clement VII. he left Rome, and finally became abbot of Prato, where, or at Rome, he died before 1548. His chief works are a spirited paraphrase of the *Golden Ass* of Apuleius, a work in close imitation of the *Decameron*, a eulogistic discussion concerning the charms of the fair sex, a couple of comedies, and some poems. Firenzuola's works are distinguished for the classic elegance of their style, as well as notorious for their licentiousness. The best collected edition is one published at Florence (2 vols. 1848).

Fire-raising, in the law of Scotland, is the equivalent term for Arson (q.v.) in England.

Fire-ship, a vessel, usually an old one, filled with combustibles, sent in among a hostile squadron, and there fired, in the hope of destroying some of the ships, or at least of producing great confusion. Livy mentions the use of such by the Rhodians, 190 B.C. Earliest in modern times, so far as known, they were employed by the Dutch in the Scheldt during the war of independence in the Netherlands, and shortly after by the English, in 1588, against the Spanish Armada. Lord Dundonald (q.v.) employed them against the French in 1809; and the Chinese tried them against the British fleet in 1857. Ships with ballast and combustibles were repeatedly used by the Japanese at Port Arthur in 1904, but rather to block the channel of the harbour when exploded than to damage the Russian ships.

Fireworks. See PYROTECHNY.

Firishta. See FERISHTAH.

Firkin (dim. from *four*), an old measure of capacity containing 9 gallons (old ale and beer measure). But previous to the year 1803 it had two values, being estimated at 8 gallons in old ale measure, and at 9 in old beer measure. The firkin is equivalent to $9\frac{1}{7}$ imperial gallons. The name is also applied to a small wooden cask, as for butter. This contains 56 lb.

Firlot (from *four*), an old Scottish dry measure, of which there were four in a Boll (q.v.). Though differing in value for different substances and places, its relation to the boll remained invariable. See PECK.

Firm. See PARTNERSHIP.

Firmament, a word formerly used to signify the vault of heaven. The term found its way into English from the Vulgate, which renders the Septuagint *stereōma*, and the Hebrew *rakia*, by the Latin *firmamentum* (Gen. i. 6). Rakia (from the verb *raka*, 'to beat or strike out') signifies whatever is expanded or stretched out, and was specially employed by the Hebrews to denote the hemisphere above the earth, compared (Exod. xxiv. 10) to a splendid and pellucid sapphire. Elsewhere (Ezek. i. 22–26) it is spoken of figuratively as that on which the throne of the Most High is placed. Hence it follows that the notions of solidity and expansion were both contained in the Hebrew conception of the firmament. The blue ethereal sky was regarded as a solid crystal sphere, to which the stars were fixed (compare the *cælo affixa sidera* of Pliny, ii. 39 and xviii. 57), and which was constantly revolving, carrying them with it. This sphere or firmament divided 'the waters which were under the firmament from the waters which were above the firmament;' and the theory of the phenomena of rain, &c. was that there were 'windows in heaven'—i.e. in the firmament, through which, when opened, the waters that were above the firmament descended. 'The same day were all the fountains of the great deep broken up, and the windows of heaven were opened' (Gen. vii. 11). The view entertained by the Greeks and other early nations was essentially the same. In the progress of astronomical observations it was found that many of the heavenly bodies had independent motions, inconsistent with the notion of their being fixed to one sphere or firmament. Then the number of crystalline spheres was indefinitely increased, each body that was clearly independent of the rest having one assigned to it, till a complex system was introduced, capable of being fully understood only by the philosophers who formed it (see PTOLEMAIC SYSTEM). It was long before men conceived the idea of the possibility of a body being maintained in motion in space without a fixed support, and, considering the number of phenomena of which the hypothesis of a crystalline firmament offered an apparent explanation, we must regard it as having been in its day a curious and ingenious speculation.

Firmân, a word of Persian origin, signifying an order, and used by the Turks to denote any official decree emanating from the Ottoman Porte. The right of signing any firman relating to affairs connected with his special department was exercised by every minister and member of the divan, but the office of placing at the head of the firman the *tughra*—a cipher, or monogram, containing the names of the sultan and of his father in interlaced letters, which alone gave effect to the decree—was committed to the hands of a special minister, called *nishânji-bashi* (see S. Lane-Poole, *Turkey*, in the 'Story of the Nations' series). The name applied to such decrees as had been signed by the sultan himself is *hatti-sherîf* (properly *Khatt-i sherîf*). The name firman may also signify a more formal kind of Turkish passport, which was granted by the sultan or by a pasha.

A written permission to trade is called in India a firman.

Firminy, a town in the French department of Loire, 9 miles SW. of St Étienne by rail. Near it are rich coal-mines; and railway material, big guns, and other iron goods are manufactured in large quantities. Pop. 20,000.

Firn (Ger., 'last year's'), snow in process of consolidation into glacier-ice; in French *névé* (Lat. *nix, nivem*, 'snow').

Firozabad, a town of India, United Provinces, 24 miles E. of Agra, with numerous ruined buildings; pop. 13,500, about two-thirds Hindus.

Firozpur, or FEROZEPORE, a town in the Punjab, $3\frac{1}{2}$ miles from the left or south-east bank of the Sutlej. Founded, it is said, by Firoz Shah (1351–87), and at one time a large and important town, it had sunk into poverty and insignificance before it actually came, in 1835, into the possession of the English. Since then the place has regained much of its former consequence, and it possesses the largest arsenal in the Punjab. It contains a church built in memory of those who fell in the Sikh wars (1845–46). Pop. 50,000, of whom about half are in the cantonment 2 miles south.—Firozpur district has an area of 4300 sq. m., and a pop. of a million. Much has been done, since British occupation, to increase the value of this once dreary and desert plain, by tree-planting and otherwise, and now most of the district is under cultivation.

Firozshah, a battlefield in the district of Firozpur, 12 miles from the left bank of the Sutlej, the scene of the attack of the British forces, led by Sir Hugh Gough and Sir Henry Hardinge, on the Sikh camp, 21st December 1845. The entrenchments were carried and the natives routed after two days' fighting.

First Aid. See AMBULANCE, BANDAGE.

First-born (Heb. *bekor*, Gr. *prōtotokos*, Lat. *primogenitus*), in scriptural use, signifies the first

male offspring, whether of man or of other animals, due to the Creator by the Mosaic law as a recognition of his supreme dominion. The first-born male, whether of men or of animals, was devoted from the time of birth to God, and the first-born male child had to be redeemed one month after birth by an offering not exceeding in value five shekels of silver (Exod. xiii. 13), provided the child lived longer than that period. The first-born male of animals also, whether clean or unclean, was equally regarded as devoted to God; that of clean animals, if free from blemish, was to be delivered to the priests within twelve months after birth, to be sacrificed to the Lord; nor was it permitted to any but the priests to partake of the flesh of such victims. If the animal were blemished, it was not to be sacrificed, but to be eaten at home. The first-born of unclean animals, again, was either to be put to death or to be redeemed with the addition of one-fifth of its value; if not redeemed, to be sold, and the price given to the priests. By the Mosaic law primogeniture had certain privileges attached to it, the chief of which were the headship of the family and a double portion of the inheritance. Among other nations considerable variety existed as to the succession of children to the inheritance of their parent, for the discussion of which see the articles ENTAIL, FAMILY, FEUDALISM, LAND-LAWS, and SUCCESSION.

First-fruits (Heb. *reshith;* Gr. *prōtogennēmata*, and *aparchai;* Lat. *primitiæ*), that portion of the fruits of the earth and other natural produce which, by the usage of the Jews and other ancient nations, was offered to God as an acknowledgment of his supreme dominion, and as a thanksgiving for his bounty. Among the Jews the institution of first-fruits comprised both public and private offerings. Of the former the three principal were made at the opening of the corn-harvest, at the Feast of Pentecost, and at the Feast of Tabernacles. The private offerings made by individual Jews were a cake of the first dough of the year and the 'first of all the fruits.' All these offerings were divided into two classes: *Bicurim*, comprising the various kinds of raw produce, of which, although the law seems to contemplate all fruits, seven sorts only were considered by the Jewish doctors to fall under the obligation of first-fruit offering—viz. wheat, barley, grapes, figs, pomegranates, olives, and dates; and *Terumoth*, or the produce of the year in the various forms in which it is prepared for human use, as wine, wool, bread, oil, date-honey, dried onions, and cucumbers.

Offerings analogous to the Jewish first-fruits became usual very early in the Christian church, as is clear from a passage in Irenæus, but appear to have been merged in the legal provision established by the emperors. The medieval ecclesiastical impost known under the name of *primitiæ* or first-fruits, and sometimes of *annates* or *annalia*, was entirely different. See ANNATES.

First of June. See HOWE (RICHARD).

Firth, or FRITH, an estuary, from the same root as *ferry;* Dan. *fiord;* akin to Lat. *portus*, and Gr. *porthmos*. For the fiords, see NORWAY.

Firth, MARK (1819–80), born in Sheffield, in 1849 with his father and brother established there the great Norfolk steel-works, whose specialty soon became the manufacture of steel ordnance. He was a munificent benefactor to his native town, his gifts including almshouses (1869), a public park (1875), and the Firth College (see SHEFFIELD).

Fisc (Lat. *fiscus*, 'a wicker-basket'), an old term for a prince's treasury. The word 'fiscal' is a derivative; as also Procurator-fiscal (q.v.).

Fiscal Question. See FREE-TRADE, PROTECTION.

Fischart, JOHANN, one of the most original German satirists, known also under the name of Huldrich Elloposkleros, was born either at Mainz or Strasburg, about the middle of the 16th century. He was brought up at Worms, studied law at Strasburg, became in 1581 advocate to the Imperial Chamber at Spires, and in 1585 bailiff of Forbach near Saarbrücken, where he died in 1590 or early in 1591. Of the very numerous writings which appeared from 1570 to 1590, partly under his own and partly under fictitious names, about fifty have been proved to be on the whole genuine, though disfigured by interpolations. In respect to others, however, the authorship is doubtful. His most celebrated works are based on foreign models, particularly Rabelais, but manifest no servile imitation: a free creative genius everywhere works plastically on the materials. To this class belong his *Aller Practick Grossmutter* (1572); *Affentheurliche Geschichtschrift vom Leben der Helden Grandgusier, Gargantoa und Pantagruel* (1575); *Podagrammisch Trostbüchlein* (1577); and *Bienenkorb des Heyligen Römischen Imenschwarms* (1579). These writings are wholly satirical. With the most inexhaustible humour he lashes, now the corruptions of the clergy, now the astrological fancies, the dull pedantry, or other follies, public and private, of the time. Next to these stands the outrageously comic work of Fischart's—quite original in its conception—entitled *Flöhhatz, Weibertratz* (1573). Essentially different in its homely and simple tone is *Das glückhafft Schiff von Zürich*, written in verse, and published in 1576. Similar in point of style are his *Psalmen und Geistliche Lieder* (1576). The rest of Fischart's numerous writings, partly in prose, partly in verse, are of unequal merit, singularly varied in style and contents; but throughout all we find the same rich satirical humour, the same warm and genuine feeling for the moral foundations of all public and private life—religion, fatherland, and the family. His works are, moreover, one of the richest sources for the manners of his time. In his treatment of the language no German author can be compared with Fischart, not even Jean Paul Richter himself. He coins new words and turns of expression without any regard to analogy, but nevertheless displays the greatest fancy, wit, and erudition in his most arbitrary formations.

See Vilmar, *Zur Litteratur J. Fischarts* (2d ed. 1865); Von Meusebach's *Fischart-studien* (edited by Wendeler, 1879); and Ganghofer, *Johann Fischart und seine Verdeutschung des Rabelais* (1881).

Fischer, EMIL, organic chemist, was born at Euskirchen, Rheinland, 9th October 1852. He studied at Bonn and Strassburg, assisted Von Baeyer at Munich for eight years, and was professor at Erlangen (1882), Würtzburg (1885), and Berlin (1892), where he raised the chemistry school to the highest repute, and where he died, 15th July 1919. He undertook successfully the solving of problems of extreme difficulty and complexity in organic chemistry. He studied especially the rosanilin dyestuffs, uric acid and allied substances, with their base purin (which he obtained), and especially the carbohydrates and ferments, and the proteins. He succeeded in preparing many organic substances synthetically. He was awarded a Nobel prize in 1902.

Fischer, ERNST KUNO BERTHOLD, the son of a country pastor, was born in the Silesian village of Sandewalde, 23d July 1824. From the Posen gymnasium he passed to the university of Leipzig, where he attended lectures on philology and theology; but after his first session he went to Halle, and here, under the influence of Erdmann and Schaller, becoming interested in philosophy,

he resolved to devote himself to this as his life-study. He took his Ph.D. degree in 1847, and in 1850 established himself at Heidelberg as a *privatdocent* of philosophy. His eloquence and his poetical sympathies, in addition to his actual knowledge of philosophy, now stood him in good stead. Students came in flocks to hear him, and his enormous popularity, resulting from his enthusiasm, deep insight, and clearness of exposition, increased steadily. Suddenly, however, in July 1853, presumably because of private charges of pantheism made against the first volume of his *History of Modern Philosophy*, the Baden government without any explanation deprived him of his position as privatdocent. During three years of academic exile that followed, Fischer lived quietly with kindred spirits amid the beautiful surroundings of Heidelberg, and continued meantime to work at his History, publishing between 1853 and 1856 the volumes on Spinoza, Leibnitz, and Bacon. In 1856 he received a call to Fichte's old chair of philosophy at Jena; and in Jena he laboured for sixteen years. At last, in 1872, when Eduard Zeller succeeded Trendelenburg at Berlin, Fischer —all practical difficulties in connection with the freedom of lecturing having now disappeared— obtained Zeller's post at Heidelberg. He resigned in 1906, and died 4th July 1907.

Fischer's chief work is his great history of modern philosophy, *Geschichte der Neuern Philosophie* (1852–93). His historical books seek to do for modern philosophy what Zeller's do for old-world systems. His other great philosophical achievement is his *System der Logik und Metaphysik* (1852; new ed. 1865), in which, while he adheres in the main to Hegel's position, he yet criticises Hegel severely on many important points. Of his other philosophical writings the most noteworthy is a *Critique of Kant*, which, like *Bacon* and *Descartes and his School*, has been translated into English. Other works deal with Goethe (1878–1904), Lessing, Schiller, Shakespeare's *Hamlet* (1896), and the history of Heidelberg. See a monograph by Falkenheim (1892).

Fish, HAMILTON, American diplomatist, was born in New York city in 1808, graduated at Columbia, and was admitted to the bar there in 1830. A Whig in politics, he was elected a congressman in 1842, lieutenant-governor of the state in 1847, and governor in 1848. In 1851 he was returned to the United States senate, where he acted with the Republican party. He was secretary of state under Grant from 1869 to 1877, signing, as one of the commissioners, the Washington Treaty of 1871, and carrying through the settlement of the Alabama Question (q.v.). He retired in 1877, and died 7th September 1893.

Fish. See FISHES, ANGLING, FISHERIES, PISCICULTURE.

Fisher, a kind of Marten. See PEKAN.

Fisher, ANDREW, Australian statesman, was born at Crosshouse, near Kilmarnock, 29th August 1862. After working as a miner, he went to Queensland in 1885, sat in the Colonial and Commonwealth parliaments, was Commonwealth minister for trade and customs (1904), and leader of the Federal Parliamentary Labour Party (1907). He was prime-minister in 1910–13, 1914–15, but resigned to become High Commissioner for Australia in London (1916–21).

Fisher, HERBERT ALBERT LAURENS, historian and statesman, born in London, 21st March 1865, was educated at Winchester, Oxford, Paris, and Göttingen. He delivered lectures, served on royal commissions, contributed to the *Cambridge Modern History*, wrote a life of F. W. Maitland, books on Napoleon and other subjects of European and English history, and in 1912–16 was vice-chancellor of Sheffield University. From 1916 he sat as a (Coalition or National) Liberal for Sheffield (Hallam) and for the combined English universities. He was president of the Board of Education in 1916–22. For his Act of 1918, see EDUCATION.

Fisher, JAMES. See UNITED PRESBYTERIAN CHURCH.

Fisher, JOHN, Bishop of Rochester, was born about 1469 at Beverley, Yorkshire, and in 1483 entered Michael-house, Cambridge, of which he became a fellow in 1491, and master in 1497. In 1502 Margaret, Countess of Richmond (1443–1509), Henry VII.'s mother, was led by his virtues and learning to make him her chaplain and confessor; and in 1503 he was appointed first Lady Margaret professor of Divinity. Next year he was elected chancellor of the university, and consecrated to the see of Rochester. Thirty years he laboured diligently for the welfare of his diocese and university. A friend of More and Erasmus, a man who at forty-six began Greek, at fifty Hebrew, he zealously promoted the New Learning, and advocated reformation from within; as zealously both by voice and by pen he resisted the Lutheran schism. So early as June 1527 he pronounced firmly against the divorce of Henry VIII.; and having lent too ready an ear to the 'revelations' of the Holy Maid of Kent, Elizabeth Barton (q.v.), in March 1534 he was attainted of misprision of treason, and next month, for refusing the oath of succession, was sent with More to the Tower. In May 1535 the new pope, Paul III., made him a cardinal; Cromwell told it to Henry. 'Yea,' said the king, 'is he yet so lusty? Well, let the pope send him a hat, but I will so provide that he shall wear it on his shoulders, for head he shall have none to set it on.' He kept his word. On 17th June the old man, worn by sickness and ill-usage, was tried for denial of the king's supremacy; on the 22d, still cheerful and courageous, he was beheaded on Tower Hill. His head was fixed on London Bridge; his body was ultimately buried in the chapel of St Peter in the Tower. In 1886 he was beatified. See Life by Bridgett (1888).

Fisher OF KILVERSTONE, BARON (SIR JOHN ARBUTHNOT FISHER), G.C.B., O.M., admiral and naval administrator, was born 25th January 1841. Entering the navy in 1854, he served in the Crimean war, in the China war of 1859–60, and in Egypt in 1882. He was Director of Naval Ordnance 1886–91; Admiral Superintendent at Portsmouth 1891; Controller of the Navy; a Lord of Admiralty 1892–97; Commander-in-chief on the North American and West Indian Station 1897–99, on the Mediterranean Station 1899–1902; Second Sea Lord 1902–3; Commander-in-chief, Portsmouth, 1903–4; First Sea Lord 1904–10; Admiral of the Fleet 1905. He carried out—not without fierce opposition—many revolutionary changes in naval organisation, such as the Dreadnought policy, ruthless scrapping of old ships, and sacrifice of tradition for efficiency in dealing with personnel or other matters. He returned to the Admiralty as First Lord on the outbreak of the Great War, but disagreed with Mr Churchill over the Dardanelles expedition, and resigned in 1915, but continued to give help to the Admiralty as Chairman of the Inventions Board. He wrote *Memories* and *Records* in 1919, and died 10th July 1920. His often-repeated cry of 'Sack the lot' expresses his method and personality and exemplifies his literary style, but gives a very inadequate notion of his achievement. See NAVY.

Fisheries include all operations for the taking of aquatic animals, not only fishes proper, but shellfish (molluscs and crustaceans), whales, seals

turtles, trepang, sponges, coral, and whatever else man finds a use for. They have been, and are, an important source of food and other things of value from Palæolithic times, and in all parts of the world where fish are found; and a vast variety of methods could be enumerated. Besides trawls, drift-nets, seines, and other nets described below (see also NETS), hooks and gorges (see ANGLING, FISH-HOOKS), and traps such as the lobster-pot, fish can be taken (not everywhere legally) by hand (tickling, gumping, guddling); by tame cormorants, as in China; by poison, explosives, arrows, tridents, including the leister, with which salmon used to be caught, and spears. The whaler's harpoon is but a development of the barbed spear of primitive man. For fishing as a sport, see ANGLING. For the law, see POACHING, SALMON. For the cultivation of fish, see PISCICULTURE.

Nearly all the most important marine fish on the coasts of Europe and North America are valuable as food, some being held in great estimation as delicacies by the rich, others forming a staple food of the poor. The chief exceptions are the dog-fishes, which are extremely abundant and at the same time of no value as food, although they are occasionally eaten in some places on the coast. The other most valuable marine animals on the European coasts are the lobster, crab, crayfish, shrimps, and prawns among Crustacea, and certain molluscs, chiefly the oyster, though mussels, clams or scallops, and whelks are of some value. Except in extensive fresh-water lakes, true fresh-water fishes are of minor importance, but there are several valuable 'anadromous' fish which ascend rivers to a greater or less distance. The most important of these are the salmon and sea-trout, but the smelt and shad are abundant in some estuaries of Europe, and another species of shad (*Clupea sapidissima*) is abundant and highly valued in America. Eels also are largely eaten in Europe, and the sturgeon, though rare in Britain, is abundant in some large rivers of the Continent.

The geographical position of the British Islands, and the wide maritime influence which, as a people, we enjoy, have brought about great opportunities of fishing. Our sea fisheries are not by any means confined to the immediate neighbourhood of our coasts. For many years the greater part has been carried on in waters equally open to the fishermen of other nationalities, and not a little fishing has taken place off the coasts of other countries. The fish captured by men sailing from our shores are of unsurpassed quality; and the competition in the fishing, keen as it is amongst the various classes of fishermen, is shared by men of half-a-dozen other European countries. The actual numbers of fish landed slightly declined, in spite of the fact that the catching-power of the country was greatly increased. Since, however, there was an increase in value, this told the less upon the fishermen; but serious depression followed the Great War.

The great increase in the catching-power has come since the introduction of steam in fishing operations. With the increase in size and general efficiency in the vessels employed, also, more distant grounds can be explored, and have been explored, because the home waters have become almost insufficient to maintain the large fishing fleets. In this way the Dogger and Great Fisher Banks of the North Sea have become relatively less important. The German, Danish, and Norwegian coasts have been regularly visited, and Iceland has become an established locality. In a southern direction, also, trawlers have tried the deep waters of the Bay of Biscay, and the coasts of Spain, Portugal, and Morocco.

Maritime wars introduced much diversity of claim respecting neutral waters and territorial limitations. To go no farther back than the American war of 1775, it may be stated that a train of sea-fights with France, Holland, and Spain followed. Treaties and decrees with respect to territorial limits followed the sea-fights, and the general result arrived at was that a cannon-shot determined the range of a country's influence from her coast. This interpretation was finally adopted by the great powers in international treaties, although Spain established in 1784 a ten-league limit, which is equivalent to a distance of about thirty-four English miles, in a fishery treaty between Great Britain and Spain concerning fishing in certain waters of the Pacific. This was in order to prevent illegal trading with the Spanish settlers at Vancouver. Similarly, in the North Sea a limit of one sea league, which was applied for purposes of neutrality, came to be applied early in last century for fishery purposes by Norway and Denmark, without reference to the distance of cannon-fire. The league of these Scandinavian countries, moreover, is reckoned as the fifth of a degree, or four miles, and is measured not from low-water mark, but from a line drawn across from the outermost points of outlying islands, an extensive sea area being thus frequently included.

Territorial limits for fishery purposes were for some years in a very unsatisfactory state, and no very safe guide could be obtained for the prevention of injury to the fishing-gear of vessels working in the North Sea. At the instance of the British Government, however, a definite inquiry was set on foot to ascertain the actual conditions which had to be met, and a conference was assembled at The Hague in 1881 to deal with this question from the international standpoint. As a result, the North Sea Convention of 1882 now fixes the limits for the signatories of the convention—viz. Great Britain, Germany, France, Belgium, Denmark, and the Netherlands. The article as finally agreed upon reads as follows: 'The fishermen of each country shall enjoy the exclusive right of fishery within the distance of three miles from low-water mark along the whole extent of the coasts of their respective countries, as well as of the dependent islands and banks. As regards bays, the distance of three miles shall be measured from a straight line drawn across the bay, in the part nearest the entrance, at the first point where the width does not exceed ten miles. The present article does not in any way prejudice the freedom of navigation and anchorage in territorial waters accorded to fishing-boats, provided they conform to the special police regulations enacted by the powers to whom the shore belongs.'

Denmark still clings to her measurement of one league so far as her Baltic coast is concerned, but in the matter of Iceland and the Färöes she agreed to the three-mile limit. The only country which did not join in the convention, although the representatives were present at the final deliberations, was the then united kingdom of Norway and Sweden.

Some mention has also to be made of foreign trawlers. With the establishment of the three-mile limit, and the prohibition, applicable only to British vessels, against trawling in the Moray Firth, the curious anomaly arose that, while foreign trawlers could not fish within three miles of the coast, they could fish, or apparently could fish, outside the three-mile limit, but inside the limits forbidden to British vessels. The Moray Firth in this way became almost a sort of preserve for German trawlers, to the great indignation of our own men. To mitigate in some measure the evils an act was passed, called the Trawling in Prohibited Areas Prevention Act, 1909. The object was to exclude foreign trawlers from working in waters *intra fauces* of Scotland, and its application extended to the whole of the United Kingdom. The provisions

of the Herring Fishery (Scotland) Act, 1889, which rendered illegal the landing or sale in Scotland of any fish taken by trawlers in prohibited areas, were incorporated. It had become evident that, to secure a benefit from the anomalous conditions indicated, a considerable number of English trawlers were registered under the Norwegian flag, and, with one or two Norwegian members of the crew to keep up the fiction, were boldly fishing where more straightforward Britishers were prohibited. The act, therefore, struck at these pseudo-Scandinavian trawlers, and in this particular it answered its purpose fairly well; but the general benefit was diminished by an almost corresponding increase of *bonâ fide* foreign trawlers who did not require to land their fish in any British port.

Trawling.—It was about the year 1878 that steam first came into use for propelling fishing-vessels, and the developments which followed from this were rapid. Trawling had up till then been practised by sailing-vessels, many of them able boats rigged as ketches, and being of 30 to 40 tons burden. Not only was the vessel propelled by steam, but the trawling gear was raised by steam. The net was the beam trawl, which was dragged along the bottom of the sea. This net was shaped as a long tapering pocket, the meshes being smaller at the tapering end than elsewhere. The tapering end, or 'cod end,' was not closed, but, before the operation of fishing began, was firmly tied up. The mouth of the net was extended by means of the long heavy beam, and the beam had at each end a large iron 'head' or runner, so shaped as to slide along the sea-bottom, carrying the beam at a height of about 4½ feet. The bridle coming from the steel-wire cable was attached to the iron trawl-heads. The upper part of the mouth of the net was attached closely to the beam, but the part which came to the ground, and which was weighted, and termed the ground or sole rope, was considerably longer than the beam. The result was that when the net was fishing the ground-rope swept the bottom in a long curve, while the beam and attached upper net had already passed over the ground stirred. The practice commonly was to drag the net for about six hours; and as each trawler carried two nets, one on each side of the boat, one net went down when the other came up. The intervals between hauls were occupied by sorting out the fish, packing, rearranging the gear, and in snatching meals or sleep. Operations went on day and night, and almost in any weather.

This system of trawling goes on still, but an almost universal change in the make of the trawl-net has been adopted. Instead of the beam trawl, the net now used is the otter trawl, so called from the manner in which the mouth is kept extended. The old trout-poacher's 'otter' board is weighted along one edge, so that it floats edge up. One man sails it into the loch to be fished, while his accomplice gently pulls upon a line attached by a traveller to the side of the board. To the line fly-hooks are attached at intervals. When the pull comes upon the line, the board glides outwards at an angle away from the man pulling. The same principle has been adopted in the otter trawl. There is now no beam or iron heads, but, in place of these, an otter-board is placed at each side of the mouth of the net, and to this otter-board the bridle from the cable is attached. Each board, when the pull comes upon the bridle, tends to fly outwards from the centre of the net-mouth, and in this way a sufficient strain is kept to hold the mouth open. With the removal of the beam and iron heads the gear is now much lighter to work, and, there being no difficulty about the longest possible beam which can be brought to the rail of the vessel, the otter trawl is much larger than the old beam trawl could be. It has been estimated that the modern otter trawl, worked by a modern steam-trawler, is eight times as efficient as a catching engine as the old beam trawl used to be. This naturally makes a vast difference in the results of trawl-fishing in certain localities.

Other methods of fishing have become rather more attractive or remunerative, but trawling-vessels themselves are becoming more powerful and more efficient in every way.

In the general competition of this branch of the industry a new system of organising operation in trawling has also come about. This is known as the fleeting system, since vessels are organised in fleets. In the early days of English trawling the sailing-vessels employed worked singly, the crews being exclusively interested in their own catches. After about a day and a night's fishing the vessel returned to land her fish. The practice of taking out ice and, in some cases, of cleaning the fish caught lengthened to a considerable extent the time during which it was possible for a trawler to remain at sea; but if no very great success attended a boat's fishing, the skipper had inevitably to choose between going to other grounds on the chance of filling up a cargo, and thus taking the risk of the fish already caught going stale, or of returning with a short catch.

To equip steam-vessels properly involved considerable capital, and companies began to be formed owning several vessels. From Grimsby and Hull especially large companies sprang up. The next step was the natural one of arranging to keep the fleets of vessels at sea for considerable periods, and to have special carrying vessels told off to bring the fish to market. The operation of transferring boxes of fish from one vessel to another in a rough sea is not always an easy matter; and it commonly happens that the vessels dare not go alongside each other for fear of damage, and the boxes of fish have to be put overboard from the trawler and hauled to the carrier, somewhat after the fashion in which warships are now enabled to coal at sea, even under way.

To save expense of coal the carriers commonly sail to the nearest ports, but the marketing of the fish is largely regulated by the considerations of prices and transport on land. London being, of course, the great objective, Grimsby, with its splendid docking accommodation and easy access to the chief fishing-banks of the North Sea, has held undisputed first rank as the trawling centre.

Catches made far north, as round Iceland, are commonly landed at Aberdeen; but many Grimsby trawlers consider the distance between Aberdeen and home insignificant, and steam on to the southern port.

From the south of England trawlers have explored the waters of west France, the Bay of Biscay, and even the coasts of Spain and Portugal, but in experience these southern grounds have not been found to be so good as the colder waters of the North Sea.

The development in the north, the Iceland and Färöe fishing, brought halibut and skates of huge proportions to the 'pontoon' of Grimsby and the fish-market of Aberdeen. A wide region was thus brought under constant toll for the markets of the country; and to comprehend the never-ceasing abundance of our fish-supply in these demersal fishes alone, apart altogether from the separate, and even larger, industry of the herring-fishing, one has to view the early morning display on the quays of our principal fishing-ports; the crowd of vessels; the busy throng of grimy men, strong from the breath of the sea, as they swing their catches ashore; the constant hustle of those who arrange the lots for purchase, or remove them after sale;

the auctioneers, after the ringing of a bell, rapidly mounting a fish-box and disposing of the lots to the surrounding crowd of buyers; the same scene repeated at many points simultaneously. One has to realise that this goes on every morning, and that the signs of it have almost vanished before many people are well out of bed. Incredible numbers of fish are purchased daily—haddocks, cod, ling, whiting, saithe, torsk, conger, hake, halibut, plaice, soles, lemon soles, flounders, dabs, witches, turbot, brill, skates and rays, gurnards, and many commoner sorts.

In England, although the fleeting system is in full force, there are still a large number of sailing-trawlers. Indeed, the economy of the sailing-vessel is sufficiently marked to make the sacrifice of mobility worth while. The sailing-drifter—i.e. the herring fishing-boat—is rapidly declining in both England and Scotland.

Line-fishing.—Another method of taking bottom-feeding fish is lining—that is, the sinking of lines, sometimes as much as seven miles long, to which at intervals short lines (two or three feet) bearing baited hooks are attached. The lines are commonly shot at night, and their position marked by buoys, so that they can be picked up next morning. Time was when a large industry was carried on by line-fishing off the east coast of Scotland, and the industry is still well in evidence, but it has largely given place to a system of fishing herring all the year round. Formerly a crew used to fish lines at one part of the season, and nets for herring at another. With the power of going to greater distances, however, the practice has steadily grown of following the herring wherever the herring is to be found. Mussel-scalps are in consequence largely now left to themselves, as the need for bait is by no means so great as it was.

Demersal and Pelagic Fish.—Fish that live mainly on the sea-bottom, and are taken by trawlers and liners as opposed to herrings, mackerel, and other 'pelagic fish,' and to shellfish, are called 'demersal fish.' Of these there are various subdivisions, and the term 'prime fish' is meant to include soles, turbot, and brill. Of other demersal fish, haddocks, cod, and plaice give greatest total weights. Important also in the markets are hake, dabs, coalfish or large saithe, skates, and ling, mentioned approximately in descending order.

The trawler catches the greatest number of haddocks. The destruction of the haddock was at one time laid to the charge of the trawler, but time has repeatedly shown the singular fluctuation in the catch of this species; indeed, on the east coast of Ireland haddocks had almost disappeared before trawlers came to that locality; and after the trawlers had been at work for some years, the catch of haddocks again became good.

The plaice is the most numerous flat-fish, and that which is generally represented by the highest total weight. Nevertheless a great development has come about in the catch of halibut by steam-liners.

The catch of turbot shows a steady decline, and many of the fish landed are so small that they cannot have reproduced their species before being caught.

It has been by the development of trawling that the much-prized sole has been introduced to the English market. This fish is not captured by other means, nor is it captured to any extent in Scottish waters. All other bottom-feeding fish are also taken by the trawler, so long as the fish are from a bottom suitable for the working of the trawl-net, for this method cannot be employed on hard, rocky bottoms.

Of 'pelagic' fishes—those that habitually swim near the surface—the most important are the herring, the mackerel, the pilchard, and the sprat. These are taken mainly by drift-nets, to some extent by seines; but during the season herring and mackerel are also trawled.

Drift-fishing.—Drift-nets are oblong nets fastened together in a long series, buoyed above so as to float vertically in the sea. The series of nets, or 'fleet,' as it is called, is fastened at one end by a rope to the boat from which it is worked, and nets and boat 'drift' or 'drive' with the tide. The nets are shot at right angles to the current of the tide, and the fish strike against them. Their heads passing through the meshes, the fish can neither swim forwards, because their bodies are too large to pass through, nor backwards, because their gill-covers are then caught by the string of the net. The nets used for herrings and pilchards differ only in the size of the mesh. For herrings they have 30 to 32 meshes to the yard; for pilchards, 36 to 38. They are supported by a rope along the upper edge, and when shot are connected by tying the ends of these ropes together, and along this rope pieces of cork are attached to keep it uppermost. To the same rope, at each end of each net, are attached bladders of considerable size by means of a few fathoms of strong line. As these buoys float on the surface of the water, the nets are suspended below at a distance depending on the length of the buoy-lines, and varying according to the depth at which the fish are expected to occur. Mackerel-nets have a larger mesh—25 or 26 to the yard—and are worked differently. The 'back' of the nets is kept at the surface, floats being fastened directly on to it, and a separate rope, called the 'foot-line,' is connected to the 'back' of each net by a long connecting-line. The foot-line therefore sinks to some distance below the bottom of the nets. The reason for this is that mackerel usually swim quite near to the surface, and as the line running along the 'back' is liable to be broken by passing vessels, it is necessary that the nets should be attached to the foot-rope, which sinks to a safe distance, and by which the nets are hauled in. The seine is a single, continuous net, with a cork-line above and a leaded line below, attached at each end by means of these lines to a long rope. In Britain the seine is always worked from the shore. It is shot from a rowing-boat in a large semicircle, and then by means of the two end ropes is hauled on shore, or the ends are brought together so as to enclose the fish.

In drift-fishing, as in trawling, great changes have occurred. The magnificent fleets of sailing-boats may be said still to exist, but herring-fishing is now best carried on by means of the steam-drifter, while there can be no doubt that the motor-engine has come to stay. Steam-drifters were, as first used, merely seaworthy wooden boats of the approved type fitted with steam-engines. In recent years all the best drifters have been of steel. Before steam was introduced to propel these herring-boats it was very largely used for hauling the nets. All the large Zulu boats of 60 feet length had their steam-capstans. The motor-engine with paraffin fuel came into use in the year 1901. At first the motors were auxiliary to sails. For use in the larger class of fishing-vessel, and especially in the herring or mackerel drifter, the motor has certain advantages, in that the engine takes up little room, coal-bunkers are dispensed with, fuel is not burnt when the boat lies at her nets, since the engine can be started up at short notice. It appears more and more evident that fishermen will not be content with a motor-engine as a mere auxiliary to a sailing-boat for use in calms. If a motor-engine is installed, it must be capable of driving the boat in all weathers, as a steam-engine can. The real need, however, is a serviceable motor-capstan for hauling nets and

other gear. With the boat lifting or rolling in a sea-way the strain on a capstan is almost invariably unequal, and often violently so. With a steam-capstan, the operation of winding-in will cease with a violent jerk or with pressure too great for the power of the engine, but will recommence when the jerk is past or the pressure lessens. In the case of the motor-capstan of any ordinary type, not only does the operation of winding-in cease, but the motor-engine is stopped altogether. In recent models of motor-capstans attempts have been made to transmit power through hydraulic pressure, compressed air, or electricity, so as to get a more elastic result. Paraffin rather than petrol is used in fishing-boats, and the use of crude oils has also been introduced.

The *herring-fishing* in Scotland can be roughly divided into winter fishing, during the first three months of the year; the early summer fishing in April, May, and June; and what is termed the great summer herring-fishing, which continues from 1st July to the end of the year. The movements of the herring, and the extraordinary fluctuations of the industry in certain localities, are factors well recognised by the fishing community. Places like Lerwick, Wick, and Fraserburgh exist very largely by reason of the herring-fishing. In Lerwick, indeed, within a lifetime, a complete change has taken place in the whole appearance, as well as in the size and characteristics, of the town. In twenty or thirty years, from being a natural harbour where a quaint, little semi-Scandinavian town, with its quiet, hospitable, thrifty people, carried on its remote occupations, and where one or two of the old six-oared boats which used to go to the 'haaf,' or distant fishing, could still be seen, where the greatest excitement of the year was the arrival of the Arctic whalers to pick up their crews before finally turning their backs upon civilisation and home, the place became a huge herring-fishing centre, with miles of curing-stations, vast stacks of barrels, and well-constructed wharfs, where in the summer-time all is bustle and noise. The harbour is packed with steam and sailing drifters, while steamers of several European nations come with coal, barrels, salt, and trade of varied sorts, to sail away loaded with herrings. Fishermen from France and Holland find notices at the post-office in their own languages, and a daily auction in a well-appointed building disposes of the silvery hoards. The great development has been due largely to the increased catching-powers of the boats used. The small boats and the boats dependent upon wind alone could not carry on a regular fishing about a hundred miles from land as the steam-drifters now do. It is the story of the trawlers over again. Distant waters have been explored, and huge shoals of herrings previously unthought of have been made to yield their share to the market.

The winter fishing is carried on on the west coast and certain parts of the east coast simultaneously. On the west coast the fish frequently come close inshore, and enter the sea-lochs in great numbers. Early in May the Stornoway fishing begins, and this includes the fishing off all the outer isles. The boats then go north to Shetland, where, right in the north of the islands, at Balta Sound, a great fishing has developed, thanks first of all to the enterprise of Dutchmen. From Balta Sound begins a southward movement of the boats, Lerwick, Orkney, Wick, Fraserburgh, Peterhead, and so on, until by late autumn the fishing winds up at Lowestoft and Yarmouth. While English boats, even from Cornwall, come all the way to Shetland to share in the bountiful supplies of the herring, the Scottish boats return the compliment by following the shoals down the English coast. A considerable number of Scottish boats also go to Ireland for the herring-fishing there.

It is believed by the fishermen, and very many others, that the well-defined movement of the shoals, and of the boats, each year is one continuous migration of the fish; that shoals do not appear separately in the north, and at a later date in the south, but that the shoals migrate just as the boats follow; that, in other words, these shoals swim from the outer isles round the north of Scotland by the Orkneys and Shetlands, and then down the east coast. In support of this view it has certainly been ascertained that the currents in the sea move in precisely this direction, and that, therefore, there is reason to believe that the minute creatures, such as free-swimming Crustacea, which form the food of the herring are floated from the west, through the Pentland and the northern isles, and thus round into the North Sea.

With the movements of the fishing-fleets go the buyers and the army of those who cure and pack. Thousands of women and girls are employed in gutting and packing herring, many of them being Gaelic-speaking girls from the Highlands. To house, control, and provide for so great a company is in itself quite an undertaking, but they are a hard-working, cheery, and, on the whole, very respectable class.

To encourage the proper curing of herring the original Board of White Fisheries, the progenitor of the present Fishery Board for Scotland, was instituted. The British government agreed to pay a bounty of four shillings per barrel for herrings cured to the satisfaction of the board. This was between the years 1809 and 1826. The supervision of the curing of the herrings was organised by the board, and officers were sent to all the principal curing centres. A brand was put upon the barrels passed by the officers, which brand, becoming a guarantee of quality, became greatly appreciated in the foreign markets, and a great part of the herring cured has always found a market abroad. By 1830 it was deemed no longer necessary to pay the bounty, and this was accordingly abolished in that year. In 1859 a small fee of fourpence a barrel was charged for the privilege of having the government brand of quality, although there was no obligation to have the brand. That the system was altogether successful—although some large curers preferred to continue the use of their own private brands—is shown by the fact that from the small fees named the Fishery Board for Scotland, which came into existence in 1882, and which will be referred to later, paid into the Exchequer a sum of between £7000 and £8000 from this source alone, and was able by this means to develop a complete service of vessels for the protection and regulation of the fishing-fleets. Unfortunately, altered views arose as to the proper curing of herring, and altered methods brought about different results in the market. Fish were oversalted or undersalted, complaints arose very largely from Germany, and confidence in the guarantee of the brand was to some extent destroyed. The income from branding fees fell off. Much has since been done to restore confidence. That the existence of the brand finds favour is well evidenced by the fact that both England and Ireland followed the lead of Scotland in this matter.

The method of trawling for herrings has also come into some prominence in the twentieth century. An adaptation of the otter trawl, so that it can be used for the capture of pelagic fishes, has been chiefly carried out in England, the vessels hailing from the east coast trawling-ports; but Aberdeen trawlers have also to some extent tried the method. Drift-net fishermen have been loud in outcry against it.

The great majority of steam-drifters and sailing herring-boats, as well as boats used in line-fishing in Scotland, are owned by the fishermen themselves. Vessels are acquired by fishermen in various ways: a skipper, or a skipper and his family or immediate friends, become owners by purchase. If they cannot raise money enough for their purpose, a loan is got from a bank after some large firm of fish salesmen or a general merchant has consented to become cautioner. The former sell the fish they catch; the latter supply them with their stores, including nets, coal, oil, &c. The cash credit is worked on the principle of an overdrawn bank-account; all the boat's receipts are paid in, and interest is charged on a day-to-day balance. At the end of the fishing season the fish salesman or merchant is paid, and the surplus is divided into three shares—one credited for the boat, one for the nets, and one divided amongst the crew. Each member of the crew contributes so many nets to the fleet of nets used, and the nets' share is allocated according to the number contributed. The boat's share is used to pay off the loan for the purchase. All the crew of a drifter may not be 'share men,' in which case the extra hands are simply paid a weekly wage, as the engineer, the stoker, and the cook are. The above method of borrowing is common along the southern section of the east coast of Scotland. In the Moray Firth it is common for fishermen to mortgage their houses in order to raise the money to purchase, or the money may be raised partly by loan and mortgage from the bank, partly from a salesman, and partly from the boat-builder in allowing part of the purchase price to remain on second mortgage.

The herring-fishing of England has in recent years taken a far more prominent place than formerly. In the year 1912, in respect both of quantity and quality of the herring, the industry surpassed all previous records, and for the first time the landings surpassed in bulk the landings of the Scottish ports. In 1913 the English herring-fishing rose still further, since it surpassed the Scottish not merely in bulk, but also in value. The distinction between English and Scottish results is, however, more local than national, since, as already stated, a very large number of Scottish fishermen contributed to the English totals at Lowestoft and Yarmouth.

Mackerel-fishing is carried on in the North Sea off the east coast of England, in the Irish Sea and the southern waters of Ireland, in the Bristol Channel, and in the English Channel.

Like the herring, the mackerel swims in shoals, and these shoals appear and disappear in a somewhat extraordinary manner. From researches into the movements of this fish, it is ascertained that a more or less definite series of migrations may be traced. In the northern parts of the North Sea catches are made from December or January to May; while in the southern parts of the North Sea the shoals appear first in April or May, disappear in June or July, and reappear in the period from August to November. Those shoals which are found in the northern parts are found some distance below the surface, and caught in trawl-nets. The southward movement is accompanied by a rising of the shoals towards the surface, which is attributed to the approach of the spawning season. The spawning takes place chiefly in the southern portions of the North Sea, and not far from land. The eggs of the herring, on the other hand, are laid upon the bottom, and become firmly attached to stones and other hard substances. After spawning in the summer months the mackerel apparently searches actively for food, and the shoals scatter freely over the great banks of the North Sea, and are caught by means of drift-nets in the vicinity of the Great Fisher Bank. Some of the shoals appear then to move northwards, while others move in a south-west direction and enter the English Channel, and by the end of autumn these shoals disappear.

The mackerel-fishing of Ireland is one of the most important branches of the fishing industry, and here again there is a spring and an autumn mackerel-fishing. The fish are largely cured for the American market, where considerable competition exists with the produce of the Norwegian spring mackerel-fishing. The price of fresh mackerel in the London market is generally considerably above the prices of cured in America, and there is a natural inclination towards the quick transport of such fish as can be sent to London in the fresh state. Mackerel must be got quickly to market to retain good quality, and the centres of fishing which are farthest from London are not likely to show a decline in curing so long as the stock of fish continues. The autumn fishing in Ireland is the more important.

The *pilchard-fishing* of the south and west coasts of England seems for some reason or other to be suffering a decline. This is especially so on the west coast, where the quantities landed have now shrunk to an insignificant figure. Devon and Cornwall are the headquarters. Great quantities have been taken in the past. The fish, being very oily, are subjected to pressure before being cured. They are almost all sent to the foreign market. The old method was to catch the pilchard by means of large seine nets, which were dragged to shore. The direction in which the shoals were heading could be best observed from the cliffs on shore, and the regular practice was for the boats to be rowed under the direction of signals from the cliffs. When a large shoal was captured and brought safely to shore, the seine was allowed to remain in the shallow water, while a smaller net, called the tuck seine, was used to remove the fish as they could be dealt with. In this way one or two days might elapse in securing the total catch. Now the old picturesque methods have largely given place to the use of the drift-net, as in herring and mackerel fishing.

Another pelagic fish which swims in shoals, and furnishes a considerable fishing, is the *sprat*. This beautiful little fish is chiefly caught in winter when it enters estuaries. In this respect it is like the sparling or smelt and the shad.

Ports.—In England most of the fishing-ports are of large size, where a certain amount of commercial shipping is already provided for. This is true also in Scotland in the case of such ports as Aberdeen or Leith, but increased harbour and docking accommodation is needed in the interests of the herring-drifters, which sail very largely from the small towns along the shores of the Moray Firth and open east coast. Harbourage being found insufficient, fishermen are often forced to keep their boats at a considerable distance from their homes, and especially when it is necessary to lay them up in the winter months and for repairs. This involves a great additional cost, not only in dock charges, but in travelling by rail. This rather pressing question has been taken up by the Fishery Board for Scotland, which, in addition to moneys usually available for harbour building and repair, has obtained grants from the Development Commission. It has been found at the same time that the tendency of modern fishing is to concentrate in the matter of harbourage and markets, so that certain places of former importance have come to be neglected, while great pressure is put upon others. Large sums have been spent, therefore, on those harbours which seem to be drawing the industry of the future, such as Buckie, Macduff, Fraserburgh, and Wick, but a large number of other ports have

also been provided for. In connection with the prosecution of the herring-fishing the Fishery Board has instituted a system of official telegraphic information between ports for the guidance of fishermen. Full statistics have long been collected and published by the board.

Eel-fisheries.—In certain localities of Ireland the eel-fisheries are of the greatest value, surpassing in this respect the salmon-fisheries. The eel enters fresh water from the sea as an elver of a few inches long, and the length of time it may remain in fresh water has been ascertained to vary very greatly—from two or three years to as many as twelve years; indeed, if by some accident the return to the sea be cut off, or if, as is so well known, the eel climbs to some almost inaccessible locality—and space would fail to tell of the extraordinary places in which eels have been found—the period during which life may be continued in fresh water is indefinitely prolonged. It also appears to be the case that a considerable proportion of so-called fresh-water eels never come into fresh water at all, but frequent the shallow bays and estuaries of the coast. During the time which may be spent in fresh water the eel does not spawn. For this a return to the sea has to be made, and it is this return from lakes and ponds which is taken advantage of for the capture of the fish, since the eels usually 'run' at stated times, and for the most part during dark nights in autumn. See EEL for life-history.

The most successful methods employed are by the construction of partial barriers or weirs in the rivers. These barriers are made of stone in the form of permanent weirs, with carefully defined gaps, or 'eel eyes,' through which the eels have to pass; or they may be constructed of wattle; or eel-nets may simply be placed close together attached to a series of posts sunk firmly in the river-bed. The eel-net is a very long, tapering contrivance of stout cord but fine mesh. It exactly fits the eel eye, and streams freely out in the rush of water which comes from the eye. The end is closed merely by means of a lashing and pin, and close beside the net is placed a live box, into which at intervals the fishermen throw the end of the net after releasing the lashing, so that the contained eels fall through the hatchway of the store-box. In the construction of eel-weirs in a salmon-river care is of course taken that a space be left for the ascent of the king of fishes. No ascending salmon can possibly be captured in the eel-nets, since the latter take only descending fish. In practice, the eel-fisheries and the salmon-fisheries not infrequently belong to the same people. The Limerick district and the Coleraine district—the Bann—form, perhaps, the two most important centres. Lough Neagh is netted and fished by means of set lines also. Other well-established eel-fisheries are at Ballina, Belleek, and Galway.

Pollan.—In speaking of eel-fishing, so much identified with Ireland, we may mention the marketing of another fish which is exclusively Irish. The pollan is found in Lough Neagh, and another pollan is found in Lough Erne, and yet another in the lakes of the Shannon district. In appearance the fish is very like a herring, and it is frequently called the fresh-water herring. In reality it is a member of the salmon family, and has the distinguishing adipose fin of the Salmonidæ. The Lough Neagh pollan is most abundant, and it is in this, the largest lake of the British Isles, that the chief fishery is carried on. In Scotland, the vendace of Lochmaben and the powan of Loch Lomond are closely akin to the Irish pollan. The vendace is now comparatively scarce; but the powans of Loch Lomond are very numerous, although not marketed. The fish can be taken only by net.

Crab and lobster fishing is carried on all round the shores of the British Isles. The largest examples come from the western portion of the English Channel, Devon and Cornwall. Since the lobster is of slow growth, and since the female carries her eggs for several months, there is some difficulty in regulating the catching of these crustaceans. The eggs of the lobster are largely used in the making of sauces, and by the capture of 'berried hens,' as the females with eggs attached are called, in large numbers, the stock of lobsters has sensibly diminished in several localities. The prohibition of the taking of lobsters under the length of eight inches does no more than keep immature and almost unmarketable sizes out of the market. In the encouraging of lobster-fishing, the best results seem to follow a more systematic collection and improved transport. Lobsters can be conveniently kept alive to suit conditions of the market, and recent operations in this direction show that lobsters can breed freely in captivity if they are kept under perfectly natural conditions. A store in the sea, of the kind indicated, was first started with success at Roscoff, in Brittany. Similar operations are now carried out in Scotland. As regards money value in England and Wales, the crab is much more remunerative than the lobster. Both are taken in 'pots' or traps, dome-shaped cages with funnel-like in-turned openings. Shrimps are caught by push-nets, hose-nets, small-meshed trawls, and shanks. The hose-net is a cylindrical net, fixed to a stake. The shank is like a trawl, with a wooden base instead of a foot-rope.

For salmon, whale, seal, and oyster fisheries, see articles under these headings, as well as PEARL and CEYLON. See also PRESERVED PROVISIONS; J. L. Jenkins, *The Sea Fisheries* (1920); W. Radcliffe, *Fishing from the Earliest Times* (1921).

Fisher's Hill, in the Shenandoah valley, Virginia, 30 miles S. of Winchester, is memorable for Sheridan's victory over the Confederate General Early, on 21st September 1864.

Fishes, a great class of backboned animals, rising above the lowly vertebrates—Ascidians, lancelet, and round-mouths—on the one hand, and leading on to the Amphibians on the other. The Tunicates or Ascidians (q.v.) are indeed numerous, but they are mostly degenerate; the level attained by the lancelet (Amphioxus, q.v.) is represented only by a single genus; the round-mouths or Cyclostomata (q.v.) are few in number and partially retrogressive, but the fishes have been and are successful. In the possession of the characteristic vertebrate axis and central nervous system, in general compactness and co-ordination of structure, in their external armature of scales, and in their great fecundity, fishes have an easy pre-eminence over their invertebrate inferiors, while as successfully adapted forms they hold as firm possession of their own special medium as birds do of theirs. Their success may be read in the immense number of individuals, species, and genera, not only now, but in the great æons of the past; in the geological record which shows how the Cartilaginous Fishes (q.v.) or shark tribe have persisted strongly from Silurian times, or how the decadent Ganoid (e.g. sturgeon) order is followed by a yet richer predominance of the modern Bony Fishes (q.v.); and, furthermore, in the wealth of adaptive specialisation which distinguishes so many, and which in the case of the 'double-breathers' or Dipnoi prophesies, in the evolution of lungs, the important transition from water to *terra firma.*

Literary History.—The history of the study of fishes finds its beginning as usual in the work of Aristotle (384–322 B.C.), who distinguished over a hundred Ægean species, is perfectly clear in dis-

criminating them from cetaceans and invertebrates, and records a surprising amount of information in regard to both their structure and habits. As with other departments of natural history, so ichthyology, in spite of its stable foundation, remained virtually unprogressive for eighteen centuries. In the 16th century at length Belon began to collect both specimens and information; Salviani, the physician of three popes, published an illustrated work characterised rather by artistic merit and popular interest than by scientific value; while Rondelet, as a medical anatomist, ventured further into structural details than either of his contemporaries. In the next century the classifying genius of Ray and Willughby achieved great progress, and the establishment of order was continued by Artedi, whose results were edited by his fellow-student Linnæus. The labours of the Linnæan school were ably continued by Bloch and Lacépède, both working during the critical period of the French Revolution. The anatomical investigations of Alexander Monro, embodied in a classical folio, led on to the great *Histoire Naturelle des Poissons* begun by Cuvier, continued by his pupil and collaborateur Valenciennes, and finally left unfinished in 1845 at the twenty-second volume. The virtual discovery of the Ganoids by Agassiz, their investigation by Johannes Müller, the separation of the Dipnoi, the Cyclostomata, and Amphioxus by the same anatomist, and the discovery of Ceratodus, described in 1871 by Günther, were ichthyological events of great importance. Within late years, apart from the vigorous prosecution of anatomical investigation, the study of the development of fishes has yielded to such workers as Balfour, Parker, and Semper results of fundamental import; our knowledge of fossil forms has been enriched by the researches of Traquair and Smith Woodward; the theoretical aspects of structure have been especially investigated by Dohrn; while the high-water mark of general ichthyology is represented in the British Museum Catalogue of Fishes and other works by Günther.

General Survey.—After excluding the lancelets and the Cyclostomes as survivors of far-removed ancestral forms, there remain three sub-classes of fishes properly so called—(1) the cartilaginous Elasmobranchs, (2) the Teleostomes, and (3) the Dipnoi. Besides these there are some extinct divisions of uncertain position, notably the ancient Ostracoderms or Hypostomes—e.g. Pteraspis and Pterichthys. (1) The Elasmobranchs stand well apart from other fishes. They include sharks and dog-fish, skates and rays, some extinct orders, and the divergent Holocephali, such as *Chimæra monstrosa*, 'the king of the herrings.' (2) The Teleostomes include the archaic Crossopterygii, now represented only by two genera, Polypterus and Calamoichthys; the Chondrostei, such as the sturgeon; the Holostei, such as the Bony Pike (Lepidosteus) and Amia; and the great host of Teleostei, which comprises, for instance, all our common food fishes. (3) The Dipnoi or double-breathers have only three representative genera, widely separated in geographical distribution—Ceratodus from Queensland, Protopterus from West and tropical Africa, and Lepidosiren from the Amazon. The Teleostomes other than Teleosteans are often called Ganoids.

General Characters.—Like other vertebrates, fishes possess a segmented body, well indicated by the disposition of the muscles; a dorsal nerve cord, swollen anteriorly into a brain; a dorsal axis or notochord, more or less completely replaced by a genuine backbone; a set of respiratory clefts on the pharynx, which here persist and are associated with gills; a ventral heart; and eyes which arise for the most part as outgrowths of the brain. But their prominent peculiarities are associated with the three sets of structures—scales, fins, and gills. The scales are usually produced by the inner layer of the skin, the dermis, and are covered over by the epidermis; the unpaired median fins are always supported by skeletal rays, and the paired lateral fins or limbs are never in any definite sense fingered; the gills are retained throughout life. Technical negative characters are the absence of an allantoic bladder and of a true inferior vena cava.

Structure and Functions.—The most characteristic *form* is that of herring, haddock, salmon, and the like, an elongated, laterally compressed spindle, thinning off like a wedge posteriorly, and obviously the result of, or an adaptation to, the mode of aquatic progression. But the skates are flattened from above downwards, and the bony flat-fish, such as plaice, are compressed laterally; the eels, the ribbon-fish (e.g. Regalecus), the band-fish (Cepola), the pipe-fish (Syngnathus), are much elongated; while the globe-fish (Tetrodon, Diodon), coffer-fish (Ostracion), and sun-fish (Orthagoriscus) are more or less globular. The flat-fish live at the bottom; the elongated forms have a serpentine habit of creeping through crevices; the globular forms are sluggish, and may float apparently passive in the water. Prominent external characters, to be presently noticed in order, are the nostrils and eyes, the openings of the gill-cavities, the various kinds of scales, the paired and the median fins, the lateral sensory lines, the openings of the gut and urinogenital organs, the symmetrical or asymmetrical shape of the tail.

The *skin* has numerous unicellular glands or goblet-cells which secrete mucus. Only in the Dipnoi and in some poisonous fishes do we find multicellular glands as in higher animals. In most cases the epidermis is a delicate transparent layer. The dermis is without muscular elements. Pigment cells under nervous control are common in the skin—e.g. in plaice, which thereby more or less rapidly alter their colour to suit their surroundings. The colours of fishes are often resplendent, and usually depend on the presence of lipochrome or fatty pigments, greatly enhanced by structural peculiarities and by the presence of a silvery foreground of guanin in the epidermic cells (see PIGMENT). As in the 'gemmeous dragonet,' the males are at the breeding season often transfigured in brilliant 'wedding' robes. The exoskeleton varies very widely, and so inconstantly that Agassiz' attempt to base a classification on the nature of the scales has been universally abandoned. Cartilaginous fishes are characterised by large or small skin-teeth, 'dermal denticles' or 'placoid scales,' forming the spines of a thornback or the shagreen of a shark. They are based in bone, cored with dentine, tipped with enamel, and are similar in structure and development to the true teeth of the mouth. The bone and dentine are formed from the cutis or dermis, the enamel from the epidermis. Spines occur here and there in other fishes, but flat scales predominate. These lie in sacks of the dermis, sometimes fuse together into plates, are covered with glistening ganoin in the bony pike and some other Ganoids, but are soft overlapping plates in the common Teleosteans, where they are called cycloid or ctenoid, according as the free margin is entire or toothed. From the rings of growth on the scales and bones and ear-ossicles, the age of the fish can often be read with reliable accuracy.

Skeleton.—The oldest vertebrate skeletons were cartilaginous, and the greater part of every individual framework has to recapitulate this stage. Very early, however, and at first in scales and teeth, bone was developed; but many of the older types of fishes are only slightly or very partially beyond

the cartilaginous level. As in all other vertebrates, the longitudinal axis begins as a rod of cells on the dorsal wall of the gut. This notochord, itself of endodermic origin, becomes surrounded by a mesodermic sheath, and when a genuine vertebral column is established it is always by the predominance of the sheath over the enclosed rod. In some Elasmobranchs, in gristly Ganoids, such as the sturgeon, and in Dipnoi, the notochord with its sheath persists undivided; while in other fishes vertebral bodies, bony or otherwise, are established. The typical fish vertebra is concave at both ends, and every two adjacent vertebræ thus enclose a wide space in which the remains of the notochord persist.

Fig. 1.—Skeleton of the Perch (after Günther).

The bony pike (Lepidosteus), one of the bony Ganoids, stands alone in having vertebræ hollow behind but convex in front. The dorsal axis protects the spinal cord, which lies above, by forming a continuous tunnel, or by a succession of 'neural arches.' In the tail region 'hæmal processes' similarly surround the blood-vessels, and the external ends of neural and hæmal arches may come to be associated with dorsal and anal unpaired fins. The tail-end of the axis is usually bent upwards, but is straight in Dipnoi and a few others, and is surrounded by a special bony sheath in many Teleosteans. Thus, we have an asymmetrical tail in Elasmobranchs and some Ganoids, a perfectly symmetrical tail in Dipnoi, and a superficially symmetrical tail in most Teleosteans, and in some Ganoids, where the way in which the rays are disposed disguises the real upturning of the axis. When the notochord remains undivided the ribs are cartilaginous, and in all fishes they are very simple.

To understand the skull it is necessary to recognise its triple origin: (1) The brain is at first enclosed in a cartilaginous box, with which the gristly capsules surrounding nose and ear become at an early stage intimately associated. This chondrocranium or gristly brain-box is a truly axial portion of the skull, corresponding to a comparatively large number of segments (see SKULL). It is always well developed, and remains entirely unossified in Elasmobranchs alone, being in other fishes more or less modified into bones. (2) But, in the second place, what are called skin bones have to be taken into account. These dermal ossifications, 'membrane,' or, better, 'investing-bones,' probably had their historic origin in the fusion of bony scales. They are greatly developed in bony Ganoids and in Teleosteans, and more or less cover the chondrocranium on its roof, floor, and sides. (3) Lastly, there depend from the skull a series of arches, of which the posterior form supports for the gills, while the anterior form at least the groundwork of the jaws, and may enter into yet more intimate union with the main body of the skull.

Limbs.—The paired fins of fishes are in origin strictly comparable with the arms and legs of higher vertebrates, but their component parts are too simple to be very definitely compared with those of fingered or toed appendages, such as occur for the first time in amphibians. A typical fin consists of a basal piece, or of several, associated internally with a pectoral, and less constantly with a pelvic, girdle. From the base a large number of rays radiate outwards. A most interesting type, from which some have attempted directly to derive the 'dactyls' of higher forms, is exhibited by the Dipnoi, in which a main axis runs down the limb (see CERATODUS). It seems most probable that the paired fins are concentrations or remnants of a continuous lateral fin extending along each side of the body. Among the many modifications may be noted the enormous pectoral fins of skates, the anterior position of the pelvic fins in many bony fishes, and the transformation of the pelvics into an adhesive disc in the Lumpsucker. As to their use, it must be remembered that the chief organ of locomotion is the tail, and that the paired fins serve to raise and depress the fish in the water, or to some extent act as rudders. In a few cases, as in the climbing perch, they are utilised as scrambling appendages. The pectoral girdle which supports the fore-limb is cartilaginous in Elasmobranchs, Dipnoi, and some Ganoids, but is elsewhere ossified. Coracoid and scapular portions are distinguishable, while in Ganoids and Teleosteans there is a special development of investing bones. The pelvic girdle is a well-developed hoop in Elasmobranchs, while in Ganoids and Teleosteans, with one or two trifling exceptions, it is absent. The unpaired fins are derived from a continuous fringe seen in the embryo (see fig. 2), and this state occasionally persists. Usually, however, there are several dorsals and anals, and the great locomotor fin of the tail. Sometimes spine-like and all of one piece, sometimes soft and jointed, they afford valuable aids in classification.

Fig. 2.—The Origin of Fins:

A, showing the undifferentiated embryonic and probably primitive state, with continuous median and lateral fins. B, showing the two dorsals, the caudal and anal unpaired fins, and the pectoral and pelvic paired fins. (After Wiedersheim and Parker.)

Muscular System.—The great muscles of the trunk and tail, which do the work of locomotion, retain a segmented arrangement (as can be very plainly seen even on a boiled fish); and the segments or myotomes are separated by septa of fibrous connective tissue. Remarkable modifications of muscular tissue and nerve-endings form most of the electric organs. See ELECTRIC FISHES.

Nervous System.—The brain and spinal cord are smaller in relation to the body than in other vertebrates. The growing skull outruns what it encloses, and the adult brain thus lies in a relatively large cranial cavity. All the usual divisions of the brain are developed, and in adult life lie virtually in one plane. Ten nerves from the brain, a large number from the spinal cord, and a sym-

pathetic system exhibit their usual relations. See BRAIN.

Sense Organs.—In most fishes a diffuse sensory system is located in the skin. Nerve endings of various kinds occur here and there over the surface, projecting superficially, arranged in definite lines, lodged in pits, or associated with a peculiar system of canals filled with mucus. The sensory structures thus variously arranged are distinguished as 'nerve eminences' and as 'end buds.' The former are very familiar in the lateral lines, one of which runs down each side of most bony fishes, and in the mucous canals which branch so abundantly on skates. The 'end buds' hardly occur in Elasmobranchs, but are abundant in Teleosteans, especially about the head. Near the mouth of the sturgeon, the cod, and other forms are tactile 'barbules.' Important too, though unfamiliar, are the 'eye-like,' 'pearl-like,' and 'phosphorescent' organs on the skin of deep-sea fishes.

The nose sacs lie ventrally in Elasmobranchs, in some of which—e.g. skates—they are connected with the corners of the mouth in a sort of hare-lip fashion. In Ganoids and Teleosteans the nasal sacs lie dorsally in front of the eyes. In many cases each nostril has two openings, and in Dipnoi one of these is within the mouth.

The eyes (see EYE) are usually large, but are destitute of glands and lids. In fishes living in darkness, whether in caves, mud, or the deep sea, the eyes may be rudimentary (see BLIND FISH). The final position of both eyes on one side is a remarkable peculiarity of bony Flat-fishes (q.v.).

As in higher forms, the ear begins as an inturning of the skin, and a canal opening to the exterior in many Elasmobranchs persists as a remnant of this. From the comparatively superficial position of the ear, the waves of sound have not to penetrate so deeply as in higher vertebrates. The ear is largely a balancing or equilibrating organ, but it has been proved experimentally that fishes become aware of vibrations in the water by their ears, as also by their lateral line and skin. Inside the ear are the usual otolithic accumulations, sometimes soft, sometimes stone-like. In many Teleosteans, as may be conveniently seen in cod or haddock, one of the otoliths is strikingly large.

Intelligence and Emotions.—Fishes are not usually credited with many emotions or with much intelligence, but their natural life has not yet been sufficiently studied to admit of a fair verdict. As it is, anglers know how they become wary and cunning, and keepers of aquaria have recorded many instances of the commoner emotions and of fair intelligence. According to Romanes, their emotions approach those of ants or of children four months old, except that no evidence of genuine sympathy is forthcoming. 'Fear and pugnacity are too apparent in fish to require special proof. The social or gregarious feelings are strongly shown by the numberless species which swim in shoals, the sexual feelings are proved by courtships, and the parental by those species which build nests and guard their young.' The stickleback woos his mate with undisguised passion and amusing coquetry, and guards the nest and eggs with jealous care. The Chinese butterfly-fish or Macropod, besides making an ingenious frothy nest of air and mucus, lifts the eggs into it by enveloping them in a cloud of bubbles. Tamed fishes have been known to become familiar with their keepers, and to answer to certain sounds. In natural life, the angling of the fishing-frog, the spitting of the archer-fish, the leaping of salmon and their careful selection of spawning-grounds, the memory for localities which some are said to exhibit, all indicate that intelligence is not asleep in the fish's brain.

Alimentary System and Food.—The gut of fishes exhibits the usual vertebrate characteristics; but the distinctions of the several regions are often less marked than in higher forms. The mouth has no salivary glands, but, except in sturgeons, some Lophobranchs, and a few more, it has well-developed teeth on various bones. These mainly consist of ivory or dentine, tipped with enamel, and vary greatly in size, form, and mode of attachment. In cartilaginous fishes they rise out of a fibrous membrane which grows over the jaw as the outer teeth are worn away; in the angler (Lophius) and some other Teleosteans they bend backwards, and oppose the egress of struggling prey; in bony Ganoids and in Teleostei they occur on branchial arches (pharyngeal teeth), as well as on the usual bones of the skull. The mouth is ventral in Elasmobranchs, but in other cases is terminal, or occasionally upturned. The pharynx opens to the exterior by the respiratory gill-slits; gullet, stomach, intestine, liver, and gall-bladder have

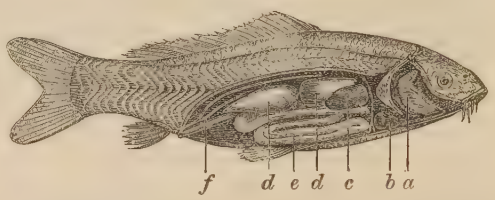


Fig. 3.—Internal Anatomy of the Carp, showing the muscle segments where the skin has been removed: *a*, gills; *b*, heart; *c*, liver; *d*, swim-bladder; *e*, intestine; *f*, ureters.

their usual relations; in Ganoids and most Teleosteans a large number of 'pyloric cæca' are given off at the beginning of the intestine; the pancreas is often diffuse or absent in Teleosteans; except in the last-named order, but especially in Elasmobranchs, there is a spiral ridge running down the large intestine, greatly increasing its internal surface. In Elasmobranchs and Dipnoi the gut ends in a cloaca or common chamber, into which the urinogenital ducts also open. In other fishes the anus lies in front of and separate from the other aperture or apertures.

The food of fishes is very diverse, from minute Protozoa to whales; they are carnivorous, vegetarian, or virtually omnivorous. Worms, crustaceans, insects, and molluscs and other fishes are important items in the carnivorous diet, in which they are usually voracious and often anything but discriminating. Some swallow mud for its living or decomposing contents; others, again, feed on sea and fresh-water weeds. The food is usually swallowed whole, though some sharks tear their prey into available pieces. Not a few forms manage to swallow other fishes out of all proportion to their own size, and in museums may be seen specimens which have managed to get outside victims even larger than themselves! It has been shown experimentally that fishes are attracted to their food in various ways—by sight, or by odours, or by chemical stimuli in the water.

Circulation.—In all fishes, except the Dipnoi, the heart receives impure blood only. This is driven by the muscular chamber or ventricle to the gills, whence being purified it is collected into the dorsal aorta which gives off arteries to all parts of the body except the head, which receives a direct supply from the most anterior of the vessels returning from the gills. From the body anterior and posterior veins convey the impure blood into the heart, into the so-called sinus venosus, or porch to the auricle. Though the direct work of the heart is solely to drive impure blood to the gills,

it need hardly be pointed out that, as the chief origin of the alterations of pressure which determine the circulation, the heart has its usual, though obviously indirect, systemic significance. Except in the bony fishes, the ventricle is prolonged into a contractile tube known as the *conus arteriosus;* but, except in the Dipnoi, the heart is accurately described as two-chambered. Venous blood from the posterior region passes through the kidneys, forming a renal-portal system, as in amphibians and most reptiles, and there is the usual hepatic-portal system wherein vessels from the intestine pass into the liver. The hepatic veins leading from the liver enter the heart independently of the other posterior veins, and thus there is no strict *inferior vena cava.* In the Dipnoi the circulation has been modified with the acquisition of lungs. The heart receives pure as well as impure blood, and the auricle is divided by a septum. Fishes have the usual lymph system, and the ordinary blood-glands—spleen, thyroid, and thymus.

Respiratory System.—From the pharynx the characteristic vertebrate clefts open to the exterior, and admit of a water current in by the mouth, down the pharynx, out by the clefts. Between the clefts extend the supporting (branchial) arches, and these bear the folds or filaments on which the blood is exposed—in other words, the gills. In the cartilaginous fishes the separate gill-clefts are obvious enough externally; in other fishes the apertures are protected by a fold or operculum, and the partitions which form a series of chambers in skate or shark become more or less reduced. Thus, in the haddock there is one external opening on each side, and the gill-filaments are borne upon arches which are only attached at their extremities. The number of gills or clefts varies considerably; there are usually five in Elasmobranchs, four in Teleosteans. The primitive fish probably had a larger number of gill-slits, and Heptanchus still survives with seven. In Elasmobranchs and some Ganoids the most anterior of the distinct gill-slits forms the 'spiracle,' opening on the top of the head, sometimes bearing a rudimentary gill, and corresponding to the Eustachian tube in higher animals. In young Elasmobranchs the gill-filaments are prolonged externally through the slits; in the larvæ of Polypterus and Lepidosiren there are true external (ectodermic) gills like those of a tadpole; in Protopterus three external gill-filaments persist in adult life. In the majority of fishes, but not in Elasmobranchs, nor in bony flat-fish such as plaice, there is an Air-bladder (q.v.) or swim-bladder, which arises almost always as a *dorsal* outgrowth from the gut, and prophesies the lung of higher vertebrates. As the name suggests, its function is in most cases hydrostatic, raising or lowering the fish according to its state of expansion or contraction, and it always receives a supply of arterial blood. In the 'double-breathing' Dipnoi, which gulp air at the surface, the swim-bladder functions as a genuine lung, and the same is true to a less marked extent of a few other fishes. In all Ganoids and in the Physostomi section of bony fishes the connection between air-bladder and gullet remains throughout life an open passage; in the other bony fishes (Physoclisti) the connection is a solid cord or is altogether obliterated. The sac extends along the back under the vertebral column, and is exceptionally (e.g. Polypterus) double like lungs; in four families of Teleostei it is connected anteriorly with the ear by a chain of bones, 'by means of which its relative fullness can be appreciated by the fish.' Some bony fishes—e.g. climbing perch and certain Siluroids—have curious accessory respiratory organs, and are able to remain for some time out of the water; and here also may be noted the dilatable sac which opens into the ventral side of the pharynx in some box or globe fishes—e.g. Diodon. See GILLS.

Excretory System.—To the zoologist the kidneys of fishes are of great interest, because it has been possible through the study of their development to reach an approximate elucidation of the 'homologies' or real resemblances in the different parts of the urinogenital system throughout the vertebrate series. Only two general sentences are here permissible. At an early stage a segmentally arranged series of ciliated excretory tubules, or nephridia, make their appearance; they are strictly comparable to the excretory tubes of invertebrates, and a certain unity is thus demonstrable between earthworm and dog-fish. Of these little tubes some form the adult kidney, others the 'Wolffian body' or 'parovarium,' while others disappear. But, besides the tubules which lie transversely, there is on each side a longitudinal duct with which some at least of the nephridia become connected; this so-called 'segmental duct' is either derived, as the insinking of a skin (ectodermic) groove, or else from the external portion of the middle (mesodermic) layer; on each side it typically becomes double, and forms the reproductive ducts for either sex, but the half which is important in the male is rudimentary or unimportant in the female, and *vice versâ.*

Reproduction.—The sexes are almost always separate, but a male organ or testis 'is constantly found imbedded in the wall of the ovary in Chrysophrys and Serranus (two bony fishes), and the last-named fish is said to be self-impregnating.' As in most other vertebrates, occasional hermaphroditism occurs as an abnormality—e.g. in mackerel and herring. The males of bony fishes are usually smaller than their mates, and sometimes very markedly so; in many cases, especially at the breeding season, they are further distinguished from the females by bright colouring. Thus, the male 'gemmeous dragonet' (*Callionymus lyra*) is so flushed with brilliant colour that it was regarded by Linnæus as quite distinct from the 'sordid,' dingy female. The male sea-scorpion (*Cottus scorpius*), usually ill-favoured, becomes gorgeously adorned during the spawning season, and the same is true of a great many forms. In Elasmobranchs the males are distinguished by the possession of copulatory organs or 'claspers.' As the males often fight with their rivals, special adaptations have come to be associated with this habit; of these the hooked lower jaw of the male salmon, so suitable for butting, is perhaps the most familiar instance. In many marine fishes the females appear to be in a very large majority. There are frequently other differences between the sexes, especially as regards the unpaired fins, and Darwin also quotes some cases (especially Ophidium) where it seems that the males, and the males only, have the power of producing sounds. See SEX, SEXUAL SELECTION. The ovaries and testes are almost always paired organs, which become large and conspicuous in the reproductive season. In all Teleosteans save one, and in the bony pike (Lepidosteus), there are ducts continuous with the ovaries; in other fishes the eggs burst into the body-cavity, and are subsequently pressed into the ducts. The male elements usually pass more or less directly into ducts. In most Elasmobranchs, in Ganoids, Dipnoi, and a few Teleosteans, there are two openings or 'abdominal pores' from the body-cavity to the exterior.

Most fishes are oviparous, laying the eggs as such, and that usually in great numbers. They are extruded on the bottom—e.g. among gravel—or in many cases are discharged broadcast in the water. A few fishes, such as sturgeon and salmon,

ascend rivers for spawning purposes; while others, like the eel, descend to the sea. The female salmon is careful in the choice of a spawning-ground, and in ploughing a groove for the eggs among the gravel is said to avoid areas which have been already occupied by her forerunners. In regard to trout, it has been observed that the absence of a suitable bottom may lead to retention of the ova, to consequent disease in the organ, and to an inferior brood the next season. The eggs of oviparous Elasmobranchs are surrounded by a horny case, the so-called mermaid's purse, so often found empty on the beach. This sheath is a product of the middle portion of the oviduct, and often has tendril-like prolongations at the corners, which twine themselves automatically round seaweed, where the embryos are rocked till the time of hatching. Most sharks and a few Teleosteans bring forth their young alive. In the viviparous Teleosteans the eggs develop in the ovary or in the oviduct; in the sharks, in the oviduct. Two of the viviparous sharks (*Mustelus lævis* and *Carcharias glaucus*) are of peculiar interest in the establishment of a vascular placenta-like union between the yolk-sac and the wall of the oviduct, an arrangement which has also been noticed in a couple of lizards. In the Teleostean Anableps the yolk-sac has villi which protrude into a dilated ovarian chamber and absorb nutritive material. As to fertilisation, the usual process is that the male deposits the spermatozoa or the milt upon the laid eggs or spawn, but it is evident that fertilisation must be internal when the forms are viviparous or when the eggs are enveloped in a firm sheath.

As an interesting illustration of inter-relations, we may note that the young of the bitterling (*Rhodeus amarus*) live for a time within the gill-cavities of fresh-water mussels—which has its striking counterpart in the fact that the larvæ of the fresh-water mussel are temporarily parasitic on fresh-water fishes like stickleback and minnow.

Parental Care is but rarely exhibited by fishes, and then usually on the part of the males. Love for offspring usually varies inversely with their number, and those of fishes are legion; nor would young fish benefit much by any care, except an impossible providence which would prevent their being swallowed. Apart from numerous viviparous forms, the female of a Siluroid genus (Aspredo) carries the ova on her belly till they are hatched, just as the Surinam toad bears her progeny on her back; and in Solenostoma a pouch for the eggs is formed by the ventral fins and skin. The male stickleback (Gastrosteus) makes a nest of grass-stems and water weeds, weaves it round with

Fig. 4.
The male of a Pipe-fish (*Syngnathus acus*), with pouch beneath the tail for carrying the eggs (after Günther).

mucous threads (which seem to be almost pathological products of the kidneys compressed by the enlarged male organs), and jealously guards the eggs laid by his mate. The same is said to be true of a species of Chromis from the Sea of Galilee; and more or less elaborate nests are formed by the males in the genera Cottus, Cyclopterus, Antennarius, Ophiocephalus, and Callichthys. 'The male of some species of Arius carries the ova about with him in his capacious pharynx,' while in the pipe-fishes and sea-horses various abdominal brood pouches are developed.

Development.—The fish egg is a small thing, except in the cartilaginous fishes, where it is very large, and enclosed in the characteristic keratin case. In other fishes there are only the usual egg-sheaths, such as the *zona radiata*, with one aperture or more for the entrance of the spermatozoon. Fertilisation usually takes place in the water, much less frequently within the female. Since the old experiments of Jacobi (1757–63), artificial mingling of the sperms and eggs has often been resorted to, both in the embryological laboratory and in the practical work of stocking rivers (see PISCICULTURE). In the egg the yolk usually bears a large proportion to the strictly formative material, and the division with which development begins is partial in all known cases except the sturgeon and the bony pike. Development is, in most cases, a

Fig. 5.—Young bony Fish, with dependent yolk-sac still unabsorbed.

rapid process, and the newly hatched forms bear the still incompletely absorbed yolk-sac dependent from their ventral surface. The larval forms are often unlike the parents, for instance, in the possession of external gill-filaments in Elasmobranchs, &c., or in minor features connected with mouth, fins, and armature. The most striking change is that which happens to young, bony Flat-fish (q.v.). See EMBRYOLOGY, and such articles as SALMON.

Relation to Environment.—In many fishes the limit of growth is less definite and less rapidly attained than is usual among higher vertebrates. In favourable circumstances individuals will go on growing, and may far outstrip the average of the species, while, on the other hand, a confined habitat and restricted food-supply may reduce the size. 'The young of coast-fishes, when driven out to sea, where they find a much smaller supply of food, remain in an undeveloped condition, assuming a hydropic appearance.' Besides affecting the size, the nature of the surroundings and the nutritive supply influence both form and colour. It is a well-known fact that the same species of trout presents a variable appearance, according to the habitat of the individual. It rarely happens among fishes that the pigment wholly disappears, but it is not uncommon for an 'incipient albinism' to be produced by a change of the contents of the pigment-cells into yellow, a variation most familiar in the gold-fish, but occurring in not a few. Very different, and of more importance in the life of the fish, is the power which some possess of sympathetic change of colour. Thus, in the plaice the colour of the environment influences the eye, a nervous impulse determining the contraction or expansion of the pigment-cells passes to the skin, and the animal is adapted to the colour of the ground on which it rests. Few general statements can be made as to the sensitiveness of fishes to changes in the medium. Pelagic fish are very susceptible; but other marine forms—e.g. flounders—thrive well in fresh water. 'A shark lives in Lake Nicaragua; a goby, blenny, and Atherina in the lakes of north Italy.' The passage of a fresh-water fish to the sea is very rare. Many fishes can endure prolonged fasting and also lowered temperature,

but in both these respects marine forms are far excelled by those inhabiting fresh water. Low temperature causes some fishes to pass into a torpid state of 'Latent Life' (q.v.), or Hibernation (q.v.), while in the dry season of tropical countries other forms (e.g. Siluroids and Protopterus) encyst themselves in the mud, where they may remain like living mummies for prolonged periods. See also BLIND FISH.

Some small fishes live in amicable partnership with other animals—e.g. inside large sea-anemones (see COMMENSALISM). The genus Fierasfer seems in a fair way to become parasitic, since the members find more or less permanent lodging within

Fig. 6.—Fierasfers entering and leaving Holothurians. (From the atlas of the Naples Aquarium.)

sea-cucumbers, medusæ, and other animals, feeding, however, not upon their hosts, but upon the minute animals which they contain. Fishes themselves are infested by numerous internal and external parasites. Crustaceans, or Fish-lice (q.v.), occur in great abundance on skin and gills, especially on sluggish or on sickly forms. Various flukes are also found externally, and a large number of Cestodes in tapeworm or bladderworm stages live in the viscera. The pike and burbot are hosts of the immature stages of the formidable Bothriocephalus; the stickleback often bears the young of the fresh-water mussel; a peculiar hydroid (Polypodium) is parasitic on the eggs of the sturgeon; and so on through a long series (see PARASITIC ANIMALS).

Distribution in Space.—Most fishes live either exclusively in the sea or exclusively in fresh water, but some pass for spawning purposes from the one to the other, and not a few thrive with apparent indifference in either or in a brackish medium. The marine forms enjoy a wider distribution over the globe, but the inhabitants of fresh water also spread by circuitous swimming, by changes in the river systems, and even by short overland marches, or by having their ova carried on the feet of water-birds. Both marine and fresh-water forms occur in Polar regions. Günther describes about forty species from the icy waters at or beyond the 1500 fathom line; and fishes are still present in Alpine lakes about the level of perpetual snow, up, indeed, to a level of 15,000 feet or more. Of genuine fresh-water fishes about 2300 species are recorded, of which four are Dipnoi, thirty-two Ganoids, and the rest Teleosteans, with a marked predominance of carps or Cyprinidæ, and Siluroids or cat-fishes. The marine forms are usually distinguished as shore, pelagic, and deep-sea fishes. The shore fishes, including about 3500 species, frequent the coasts, and rarely descend below 300 fathoms. The pelagic fishes swim and usually spawn in the open sea, are less numerous than the shore forms, and thrive especially in the equatorial waters: the cartilaginous fishes form a large percentage of the pelagic fauna. The deep-sea fishes include over a hundred genera, most of which are Teleosteans. Of these forms, monographed by Günther in his *Challenger* Report, a little more must be said.

Deep-sea Fishes were not known with any definiteness till the *Challenger* expedition virtually discovered the new zoological world which they inhabit. The explorations of the *Talisman* and the *Travailleur* have also contributed important results to our knowledge of these usually strange-looking forms. To understand their peculiarities it is necessary to recall the principal factors in their environment. (*a*) Sunlight is absent, and so often are eyes, which, in the absence of stimulus, remain undeveloped. It is interesting to notice Günther's results. From a depth of from 80 to 200 fathoms the eyes are larger than usual, to make the most of the scanty sun-rays which fade away at those depths. Beyond the 200 fathom line 'small-eyed fishes as well as large-eyed occur, the former having their want of vision compensated for by tentacular organs of touch, whilst the latter have no such accessory organs, and evidently see only by the aid of phosphorescence. In the greatest depths blind fishes occur, with rudimentary eyes, and without special organs of touch.' The Phosphorescence (q.v.) is produced by numerous marine animals and by the fishes themselves. Many of the latter exhibit round, shining, mother-of-pearl-coloured bodies, imbedded in the skin, in part sensory, in part phosphorescent. (*b*) The temperature of the bottom is low and equable, and a wide range of distribution is thus unimpeded. (*c*) The pressure is, of course, enormous at those great depths, and, though the fishes feel it as little as we do that of the air, it has doubtless been an

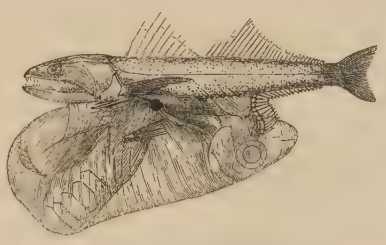


Fig. 7.—A deep-sea fish (*Chiasmodus niger*) which has swallowed another fish (seen beneath) bigger than itself (after Günther).

important factor in determining their structure. Bones and muscles are less developed; the former are very light and brittle; the latter are thin. The forcible ascent to diminished pressure, of course, produces rupture and other changes, so that it is sometimes difficult to infer the natural form of the body and texture of the tissues. (*d*) As sunlight is absent, so also are plants. The abyssal fish are therefore carnivorous, 'the most voracious feeding frequently on their own offspring, and the toothless kinds being nourished by the animalcules which live on the bottom, or which "like a constant rain" settle down from the upper strata.' Some of the carnivorous forms show evidence of great rapacity, and not a few are characterised by wide gape and dilatable stomach, able to 'receive a fish twice or thrice the bulk of the destroyer.' The skin in many deep-sea fishes is marked by an extraordinary development of the mucus-secreting system, and this exuded layer has been observed to be phosphorescent in some fresh specimens. The colouring is simple, most of the forms being either black or silvery. The absence of light and the sluggish habit may have something to do with this peculiarity. (*e*) Lastly, the perfect calm of the abyssal water must be remembered, and associated with the tendency many of the fishes have to develop long, delicate filaments on fins or tail. As

to the maximum depth at which fishes certainly occur, *Bathyophis ferox* was dredged from 2750 fathoms.

History of Fishes.—The earliest fish remains occur in the Upper Silurian strata, mostly in the form of spines, scales, shields, and mere fragments.

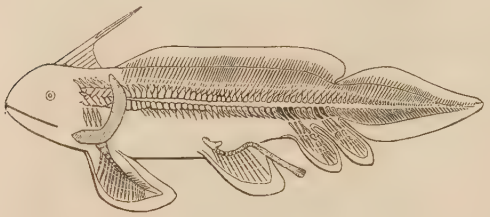


Fig. 8.—Restoration of *Pleuracanthus gaudryi* (Brongniart).

Some of these belong to the archaic order of Hypostomes—e.g. *Pteraspis*—and being without jaws or ordinary paired fins, are probably not fishes in the strict sense. Others are Elasmobranchs of the shark type. In the Devonian and subsequent Palæozoic periods there were numerous cartilaginous 'Ganoids' and Elasmobranchs and some Dipnoi, besides orders which represent lost races, having no direct descendants to-day. Thus a separate order (Ichthyotomi) must be erected for a form like *Pleuracanthus* which Brongniart discovered in the French coal-measures. Ganoids with a thoroughly ossified skeleton appear first in Jurassic rocks, and about the same time the first Teleosteans (e.g. *Thrissops* and *Leptolepis*) emerged. The bulk of the Dipnoi were Palæozoic, but *Ceratodus* existed in Triassic and Jurassic times, and has persisted until now. Perhaps the most striking general fact is the decadence of the 'Ganoids' and

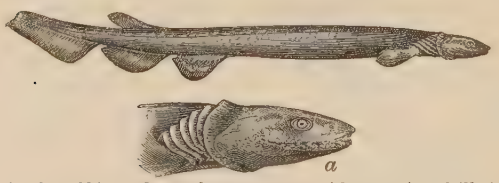


Fig. 9.—*Chlamydoselachus anguineus* (Garman), a frilled shark, one of the oldest living types of Fishes: *a*, head on larger scale.

the Dipnoi, while Elasmobranchs have to some extent held their own, and the Teleosteans have become the dominant race of fishes.

Economic Interest.—Apart from the import of fishes in the general economy of nature, their practical interest for mankind is centred in the fact that so many form part of our food-supply. Their importance in this respect is especially great in Polar regions, where other sources of nutrition are scanty. It may be here noticed that many are temporarily or constantly poisonous. The poison is in the blood and is destroyed by heat in the eels; it is constant and in the flesh in *Clupea venenosa*, various globe-fish, and many others; it is temporary and in the roe of spawning pike, burbot, &c.; while in many cases it is not intrinsic, but due to the food on which the fish lives, or to decomposition products formed after death. Gills and other parts which quickly decompose should always be avoided. Some fishes, such as stingrays and weavers, readily give wounds with their spines, and the mucus of the body thus inoculated produces symptoms of poisoning. In Synanceia, Thalassophryne, and other forms there are true poison organs associated with spines, and the results of a wound are sometimes fatal. Besides the great nutritive utility of fishes, there are a few minor products of some importance, such as cod-liver oil from the liver of Gadoids, isinglass from the swim-bladder of sturgeons, &c., and shagreen from the skin of sharks and rays (see PISCICULTURE).

From their position near the base of the vertebrate series, fishes are the most hopeful subjects for the solution of many of the fundamental problems of zoology; in their endless variety of habit they afford wide scope to the observant naturalist; while for their grace of movement, beauty or quaintness of form, and splendour of colouring they merit a larger share than they have hitherto received of artistic attention.

The whale and the sturgeon, either when thrown on shore or when caught near the coast, are at common law the property of the crown, and as such are known as *Royal Fishes*.

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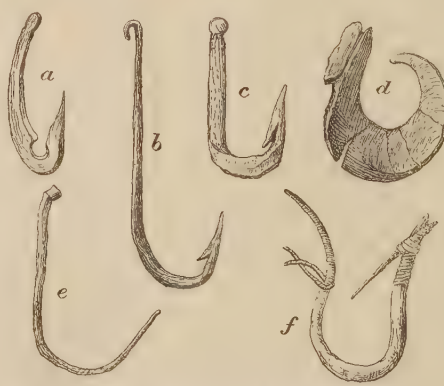
Fish-guano. See GUANO.

Fishguard, till 1918 one of the Pembroke boroughs, 14½ miles N. of Haverfordwest, has a good harbour, whence since 1906 Great Western Railway steamers run to Rosslare and Waterford in Ireland. Pop. 3000. For the French descent here in 1797, see PEMBROKESHIRE and the *Diary* of D. Rowlands (published in 1892).

Fish-hawk, or FISHING EAGLE. See OSPREY.

Fish-hooks. Both in Europe and in America fish-hooks have been found, belonging to prehistoric times, which are made of flint, bone, shell, copper,



Early Fish-hooks (from Rau's *Prehistoric Fishing*): *a*, lacustrine fish-hook, made of a boar's tusk, found at Mooseedorf, Switzerland; *b*, bronze lacustrine fish-hook, found at Romanshorn, Lake Constance; *c*, deer-horn fish-hook, found in Madison county, New York; *d*, shell fish-hook from Santa Cruz Island; *e*, cactus-spine Indian fish-hook from Arizona; *f*, halibut hook, made by the Makah Indians, Cape Flattery, from the knots of the hemlock spruce.

bronze, and, on the latter continent, even of gold. The oldest apparatus for catching fish was not a hook, but a cross-bar of flint sharpened at both ends and attached to a thong. Some of the oldest

prehistoric fish-hooks, including a few of bone, bear a considerable resemblance to modern English hooks in shape and in the form of the barb. Many of the rude-looking fish-hooks made by savage races are strong, well made, and ingeniously contrived. The shell and bone hooks of the Maoris of New Zealand and the natives of the Solomon Islands, as well as the bone and iron hooks of the Eskimos, are examples of these. Curious fish-hooks of cactus spines, made by Indians, have been found in Arizona. Ancient Roman fish-hooks discovered at Pompeii exactly resemble those in use at the present day, only they are of bronze instead of steel. But almost as much may be said of the prehistoric bronze fish-hooks discovered in Scotland, Ireland, and at several places on the continent of Europe. Illustrations of a large number of ancient fish-hooks are given in a volume on *Prehistoric Fishing in Europe and North America*, by C. Rau, published by the Smithsonian Institution. See also W. Radcliffe, *Fishing from the Earliest Times* (1921).

In England fish-hooks are chiefly manufactured at Redditch in Worcestershire. The best of these are still made by hand, and the following is an outline of the stages in the process. (1) Soft cast-steel wire is cut by shears to the length required for a given size of hook. (2) A number of these cut wires are placed on a plain surface against an upright, and then by means of a strong knife the beards or barbs are formed. (3) The points are next put on by carefully filing the wires, each being pointed almost in an instant. (4) By means of a mould mounted in a wooden handle the wires are bent or turned to the proper shape. (5) The ends of the shanks are now ringed, flatted, or marked by an ingenious machine or hammer. (6) At this stage the hooks are hardened; i.e. they are placed in a furnace and brought to a certain heat, which varies with the kind of hook, and then plunged into a vat of oil. (7) They are next tempered by placing them, mixed with emery sand, in a pot over a charcoal fire. There they are kept in constant motion till they are sufficiently tempered. (8) Scouring is effected by placing the hooks with water in barrels and keeping these in motion for one or two days, to remove all scale. (9) Polishing is done by placing the hooks in an oblong bag with emery and rapidly shaking them. Sometimes the polishing is done in barrels moving round at an angle of 45°. Fish-hooks are now, however, chiefly made by machinery which performs most of the above operations automatically. See ANGLING.

Fishing-frog. See ANGLER.

Fishkill Landing. See BEACON.

Fish-louse, a name widely applied to any of the Copepod crustaceans which occur as external parasites both on fresh-water and marine fishes. Some have also been found on amphibians. As they live on the juices of their hosts, they undoubtedly do damage, and the fishes on which they are abundant are often sickly. They may occur on the skin itself, but are even more common about the gills. To the zoologist they have a special interest on account of the degeneration which they often exhibit, when contrasted with their free-living relatives or even with their own young stages. They are often curiously misshapen, and swollen out with abundant feeding; the males are sometimes free and the females alone parasitic, or the males may be pigmies borne on their mates. In other cases the females become truly parasitic only after sexual union, when about to bear eggs, and the habit of parasitism has doubtless been acquired in some instances for the safety and convenience of the mothers. Some (e.g. Penella) pass from being external hangers-on to become true internal parasites. The following are examples of common 'fish-lice' and of the hosts which they infest: *Chondracanthus cornutus*, on flat-fish (frequent); *Caligus rapax*, dog-fish, gurnard, lumpsucker, dab, whiting, &c. (frequent); *Ergasilus sieboldii*, carp, pike, &c. (frequent); *Dichelestium sturionis*, sturgeon (on gills); *Lernæocera cyprinacea*, carp, &c. (boring in flesh); *Lernæa branchialis*, flounder, &c. (on gills); *Penella sagitta*, fishing-frog (in flesh); *Achtheres percarum*, perch, &c. (on gills); *Lernæopoda elongata*, dog-fish (on eyes); *Anchorella uncinata*, cod species (on fins and gills); *Argulus foliaceus*, carp, perch, pike, stickleback, trout, &c. (frequent). The above are all Copepods—i.e. low down in the crustacean series; but parasitic Cirripedes (q.v.) occur in the skin of whales and fishes, and on other crustaceans; a little family of Amphipods (Cyamidæ) also infest cetaceans; among Isopods, many Cymothoidæ live on the skin and gills of fishes, while Bopyridæ and Entoniscidæ frequent other crustaceans. See CRUSTACEA, PARASITIC ANIMALS.

Fish-louse (*Achtheres percarum*), magnified.

Fish-skin Disease. See ICHTHYOSIS.

Fiske, JOHN, born 30th March 1842 at Hartford, Conn., studied at Harvard, where in 1869 he began as a positivist to lecture on philosophy, and in 1872–79 was under-librarian. He was widely known as a lecturer. Among his works are *Tobacco and Alcohol* (1868), *Myths and Mythmakers* (1872), *Outlines of Cosmic Philosophy* (2 vols. 1874), *Darwinism* (1879), *The Beginnings of New England* (1889), *Theodore Parker* (1889), *The American Revolution* (1891), *The Discovery of America* (1892), *Old Virginia and her Neighbours* (1897), *Through Nature to God* (1899), *A Century of Science* (1900). He died 4th July 1901. See his *Life and Letters* by J. S. Clark (1920).

Fissirostres, Cuvier's name for wide-gaping, insect-eating goatsuckers, swifts, and swallows.

Fistula, an abscess contracted to a narrow, hard, open passage in communication with, or in the immediate neighbourhood of, one of the mucous canals, lined by a kind of false membrane, giving rise to a thin discharge. There is salivary fistula, urinary fistula, &c.; but the most common and troublesome kind of all is the *fistula in ano*, in the lower bowel (see ANUS, RECTUM). The term is also applied to unnatural communications between two adjacent mucous canals (e.g. vesico-vaginal fistula), or between one of these and the external surface (e.g. gastric fistula, fœcal fistula), independently of their size and shape. The treatment of fistula should only be entrusted to experienced surgeons.

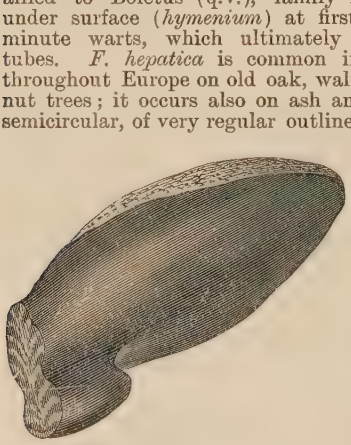
For the cure of salivary or urinary fistula all that is generally necessary is to restore the patency of the natural ducts, which is done by passing instruments along them. Should a fistula, however, be situated where it is surrounded by muscular fibres, as at the orifice of the lower bowel, it is necessary to divide these, so as to leave the part at rest while nature repairs it. During the process of healing care must be taken that the wound closes from the bottom, otherwise the cut surfaces are apt to reunite, leaving the fistula unimproved. This may be secured either by stuffing the wound with lint, or by daily passing a probe or a finger along it to break down any adhesions that may have formed. Stimulant applications are also

sometimes necessary to promote the healing process.

At times, however, fistulæ require more elaborate treatment, and are extremely difficult to close, especially those which result from loss of tissue between two adjacent mucous canals; fortunately, however, modern surgery is able to remedy these also. It is necessary to make the edges of the orifice once more raw, and to bring them in contact, but formerly the wound used rarely to unite, as the stitches produced such an amount of irritation. Now, however, by the use of silver-wire, or catgut, and by scrupulous attention to cleanliness, the parts can be kept together long enough to insure union; and thus, by the ingenuity of American surgeons, especially the late Marion Sims of New York, and others in Britain, certain diseases of women, arising from protracted labours, and formerly rendering the unfortunate subjects of them miserable and unfitted for any of the duties of life, may be now remedied by a skilfully performed operation.

Fistularia, Fistularidæ. See FLUTE MOUTHS.

Fistulina, a genus of Hymenomycete fungi allied to Boletus (q.v.), family *Polyporei;* the under surface (*hymenium*) at first covered with minute warts, which ultimately form separate tubes. *F. hepatica* is common in Britain and throughout Europe on old oak, walnut, and chestnut trees; it occurs also on ash and beech. It is semicircular, of very regular outline, with a lateral stem, or none; its colour red; its substance fibrous and fleshy, much resembling beet-root. When old and beginning to decay, it looks like a mass of liver. It sometimes attains a great size. Mr Berkeley mentions one which grew on an ash pollard, and weighed nearly thirty pounds. This fungus, while young, is much esteemed in some parts of Europe as an esculent; whilst there is almost no possibility of confounding it with any dangerous fungus. Its taste resembles that of the common mushroom, but is rather more acid. 'When grilled, it is scarcely to be distinguished from broiled meat.' It furnishes itself with abundance of sauce.



Fistulina hepatica.

Fitch, JOHN, inventor, was born in what is now South Windsor, Connecticut, in 1743, and after a short, unhappy, married life, and a period of wandering, settled at Trenton, New Jersey. At the outbreak of the revolution he became a gunsmith for the American troops, with whom he wintered at Valley Forge. He next made surveying and trading tours in the West, and after escaping from captivity among the Indians returned to Pennsylvania, where in 1785 he completed his first model of a steamboat; this had wheels at the sides, which were replaced in the following year with paddles or oars. In the face of discouragement and neglect he succeeded in constructing a vessel, 45 feet long and 12 feet beam, with an engine of 12-inch cylinder, which made a successful trial-trip on the Delaware, at Philadelphia, 22d August 1787. Larger vessels were built in 1788 and 1790, the latter being run as a passenger-boat, at eight miles an hour, to Burlington (20 miles) throughout the summer. Misfortune, however, dogged 'poor John Fitch's' steps; his supporters fell away; and in 1793 he went to France to construct a steamboat, only to find his project frustrated by the Revolution there. It is said that his plans and specifications were deposited with the American consul at L'Orient, who for several months entrusted them to Robert Fulton (q.v.); and the latter's steamboat certainly was in 1817 declared by a committee of the New York legislature to be 'in substance the invention patented by John Fitch in 1791.' Penniless and dejected, Fitch worked his passage back to America, where in the summer of 1798 he is said to have committed suicide in a tavern at Bardstown, Kentucky.

Fitchburg, a city of Massachusetts, on the Nashua River, at the junction of three railroads, 40 miles WNW. of Boston. It has granite quarries, and manufactures of rolling-stock, machinery, paper, shoes, and tools, besides iron-foundries. Pop. 41,000.

Fitches. See VETCHES.

Fitchet. See POLE-CAT.

Fits, sudden seizures of disease implying loss of consciousness, or any considerable change in the condition of the mind, but particularly attacks of Epilepsy (q.v.), and other forms of Convulsions (q.v.).

Fitz (also *fiz* and *filtz*) is an old Norman-French word signifying 'son,' from the Lat. *filius* (Fr. *fils*). Like the Gaelic *Mac*, the Irish *O'*, and the oriental *Ben*, it is prefixed to proper names to signify descent, as in the Norman names Fitzwilliam, Fitzwalter, Fitzgerald. A special application of it is for natural sons of royalty, as in Fitzroy, Fitzjames (see BERWICK, DUKE OF), and Fitzclarence.

Fitzgerald, LORD EDWARD, a prominent member of the society of United Irishmen, was a younger son of the Duke of Leinster, and was born at Carton Castle, near Dublin, October 15, 1763. After his father's death he was brought up in France, but returned to England in 1779 to enter the army. He served with distinction in the American war, next sat for Athy in the Irish parliament, and was drawn to Paris by the resistless spell of the great Revolution. Here he renounced his nobility, and married Pamela (long believed to be a daughter of Madame de Genlis by *Égalité* Orleans; really a daughter of G. de Brixey and Mary Sims, born in Newfoundland). Returning to Ireland in 1793, he joined the United Irishmen in 1796, and went to France to arrange for a French invasion of Ireland. Soon after his return the plot was betrayed to the government, and Fitzgerald, after a few days of hiding in Dublin, was seized, not without a desperate scuffle, in which he received wounds of which he died, sixteen days later, 4th June 1798. See the Lives by Moore (2 vols. 1831), Taylor (1903), and Campbell (1904).

FitzGerald, EDWARD, was born March 31, 1809, at Bredfield House, near Woodbridge, in Suffolk. His father, John Purcell, took his wife's family name on her father's death in 1818. In 1816 the family went to France, and lived for a time at St Germains, and afterwards at Paris. In 1821 he was sent to King Edward VI.'s School at Bury St Edmunds, where James Spedding, W. B. Donne, and J. M. Kemble were among his schoolfellows. He went up to Trinity College, Cambridge, in October 1826, where Spedding joined him the next year, and where he formed fast friendships with Thackeray, W. H. Thompson, afterwards Master of Trinity, and John Allen, afterwards Archdeacon of Salop. He took his degree in January 1830.

His father's family resided at Wherstead Lodge, near Ipswich, from 1825 to 1835, and subsequently at Boulge Hall, near Woodbridge; there he lived with them until 1838, when he took up his separate residence in a cottage near the gate of Boulge Hall. His life at this time was a quiet round of reading and gardening, occasionally broken by visits from or to friends; his chief friends in the neighbourhood were the Rev. G. Crabbe, the son of the poet, and vicar of Bredfield, Archdeacon Groome, and Bernard Barton, the Quaker-poet of Woodbridge, whose daughter he afterwards married. Every spring he used to make a long visit to London to see his friends. There he constantly met Donne, Spedding, and Thackeray, and was a frequent visitor at Carlyle's house. Lord Tennyson and his brother Frederic had been his contemporaries at college; but it was in London that they became intimate; how fast the friendship was is best shown by Lord Tennyson's dedication of *Tiresias*. In 1853 he left the cottage and settled near Woodbridge, and afterwards in the town itself; but in 1874 he removed to Little Grange, a house which he had built for himself in the neighbourhood. His great outdoor amusement in these years was yachting; and every summer was spent cruising about the Suffolk coast, especially near Lowestoft and Aldborough, the latter locality being of great interest to him as associated with the poems of his favourite, Crabbe. He thoroughly enjoyed the life on his yacht, carrying his books with him, and delighting to take his friends for short trips, when they might read and talk over well-known passages together. He also enjoyed the rough, honest ways of the sailors and fishermen; and he liked to collect their peculiar words and phrases. But he could not escape 'the browner shade' which Gibbon ascribes to the evening of life, and the sea gradually lost its charm; one old sailor died, and another grievously disappointed him; and he at last gave up the yacht for his garden, where his favourite walk was called the 'Quarter-deck.' He died suddenly, June 14, 1883, while paying his annual visit to his friend the Rev. G. Crabbe, the poet's grandson, at Merton Rectory, Norfolk. One of his great characteristics was steadfastness in friendship; he was slow to form intimacies, but, once riveted, the link lasted till death. His outward manner was reserved, and he might sometimes seem a little wayward or petulant; but under all this cold exterior there lay a tenderness like Johnson's, and a fine stroke of imagination or a noble deed would make his voice falter and his eyes fill with tears.

The first forty-two years of his life passed in quiet reading and thinking, and it was not till 1851 that he published anonymously his dialogue on youth, *Euphranor*, which was followed by *Polonius* in 1852. In the meantime a friend had persuaded him to begin Spanish, and this not only opened a new world of interest, but revealed to him his own powers. He at once took to Calderon's plays, and afterwards to *Don Quixote*, and in 1853 he published a translation of six dramas of the former with his name attached; but he soon withdrew it from circulation, and two more were afterwards printed privately. About 1853 the same friend interested him in Persian. Sa'di's *Gulistán* early attracted him by its quaint stories, and in 1856 he published an anonymous version of Jámí's *Salámán and Absál;* and he also wrote, but never printed, an abridgment in verse of 'Attár's *Mantik ut tair*. But the Persian poet who most interested him, from the time of his first seeing his works in 1856 in a MS. in the Bodleian Library, was 'Omar Khayyám, the astronomer-poet of the 11th century. These poems were then known only by a few current quotations, as they were first printed at Paris in 1857 by M. Nicolas; but FitzGerald at once recognised their beauty, and his name and the poet's will probably remain indissolubly linked together. Here his genius as a translator appears at its height. He possessed to an extraordinary degree the power of reproducing on his reader the effect of the original; and, though the original ideas are often altered, condensed, and transposed in an apparently reckless way, these lawless alterations are like Dryden's, and they all tell.

See his letters, his works, and his *Letters to Fanny Kemble*, ed. Aldis Wright (7 vols. 1889–1901 and 1902–3); a variorum *Omar*, ed. F. H. Evans (1915); Life by T. Wright (1904); monograph by A. C. Benson (1905).

Fitzherbert, MRS, a Roman Catholic lady, born Maria Anne Smythe in 1756, to whom, after she had been a second time left a widow, the Prince of Wales, afterwards George IV., was secretly married in 1785 by an Anglican clergyman. This marriage, contracted without the king's consent, was of course invalidate under the Royal Marriage Act of 1772; but the prince carried his meanness so far as to persuade Fox to deny that there had been a marriage at all, and afterwards denied that he had done so. On his marriage to the Princess Caroline in 1795 the connection was broken off for a time, to be resumed with the pope's consent, and finally broken off in 1803. Mrs Fitzherbert, whose conduct in trying circumstances has been warmly praised, died at Brighton, 29th March 1837. See her Memoirs by Langdale (1856), and a Life by Wilkins (1905).

Fitzroy, the largest river of Western Australia, has its sources in the King Leopold Range, and, after describing a wide curve to the south, reaches the sea at the southern end of King Sound after a course of 300 miles, the lower 100 navigable for small boats. It was discovered by Stokes in 1838.—For the Queensland Fitzroy, see ROCKHAMPTON. Fitzroy is also the name of a north-eastern suburb of Melbourne.

Fitzroy, ROBERT, admiral and meteorologist, a grandson of the third Duke of Grafton, was born at Ampton Hall, near Bury St Edmunds, July 5, 1805, and entered the navy in 1819. His first important work was that of surveying the coasts of Patagonia and Tierra del Fuego, 1828–30; and this work he was charged to continue on his reappointment to the command of the *Beagle* in 1831. On this voyage he was accompanied by Darwin, the two together publishing in 1839, three years after their return to England, a *Narrative of the Surveying Voyages of H.M.S. 'Adventure' and 'Beagle,'* vols. i. and ii. by Fitzroy, and vol. iii. by Darwin. For two years (1843–45) he was governor of New Zealand, then a newly-constituted colony. Although placed on half-pay in 1850, he was promoted in due course to be rear-admiral (1857) and vice-admiral (1863) on the retired lists. In 1854 he received an appointment in the meteorological department of the Board of Trade, his attention being principally given in his later years to meteorology and the lifeboat service. The cheap and serviceable 'Fitzroy barometer' was made on a plan suggested by him; and it was he who instituted the system of storm warnings that has grown into the daily weather forecasts. Among his works are *Meteorological Observations* (1859), and *Weather-book* (1863), as well as *Remarks on New Zealand* (1846). He put an end to his own life, in a fit of mental aberration, 30th April 1865, at Norwood in Surrey.

Fitzwilliam, WILLIAM, Earl Fitzwilliam, was born in 1748, and, succeeding his father in 1756, took his seat in the House of Lords in 1769. He at first opposed Pitt, to whom he afterwards went over, with a considerable portion of the Whig party, owing

to the excesses of the French Revolution. As lord-lieutenant for three months of Ireland (1794–95), where his warm support of Catholic emancipation aroused enthusiastic hopes, he was considered by Pitt too liberal; and his recall was followed by the rebellion of 1798. He was president of the council in the Grenville ministry, in 1806, and took some part in the Reform Bill agitation. He died 8th February 1833.

Fiume (Serb. *Rjeka*, Lat. *Fanum Sacti Viti ad flumen*), an important seaport and district, at the mouth of the Fiumara or Rjeka, 142 miles WSW. of Zagreb by rail, and 35 miles ESE. of Trieste across the Istrian peninsula, stands at the head of the beautiful Gulf of Quarnero, in the Adriatic, where the Julian Alps end. It consists of an old and a new town, the latter on the sea, being well built and laid out with many handsome streets and squares. Its extensive industries include oil and rice refineries; shipbuilding; starch, tobacco, chocolate, paper, and macaroni factories; chemical works, and tanneries. The tunny-fisheries of the Gulf also are valuable. Fiume's chief importance, however, is as a great entrepôt of commerce, the place being the sole practicable maritime outlet for the produce of the whole middle-Danubian basin. A free port from 1717 till 1891, it has a harbour with a lighthouse and several breakwaters, which was greatly improved by the Hungarian government in the years following 1872, when new moles and quays with warehouses, and petroleum and other docks, were added at a cost of nearly a million sterling, with the immediate effect of increasing the trade fivefold within the next twelve years. Further improvements were begun in 1888 and in 1902. The exports are chiefly flour and grain, sugar, oak staves and timber, wine, mineral waters, magnesite, tannin, and tobacco; the imports, cereals, textile raw materials, and leaf-tobacco. The trade is almost entirely a transit trade, even the petroleum and rice going forward into the interior after manipulation. The chief imports from Britain are cotton goods and yarn, American tobacco, machinery, hardware, and coal; a large quantity of paddy rice and jute are imported from British India. Population (with Sushak, its eastern Slav suburb), 60,000, including Italians and Southern Slavs in about equal numbers. Both nations hoped to obtain Fiume (then a free town under the crown of St Stephen) as a part of the spoils of the Great War. Long and troublesome negotiations ensued, and were broken in upon by Gabriele D'Annunzio (q.v.), who, with a band of volunteers, seized the town on the 12th September 1919. The treaty of Rapallo (November 1920) made Fiume an independent state (8 sq. miles; pop. 65,000). It was agreed in 1924 that the city should be Italian, Sushak and part of the harbour Yugoslav.—The *county* of Fiume, in Croatia, between Carniola and the sea, is almost entirely filled by the Karst range. In the relatively small valley area, and along the coast, olives, figs, pomegranates, and citrons flourish.

Five Members, The, were those members of parliament—John Pym, John Hampden, Denzil Holles, Sir Arthur Haselrig, and William Strode—whom Charles I. endeavoured to arrest on 4th January 1642. This action, by which Charles had meant to prevent the impeachment of the queen, precipitated the Civil War. See CHARLES I.

Five-mile Act, an Act passed in 1665, enacting that no Nonconforming clergyman should be allowed to come within five miles of a corporate town, or of any place where he had once ministered, nor act as a tutor or schoolmaster, unless he first took the oath of non-resistance, and expressed his willingness to make no attempt to alter the constitution of either church or state.

Fives, a game of hand-ball still popular in England, chiefly at the great public schools. The game existed at least as early as the 14th century, both in France and England, being termed 'palm-play' in the former, and 'hand-tennis' in the latter; its name is derived from its being played with the 'bunch of *fives*'—i.e. hand. The principle of the game is very simple, although the minor rules depend largely on local tradition. In a 'single' one player constitutes a side; in a 'double' there are two on either side. A roomy court is requisite, bounded by a high wall at one end, and against this wall a ball is propelled by striking it with the open hand. A 'close' court has also two side walls, and the whole is sometimes covered. The game is begun by one player striking the ball against the wall, and causing it to rebound anywhere beyond the floor-score, which is about two yards from the wall; the ball as it rebounds is then returned by the opposing sides alternately, a player's stroke counting a failure whenever the ball does not touch the wall higher than three feet from the ground, and the opposite side scoring one. The ball may be struck either from a direct rebound before it reaches the ground, or after it has 'dapped' or hopped from the ground once. Fifteen is usually game. When the players are skilful the ball is kept going by the alternate strikers for many minutes at a time, and the game is thus rendered exciting both for players and onlookers.

Fixed Bodies is a term applied in chemistry to those substances which remain fixed, and are not volatilised at moderately high temperatures.—*Fixed Air* was the name given in 1756 by Dr Joseph Black (q.v.) to what in 1784 was named by Lavoisier Carbonic Acid.—*Fixed Oils* are those oils which, on the application of heat, do not volatilise without decomposition. See OILS.

Fixed Stars. See STARS.

Fixtures, The Law of, is very much the same in England and Scotland. The general idea of a fixture is that a movable has been fastened to the soil or to a house, and has thus become the property of the owner of the soil or house. Such questions arise frequently between vendor and purchaser, heritable and ordinary creditors, heir and executor, landlord and tenant. The last case is that most favourable for the right to remove a fixture. The first question is, however, whether the movable has become a fixture. Things not actually attached may be constructive fixtures—e.g. the keys of doors, the leathern belts of machinery, &c. In general, however, there must be physical annexation. Apart from this the main tests are: (1) can the thing be taken away without material injury to itself or to the premises? (2) is it essential, or material, or specially adapted to the enjoyment of the premises? In a famous case saltpans were held to be fixtures, because, though they could be removed without much injury, they were necessary to the use of the premises. But, further, especially between landlord and tenant, it is important to know what was the purpose of annexation, the intention of parties; were the things intended for perpetual or for temporary use? In *non-agricultural* subjects there are two main classes of fixtures—viz. those put up for ornament, convenience, or domestic use, and those put up for purposes of trade. The removability of the first class is a good deal settled by custom. The character of the article may show it to be purely temporary, otherwise the test must be whether the injury of detachment would be substantial. In dwelling-houses, for instance, pier-glasses, ornamental chimney-pieces, grates, book-cases screwed to the wall, are all regarded as movables, and

therefore removable by the tenant. Of course, injury caused to the premises by removal must be repaired by the tenant. In trade, on the other hand, all trade appliances and machinery put in by a tenant for the purposes of his trade are removable by the tenant, if there is no custom or stipulation to the contrary. Questions as to the right to remove fixtures are frequently settled by a remit to a practical man acquainted with the practice of the particular trade. In England a tenant cannot, unless by permission, remove fixtures *after* quitting the premises at the end of his lease. As regards *agricultural* subjects, the law in both England and Scotland is now largely statutory. The English and Scottish Agricultural Holdings Acts of 1883 placed the agricultural tenant (which includes pastoral, market-garden, and mixed holdings) in almost as good a position as the commercial tenant. To some extent this had been accomplished for England by a previous act in 1851. Prior to these statutes everything physically annexed by the tenant became the property of the landlord without compensation. The general statutory rule under the Agricultural Holdings Acts of 1908 now is that where a tenant puts up any engines, machinery, fencing, or other fixtures and buildings for which he is *not* entitled to compensation under the statutes, he is entitled to remove them if he has given a month's notice, and has paid his rent. The landlord, however, by counter notice, may purchase the fixture at a valuation. The tenant has to make good any damage occasioned to the holding by the removal.

Flabellum (Lat.). See FAN.

Flaccus. See HORACE, FESTUS, and PERSIUS.

Flaccus, C. VALERIUS, a Roman poet, who flourished in the time of Vespasian, but of whose life nothing is known. He wrote the *Argonautica*, an unfinished epic poem, a good example of learned mediocrity rather than of genuine inspiration. The chief editions are those of Thilo (1863) and C. Schenkl (1871). An English metrical translation was published by Nicholas Whyte in 1565. See a *Study* by Summers (1894).

Flacius, or VLACICH, MATTHIAS, surnamed Illyricus, a pupil of Luther and Melanchthon, was born at Albona, in Illyria, in 1520. He studied at Basel, Tübingen, and Wittenberg successively, and became professor of the Hebrew Scriptures at this last-named university in 1544. From this time he took an active part in all the theological discussions of the time; and for his attacks upon Melanchthon's compromise, known as the Leipzig Interim, he was, four years later, deprived of his professorship. Nor did he procure another appointment until 1557, when he became professor of Theology at Jena. This post he again lost, after holding it for five years, on account of his doctrine that original sin was essentially inherent in man's nature. After this he led a wandering life, dying in great poverty at Frankfort-on-Main in 1575. Of his numerous works three deserve mention—*Clavis Scripturæ Sacræ* (1567), *Catalogus Testium Veritatis* (1556), and *Ecclesiastica Historia* (1559–74). It is said that Flacius, in order to gather materials for his work, visited, in the disguise of a Franciscan monk, several monastic libraries throughout Europe, and purloined from them such MSS. as were useful to him, amongst those thus stolen being the original of Fordun's *Scotichronicon*, which, with other MSS., was after his death purchased by the Duke of Brunswick for the library at Wolfenbüttel. The history, called Magdeburg Centuries, was only partly written by him. See CHURCH HISTORY, and Preger's monograph (1861).

Flag, a popular name for many monocotyledonous plants with sword-shaped leaves, mostly growing in moist situations. It is sometimes particularly appropriated to the species of Iris (q.v.) or Flower-de-luce, especially to the common yellow flag (*I. pseudacorus*); but is given also very indiscriminately to other plants of similar foliage, as the *Acorus Calamus* (see CALAMUS), which is called Sweet Flag. It is even frequently applied in the United States to some of the algæ—e.g. Fucus (q.v.).

Flag, a piece of some coloured fabric (usually bunting), generally with a design upon it, and attached by an edge to a staff or halyard, used as a national or personal emblem for military and naval purposes, for signalling, or for decoration or display. As a military ensign, it was probably developed out of the fixed standard of the Romans and other ancient nations through the *vexillum* and *labarum*. With the rise of the feudal system the use of flags became more and more common, and by the 11th century they were in general use by military leaders, as may be seen from the Bayeux Tapestry. Flags may be divided into four classes—the standard, the banner, the pennon, and the gonfalon.

The *Standard*, as its name implies, was not meant to be carried about, but to be fixed on the ground either as a rallying-point or to show the location of its owner. Standards are not now generally used, but they were much in evidence in medieval times. They were of enormous size, ranging from eight yards in length for a king, down to four for an ordinary knight. The standard never bore the full arms of its owner; next the staff, or, as it is technically termed, at the 'hoist' of the standard, was depicted the Cross of St George in England or that of St Andrew in Scotland; the end or 'fly' of the standard was rounded off and split into two. On the flag itself two bands were drawn obliquely across it containing the motto of the owner, while in the vacant spaces on each side of the bands were his badge, crest, or small charges taken from his

Standard of Sir Henry de Stafford, K.G., 1475.

shield-of-arms. The colours of the standard were generally regulated by the 'livery colours' of the possessor—that is, the principal metal and tincture which appeared on his arms. The accompanying illustration gives a good idea of a 15th century standard; the badge here displayed so frequently is that termed the Stafford Knot (see BADGE). The *pennant* or *pendant* is a miniature standard in shape, usually much elongated, but is not charged with any device except a cross at the hoist. It is practically only used at sea, and the pennant of a battleship may be some 6 inches in breadth by 20 yards long.

The *Banner* (q.v.) is rectangular in form and ought to be exactly square. On it are depicted the arms of its owner, taking up the entire surface of the flag without any shield or external ornaments being displayed. The *Siege of Caerlaverock*, a Norman-French rhymed chronicle of the 14th century, describes the arms on the banners of all the lords and knights-banneret who were with Edward I. on his campaign against Scotland in 1300. The flag flown by the king, usually called the royal

standard, should really be styled the royal banner. It contains the personal arms of the sovereign, and should never be displayed except where he is actually present; it is a popular error to suppose that this flag is in any way national.

The *Pennon* was a smaller flag carried below the lance-head, and tapered or forked at the extremity. It was, from its size and shape, the most easily carried of all flags; but it was not every one who could use even a pennon—it could only be borne by a knight who had followers to defend it. It generally bore, in heraldic times, the arms or badge of its owner, which were so displayed as to appear correct when the lance was at the rest, not when held upright. A diminutive of the pennon was the pennoncel, a flag that might be borne by esquires, but which was chiefly used in large numbers at funerals, when heraldic displays were one of the chief features at such functions.

The *Gonfalon* or *Gonfanon* (*Scottic*é, gumpheon) was a very early shape of flag, said to have been originally fixed in a frame in which it could turn; latterly, however, it came to be suspended from one end to a cross-bar from which it hung downwards. It was and is the most usual form for religious and ceremonial flags, and was also largely used, like the pennoncel, at funerals. Sometimes an immense number of them were painted with the arms of the deceased; they were quite small, and must have been rather roughly done, as they were turned out by the dozen.

An account of military flags is given under Colours (Military). What follows relates chiefly to national flags as borne at the present time or lately. Their most general and important use is at sea, as ships sail under the colours of the country in which they are registered; but national flags are, of course, frequently displayed on shore also.

The union flag of the United Kingdom, or Union-jack, as it is often incorrectly termed (a jack being a miniature flag displayed from a staff at the end of the bowsprit), took its origin, in 1606, soon after the union of the crowns of England and Scotland. As it was desirable to have a common flag for the two kingdoms, a combination was made of the red St George's Cross of England and the white St Andrew's Cross of Scotland, retaining the blue ground of the latter and superimposing the Cross of St George over that of St Andrew. But in making this arrangement it was necessary, from a heraldic point of view (which forbids colour to be put on colour), to place a narrow border (technically called a fimbriation) of white on the outside of the red cross, so as to separate it from the blue ground. Such was the first union flag. In 1801, at the union of Ireland, the red saltire of St Patrick had to be united with the former two crosses in the union flag. The way that was done was as follows: The white St Andrew saltire was halved in breadth, and a corresponding breadth of the St Patrick red saltire was laid alongside it, but on the reverse side, in each quarter, or in heraldic language counterchanged. But this, again, involved colour being placed on colour, so, in accordance with the above-mentioned rule, a narrow fimbriation of white was put in between the red saltire and the blue ground. It should be borne in mind, also, that a line running down the centre of the united saltires of St Andrew and St Patrick (irrespective of the fimbriation at the side of the latter) should pass through the true centre of the flag, though, of course, it is discontinued when meeting with the Cross of St George. The following is the official blazon of the flag: 'Azure the crosses saltires of St Andrew and St Patrick quarterly per saltire, counterchanged argent and gules, the latter fimbriated of the second, surmounted by the Cross of St George of the third, fimbriated as the saltire.'

The blazon assumes that the two saltires are to be of the same width, but the official proportions given for making the flag involve reducing the width of the St Patrick saltire, so that it and its narrow fimbriation must together be equal to the broad white of the St Andrew saltire.

The union flag, though not strictly a land flag, may be used on shore by any British subject. This was distinctly stated in 1908 on behalf of the government of the day. Certain official persons, such as military officers commanding stations, honorary diplomatic servants, and governors of colonies, bear the union flag with a distinguishing mark in the centre. At sea the union flag pure and simple is only borne by an admiral of the fleet at the main-top-gallant masthead in place of a pennant. Otherwise the union is combined with one of three ensigns—white, blue, and red—corresponding to the three divisions into which the British fleet was at one time divided. That system was abolished in 1864, but the different ensigns are still in use. The white ensign is charged with the St George's Cross, and in the upper corner next the staff the union flag appears; it is used by all British ships of war and by the Royal Yacht Squadron. The blue ensign, a similar flag, but uncharged with any cross, is flown by the Naval Reserve and certain yacht clubs; while the red ensign is borne by all other vessels belonging to British subjects. The Union-jack, with a white border of one-fifth the size of the jack, is used as a pilot-flag by British ships in all parts of the world.

There are certain personal flags apart from that of the sovereign which may be mentioned here. The Lord High Admiral's flag, or Admiralty flag, is red, with an anchor and cable, and is hoisted when that functionary or any of the Commissioners of the Admiralty are on board. Admirals fly a white flag with the red St George's Cross thereon displayed; vice-admirals the same, with one red ball in the upper canton next the staff; and rear-admirals one red ball in the upper and another in the lower canton, both next the staff. Commodores fly a broad white forked pennant charged with the St George's Cross. The following ensigns are borne by the under-mentioned officers, in a circle:

The Lord Lieutenant of Ireland bore the union, and in the centre a blue shield charged with a gold harp. Diplomatic officers bear the union, and in the centre a white circle charged with the royal achievement, and surrounded with a green garland. Governors of colonies and administrators thereof bear the union, and in the centre a white circle bearing the arms or badge of the colony, and surrounded by a green garland. Officers in the consular service bear, while afloat, the blue ensign with the royal arms in a white circle on the fly thereof—that is, in the centre of that part between the union flag and the end of the flag; but when ashore an imperial crown takes the place of the royal arms. General officers commanding fly, when afloat, the union, and in the centre the royal initials surmounted by a crown all on a blue circle surrounded by a green garland. Lords lieutenants of counties fly the union flag charged with a sword, lying fess-ways, point to the fly, and in the upper member of the St George's Cross the royal crown.

The following is a description of the flags of some of the principal nations of the world:

Argentine Republic.—The ensign is divided laterally into three equal parts, blue, white, and blue. In the centre of the white stripe is a golden sun.

Austria.—The flag of the republic is divided horizontally into three stripes, red, white, and red.

Austria-Hungary.—The emperor's standard was yellow, having within an orle of eight crowns the double-headed eagle of the empire, ensigned with an imperial crown, its wings charged with eleven

small crowned escutcheons, and its breast with one large one bearing the arms of Hapsburg, Austria, and Lorraine, and surrounded by the collar of the Golden Fleece. The standard was enclosed in a border, indented, of gold, red, white, and black. The ensign had three broad horizontal stripes, red, white, and red, the middle one being charged with an escutcheon divided as the flag itself, surrounded by a gold border and surmounted by a crown. The merchant flag was similar, but with an additional escutcheon for Hungary and with the lower stripe divided into two halves, red and green.

Belgium.—The royal standard is divided vertically into three parts, black, yellow, and red, with the royal arms in the centre division. The merchant flag is the same, without the royal arms.

Brazil.—The national flag is green, with a yellow diamond-shaped compartment in the centre bearing a globe of pale blue studded with stars, with the words *Ordem e Progresso* in a white equatorial line.

Chile.—Two horizontal stripes. On a blue canton occupying the third part of the upper stripe nearest the hoist is a white star.

Chinese Republic.—The national flag is divided into five horizontal stripes, red, yellow, blue, white, black (reading from the top of the flag). Merchant vessels fly these colours only. The ensign is red with a blue canton charged with a white sun.

Czechoslovakia.—Two horizontal stripes, white and red, intersected by a blue triangle having its base at the hoist.

Denmark.—The ensign is a bifurcated red flag with a white cross; when used as a standard the royal arms are inserted on a white ground in the centre of the cross.

France.—The ensign is divided vertically into three equal parts, blue, white, and red. The merchant flag is the same.

Germany.—The national flag is divided into three horizontal stripes, black, red, and yellow (reading from the top). The merchant flag has horizontal stripes of black, white, and red, with the national colours in the upper hoist canton. The standard of the emperor was yellow, semée of sable eagles displayed and crowns; in the field was the Iron Cross throughout, its arms charged with the words *Gott mit uns, 1870.* In the centre was the escutcheon of the empire, a gold shield with a black single-headed eagle bearing on its breast an escutcheon with the arms of Hohenzollern. The principal escutcheon was surrounded by the collar of the Order of the Black Eagle. The ensign consisted of a white flag with a plain black cross, the arm on the fly being longer than that on the hoist. The cross was cotised or bordered with a narrow stripe of black at a little distance from the edge; in the centre of the cross was a white circle bearing the German eagle, and the first quarter of the flag was divided into three horizontal parts, black, white, and red, with the Iron Cross over it. This quarter formed the jack, and the merchant flag was similar to the jack, with the exception that the Iron Cross was omitted.

Greece.—The jack is blue, with a plain white cross throughout. The merchant flag is a curiously designed flag of five horizontal blue and four white stripes, with a white cross on a blue ground in the upper quarter next the hoist.

Italy.—The royal standard is pale blue, with a crown at each of the four corners. In the centre is a black single-headed eagle displayed, ensigned by a crown, and bearing on its breast a red shield with a white cross; the eagle is surrounded by the collar of the Order of the Annunciation. The ensign is divided into three vertical parts, green, white, and red; in the centre compartment is the red shield and white cross of Savoy within a blue border, and ensigned by a crown. The merchant flag is the same, without the crown.

Japan.—The imperial standard is red, with a gold chrysanthemum in the centre. The ensign is white, with a red ball nearer the hoist than the fly, with sixteen red bands radiating from it and getting broader as they approach the edge of the flag. The jack is white, with a red ball in the centre.

Netherlands.—The royal standard is yellow, with a blue cross charged in the centre with the royal arms surrounded by the orange ribbon and badge of the Order of William I.; in each of the four quarters of the flag is a hunting-horn blue, and stringed red. The ensign and jack are composed of three horizontal stripes, red, white, and blue.

Norway.—The royal standard is red, with a gold lion crowned rampant and holding in its paws a silver battle-axe. The jack is red, with a blue cross fimbriated white. The ensign is similar, only three-pointed instead of square. The merchant flag is rectangular, with the vertical members of the cross nearer the hoist than the fly, thus making the two horizontal members of unequal length.

Poland.—Two horizontal stripes, white and crimson.

Portugal.—The national flag of the republic is divided vertically into two parts, green and red, in the following proportions: length 3, breadth 2, green 5, red 8. On the intersecting line of the colours is placed a banded sphere, and on it a red shield with seven gold castles placed in orle, and in the centre a white shield charged with five small blue shields in cross, each charged with five silver roundles. The jack is square, with a red centre charged with the banded sphere and shields as above, and surrounded by borders of green.

Russia.—The national flag of the Soviet republic is red, with the letters P. C. Ф. C. P. in the upper left-hand corner. The imperial standard was yellow, charged with a black double-headed eagle displayed, bearing on its breast a red shield with St George and the Dragon, being the arms of Moscow, the shield being surrounded with the Collar of St Andrew. The wings were charged with eight escutcheons containing the arms of different provinces of the empire. The ensign was white, with a blue St Andrew's Cross. The jack was red, with a white cross surmounted by a blue saltire fimbriated white. The merchant flag was composed of three horizontal stripes, white, blue, and red.

Serbs, Croats, and Slovenes (*Kingdom of the*).—A long oblong flag, its height being double its width; three horizontal stripes, red, white, and blue.

Siam.—A broad blue horizontal stripe between two narrower white ones, with as many red at the top and bottom of the flag.

Spain.—The royal standard is purple. In the centre, on an oval shield, and ensigned by a crown, are the royal arms, the shield being surrounded by the Collar of the Order of the Golden Fleece. The ensign has a broad yellow horizontal stripe between two narrower ones of red, the former being charged with an oval shield with the arms of Castile and Leon impaled thereon and surmounted by a crown. The merchant flag is yellow, with two red horizontal stripes.

Sweden.—The royal standard is three-pointed, blue with a yellow cross, in the centre of which is a white square bearing the royal arms. The ensign is the same, without the royal arms. The national flag is oblong instead of three-pointed, and the yellow cross is borne in the same fashion as the blue cross of Norway.

Switzerland has only an ensign, which is red, with a white Greek cross, the arms of which do not extend to the edges of the flag.

Turkey.—The imperial standard was red, with an

oblong rayed design in white in the centre. The ensign and merchant flag is red, with a white crescent and star.

United States of America.—The national flag, which is used as ensign and merchant flag, has thirteen horizontal stripes alternately red and white. In a blue canton, in the top corner of the flag next the hoist, are forty-eight white stars. The jack is a plain blue flag with the same number of stars.

The following are the flags of the principal British dominions; the colonies and dependencies of the empire have each an armorial badge, which is superimposed on the fly of whatever British ensign it may be proper to use. When the border of the badge is of the same colour as the ensign, the former is put within a white circle:

Irish Free State.—Three vertical stripes of green, white, and orange.

Australia.—The Commonwealth of Australia bears the blue ensign as a national flag, with five stars (the Southern Cross) on the fly and a large six-pointed star below the union canton. The merchant flag is similar, but red. The governor-general's badge, borne on the centre of the union flag in a white circle, is a seven-pointed faceted star in gold, ensigned by a crown and surrounded by a green garland.

New Zealand also bears the blue ensign with four red stars fimbriated white on the fly. The merchant flag is the red ensign with four white stars on the fly.

Canada.—The merchant flag is the red ensign with the badge of the Dominion.

Newfoundland.—The badge represents Mercury bringing gifts from a ship to Britannia, with the mottoes *Terra nova* and *Hæc tibi dona fero.*

Union of South Africa.—A shield with the arms of the Union borne on the fly of the red ensign.

India.—Badge of the governor-general—a many-rayed golden sun, on the centre a five-pointed silver star surrounded by a blue ribbon bearing the words, *Heaven's Light our Guide*, being the motto of the Order of the Star of India, borne on the union flag, and ensigned with an imperial crown.

See SIGNALLING.

Flag-captain, in the Navy, is the captain of the admiral's ship in any squadron, and is ordinarily his nominee.

Flagellants, the name applied to those groups of fanatical enthusiasts who, at intervals from the 13th to the 16th century, made their appearance in various countries of Europe, proclaiming the wrath of God against the corruption of the times, inviting sinners to atone for sin by self-inflicted scourgings or flagellations, and publicly enforcing this exhortation by voluntarily scourging themselves, as well as by other forms of self-castigation. In large and disorderly bands—frequently headed by priests, and by fanatics in the costume of priests and monks, bearing banners and crucifixes aloft, their breasts and shoulders bare, and their faces concealed by a hood or mask, each armed with a heavy knotted scourge, loaded with lead or iron—they marched from town to town, chanting hymns full of denunciations of vengeance and of woe. In the most public place of each town which they entered they threw themselves upon the earth, and there inflicted upon themselves the discipline of scourging, frequently to blood, and even to mutilation. Each member enrolled himself for thirty-three days, in honour of the thirty-three years of the life of our Lord on earth; and all for the time professed entire poverty, subsisting only on alms or voluntary offerings. These fanatical movements recurred at frequent intervals; the most remarkable, however, are three in number. The first originated at Perugia in 1260, at a time when society in Italy was greatly disorganised by the long-continued struggles of the Guelph and Ghibelline factions. Numbers crowded to follow the new cry, until at last the body became so formidable as to draw upon itself the suspicions of Manfred, the son of Frederick II., by whom it was vigorously suppressed. Later offshoots of the party made their appearance in Bavaria, Austria, Moravia, Bohemia, Poland, and France; when to their extravagant practices they added still greater extravagances of doctrine. In virtue of a pretended revelation, they asserted that the blood shed in self-flagellation had a share with the blood of our Lord in atoning for sin; they mutually confessed and absolved one another, and declared their voluntary penances to be a substitute for all the sacraments of the church, and for all the ministrations of the clergy. The Jews were to them an object of special abhorrence, and suffered dreadfully from their fury in many towns of Germany and the Netherlands. In the second outbreak of Flagellantism, about 1349, the outrages against public decency were much more flagrant than on its first appearance. Men and women indiscriminately now appeared in public half naked, and ostentatiously underwent these self-inflicted scourgings. The immediate occasion of this new outburst of fanaticism was the terror which pervaded society during the dreadful plague known as the Black Death. The same extravagances were again repeated in Upper Germany, the provinces of the Rhine, the Netherlands, Switzerland, Sweden, and even England. Although rigorously excluded from France, these fanatics effected an entrance into Avignon, then the residence of the popes, but were condemned by a bull of Clement VI. The mania gradually subsided, nor do we again find any permanent trace of it till the beginning of the next century. In the year 1414 a new troop of Flagellants, locally called *Flegler*, made their appearance in Thuringia and Lower Saxony, renewing and even exaggerating the wildest extravagances of their predecessors. These new fanatics appear to have rejected all the received religious usages, and indeed all external worship, placing their entire reliance on 'faith and flagellation.' Their leader was called Conrad Schmidt. They rejected not only the doctrines of the church upon the sacraments, but also purgatory and prayers for the dead. Their violence drew upon them the severest punishments of the Inquisition. Many of them were capitally condemned, and Schmidt himself was burned at Sangerhausen in 1414. Their doctrines, comprised in fifty articles, were condemned in the Council of Constance.

These strange extravagances are reprobated by the Roman Catholic Church in common with all other Christian communities; but Roman Catholics (relying on 1 Cor. ix. 27; Col. iii. 5) hold the lawfulness, and even the meritorious character, of voluntary self-chastisement, if undertaken with due dispositions, practised without ostentation or fanaticism, and animated by a lively faith and a firm hope in the merits of Christ. This is the self-castigation known under the name of 'the Discipline'—a form of mortification not unfrequent in the monastic state, and even practised by lay persons, and these sometimes of the highest rank, both in ancient and in modern times. See PENANCE.

See Wadding's *Annales Minorum Fratrum;* Raynaldi's *Continuation of Baronius;* Mosheim's *Church History;* Gieseler's *Kirchengeschichte;* and Milman's *Latin Christianity.* Also the following special treatises: Förstemann, *Die Christlichen Geisslergesellschaften* (1828); Schneegans, *Die Geissler* (1840); W. M. Cooper, *Flagellation and the Flagellants* (new ed. 1887); and Röhricht in the *Zeitschrift für Kirchengeschichte* for 1877.

Flagellum, a vibratile filament of living matter associated with a cell, whether that be an isolated unit as in most flagellate Infusorians, or an

element in a multicellular organism, as in the flagellate chambers of a sponge. A flagellate cell has in most cases a single flagellum, and two are not uncommon; cilia, however, usually occur in numbers. A cilium is simply bent and straightened again; a flagellum wriggles from side to side with a more complex undulatory contraction and extension. A rudder-like flagellum, driving the cell before it, as in spermatozoa and bacteria, has been called a *pulsellum;* while the commoner type, which draws the cell after it, as seen in many Infusorians, has been termed a *tractellum.* A flagellum is usually locomotor or food-wafting in function, and is an expression and outcome of marked activity in the cell to which it belongs. See CELL, CILIA, PROTOZOA.

Flageolet (Old Fr. *flajol*), the modern form of the old *Flûte à bec,* or straight flute, the simplest kind of which is the tin whistle with six holes. It is said to have been invented by Sieur Juvigny in 1580. The English flageolet has the same scale as the Flute (q.v.). The French flageolet, which at one time was very popular in dance music, is a smaller variety, having only four holes in front, with two behind for the thumbs, and additional keys. Its compass is a little over two octaves from G on the treble stave. The flageolet is not used in orchestral music.

Flag-lieutenant is an officer who, in the navy, performs such duties for an admiral as would devolve upon an aide-de-camp in the army. He is also in charge of signalling. He communicates the admiral's orders to the various ships by signal, and reports when they understand them.

Flag-officer, in the British Navy, is an admiral, vice-admiral, or rear-admiral. He is so called from his right to carry, at the mast-head of the ship in which he sails, a flag denoting his rank. The Lord High Admiral, or the commissioners appointed to fulfil his duty—i.e. the Lords of the Admiralty—fly the Admiralty flag at the main. For an admiral of the fleet the union flag is borne at the main. For an admiral the flag is borne at the main; for a vice-admiral, at the fore; and for a rear-admiral, at the mizzen: the flag varying as described at FLAG.

Flagship, the ship in a fleet which bears the admiral's flag, and therefore forms a sort of centre to which all other vessels must look for orders. It is usually the most powerful vessel in the fleet.

Flagstone, a rock which splits into tabular masses, or flags of various size and thickness, in the original planes of stratification. Flagstones are generally sandstones combined with more or less argillaceous or calcareous matter; some, however, are indurated clays, and others thin-bedded limestones. They are used for paving, cisterns, &c. The most famous are those of Festiniog (North Wales), remarkable for their large size, even grain, and great beauty; those of Yorkshire, also of large size, and of great hardness and toughness; and those of Caithness, which are extremely tough and durable. The Caithness flags belong to the Old Red Sandstone; the Yorkshire are taken from the millstone grit division of the carboniferous system.

Flahault de la Billarderie, AUGUSTE CHARLES JOSEPH, COMTE DE, a French soldier and diplomatist, was born at Paris on 21st April 1785. Entering the army a mere lad, he was rapidly promoted to the rank of aide-de-camp of Napoleon. He distinguished himself in the Peninsular war and the Russian campaign, and in 1813 received the title of Count, and the rank of general of division in the new army. He became an exile after Waterloo; and while in England married a Scottish peeress, the Baroness Keith and Nairne, proprietor of Tulliallan, in Clackmannanshire. After the revolution of 1830 Flahault returned to France, entered the household of the king, and was appointed ambassador at Vienna (1842–48). By Napoleon III. he was sent as ambassador to London (1860–62), and made Grand Chancellor of the Legion of Honour. He died 2d September 1870.

Flail. See THRASHING.

Flambard, RANNULF or RALPH, justiciar of England under William II., was a Norman of obscure birth. Although he entered the church, and in 1099 obtained the bishopric of Durham, he did not scruple to make himself the king's man, ministering to his vices and extravagances by cruel and oppressive extortion of the king's subjects. He it was who taught the king to apply the usages of feudalism to the estates belonging to the church. He died 5th September 1128.

Flamborough Head, a promontory of the Yorkshire coast, forming the northern horn of Bridlington Bay, 18 miles SE. of Scarborough (by road 24). It terminates a range of steep chalk cliffs, 300 to 400 feet high. Its rugged sides are pierced with many caverns, and in the sea close by are picturesque chalk rocks, which swarm with sea-birds. On the Head is a light-house, 214 feet above sea-level, and 80 feet high, seen 21 miles off. Across the peninsula, ending in the Head, runs a double entrenchment, called Danes' Dyke, but really an ancient British earthwork.

Fig. 1.—Window, Harfleur.

Flamboyant, the latest style of Gothic architecture, which prevailed in France during the 15th and part of the 16th century, and corresponds to the Perpendicular (q.v.) in England. The name is derived from the flame-like forms of the tracery of the windows, panels, &c. (fig. 1). The characteristics of this style are minute and elaborate ornament, combined with general bareness of surface. The crockets, for instance, are generally cut into a great number of small leaves, while they are placed far apart; the mouldings are divided into large empty hollows and small thin fillets and beads; the finials have crockets minutely carved, set upon bare pyramidal terminals; the arch-mouldings are divided into a great number of small members, and want the boldness and decision of the earlier styles.

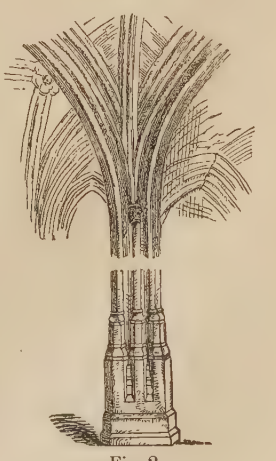
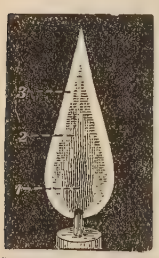


Fig. 2.

These mouldings are frequently abutted on the pillars, or continued down them without any caps; and when there are caps, they are small and without effect (see fig. 2). When mouldings join, they are frequently run through one another, so as to appear to interpenetrate. The effect is intricate rather than beautiful, suggestive of ingenuity in stone-cutting rather than art.

Flame may be defined as a mass or region of glowing gas; and, in so far as terrestrial conditions are concerned, the glow is excited by some exothermic chemical change. Thus the glow which strongly heated iodine vapour exhibits is due to the recombination of its dissociated atoms $I+I=I_2$. Nitrogen also glows and becomes chemically 'active' when subjected to a powerful electrodeless discharge at low pressures, the glow being due to the recombination $N+N=N_2$. Flame is always, however, associated, in the popular mind, with the phenomenon of combustion, and in this restricted sense the glow is excited by interactions in an explosive mixture of combustible gases (or vapours) and oxygen (air). Such interactions probably involve the transient formation of vibratory systems intermediate between the initial reacting mixture and the products which finally emerge therefrom. Hence all flames radiate a certain part of the energy liberated during combustion, and are luminous. In no case are the chemical changes concerned instantaneous, and in many cases they involve complex intermediate stages, so that the process is only gradually completed. Hence a certain space (flame-volume) is required, and the temperatures in different regions thereof may be very unequal. The process may be intensified, and the flame-volume diminished with consequent increase in temperature, by various means, such, for example, as (1) the perfect mixing of the combustible gas and oxygen (air) in proper combining proportions before ignition; (2) preheating of the mixtures; (3) the setting-up of 'turbulence' in the mixture before ignition by the influence of compression-waves during combustion.



Flame of a Candle: Showing 1, area of non-combustion; 2, area of partial combustion; 3, area of complete combustion.

The simplest type of flame is that propagated through a homogeneous explosive mixture of combustible gas (vapour) and oxygen (air); for each particular mixture there is a certain temperature (the 'ignition' temperature) to which it must be raised before it will 'self-heat' itself by combination, so that if left to itself it will eventually burst into flame. Thus in the case of hydrogen burning in air or oxygen at atmospheric pressure, the ignition temperature is 585° C., for carbon monoxide 650°, and for acetylene 428°.

Flame is initially propagated from its point of origin for a certain short distance through such a homogeneous explosive mixture, with a slow uniform velocity (e.g. 20 metres per second for a mixture of hydrogen and oxygen in combining proportions, and 2 metres per second for a similar mixture of carbon monoxide and oxygen), each successive layer of the mixture being ignited 'by conduction'—i.e. by admixture with the hot burnt products from the previous layer. This phase of gaseous explosion is usually termed '*inflammation*,' and it is a condition which applies to all ordinary flames. But in the most intense form of flame (*detonation*) the chemical action is propagated from layer to layer by adiabatic compression, with a constant maximum velocity, which, in the case of hydrogen and oxygen in their combining proportions, is 2817 metres per second.

A stationary flame may be obtained (1) by igniting an explosive mixture as it issues from a suitable orifice, with a velocity equal to the velocity of 'back-firing,' or (2) by allowing one of the combining gases to issue into an atmosphere of the other, and igniting the mixture so produced. The case of ordinary 'atmospheric' (Bunsen) burner flames, in which a non-explosive mixture of gas and air is ignited as it issues from an orifice into the air, is intermediate between (1) and (2). In the well-known Méker type of burner an explosive mixture of gas and air in combining proportions (or nearly so) is ignited as it issues from an enlarged burner-head through a deep metal grid; the resulting conical flame is small in volume, and very hot.

The temperatures of flames vary enormously, according to the conditions of combustion, degree of aeration, and region in the flame, and they are only known approximately. Thus, according to Féry's determination, the temperature of a coal-gas Bunsen flame, fully aerated, is 1871° C., of hydrogen burning in air 1900°, and of acetylene in air 2548°. That of an acetylene-oxygen flame is variously estimated to be between 3000° and 4000° C.

All flames are luminous to a degree, dependent upon the nature of the gas undergoing combustion; the brilliant yellow luminosity of hydrocarbon flames is due to the incandescence of solid carbon particles which are liberated in the flame as the result of the chemical changes occurring therein. The structure of flames has been the subject of much scientific research (*vide* Smithells and Ingle, *Journ. Chem. Soc.* 1892, pp. 204–226), whilst recent developments of the chemistry of the subject were summarised by Professor W. A. Bone in the British Association Reports for 1910.

Singing and Sensitive Flames.—If the flame of coal-gas, or, better still, hydrogen issuing from a blowpipe-nozzle, be slowly passed up a wide glass tube, it will be found that at a particular position up the tube the flame alters its character, being rapidly extinguished and rekindled, while at the same time it gives forth a peculiar musical note. To this is given the name of a *singing flame*. The sound is caused by longitudinal vibrations of the air in the tube, originally set up by a decrease in pressure above the flame, caused by the upward draught; a downflow is thus momentarily produced, which in its turn is checked by the upward motion of the air, and so on.

When an inflammable gas issues from a narrow vertical jet, and is ignited above a sheet of wire-gauze held horizontally about two inches above the orifice, a flame is produced which is easily affected by any sound-waves which strike it, and is hence termed a *sensitive flame*. It will respond to sounds, especially those of high pitch, produced in its neighbourhood, by sinking down to the wire-gauze.

Flamens were priests in ancient Rome devoted each to some special deity. There were fifteen in all. The chief of these (*Flamines Majores*) were the flamen of Jupiter (*Flamen Dialis*), of Mars (*Martialis*), and of Quirinus (*Quirinalis*), who were always patricians; the remaining twelve (*Flamines Minores*) were chosen from the plebeians. The flamens were elected at first by the Comitia Curiata, but afterwards by the Comitia Tributa, and were installed into their office by the supreme dignitary of the Roman official religion, the pontifex maximus. The flamen of Jupiter was a privileged person; he was not required to take an oath, was attended by a lictor, his house was an asylum, and he had a seat in the senate. But all this was attended by numerous restrictions: he might not have a knot on any part of his attire, nor touch flour, or leaven, or leavened bread; he might not touch or name a dog, or mount a horse, or be a night out

of the city, &c. His wife, called Flaminica, was subjected to similar restrictions, and when she died the flamen was obliged to resign. The majority of Roman writers attribute the institution of flamens to Numa.

Flamingo (*Phœnicopterus*), a genus of remarkable birds, forming a distinct family, Phœnicopteridæ, intermediate between the Anserine birds and the storks. The genus includes eight species, four of which are American (in Chile, Galápagos, Mexico, West Indies, Florida), while the others are distributed in Africa, south Europe, India, and Ceylon. The bill is very peculiar, longer than the small head, and suddenly bent downwards in the middle; the neck is very long and thin; the same adjectives are even more applicable to the legs;

Flamingo (*Phœnicopterus ruber*).

the short toes are webbed. The flamingoes live sociably on marshy shores of the sea, sometimes of fresh water. They stir up the bottom with restless feet, and grub for small animals. In thus fishing, the upper half of the spoon-like bill is turned downwards. The edges of both upper and lower jaw are furnished with small transverse plates, which serve for a sieve, retaining small worms, crustaceans, molluscs, fishes, &c. The upper surface of the tongue is beset on the sides and base with flexible, recurved, horny spines. The flamingoes are birds of powerful flight, and fly like geese in strings or wedge-shaped flocks. They also swim in deep water, but the legs are too long to be well adapted for this purpose. They are habitual waders, and the webbed membrane of the feet helps to support them on soft muddy bottoms. Hundreds feed and nest together, and, being large and richly coloured, form a brilliant assembly, their exquisite pink plumage sometimes making a striking contrast against a background of dark-green mangroves. The nests are mounds of mud, from 8 to 15 inches in height, gradually raised year after year, and built at distances of 3 to 4 feet apart. During incubation the females, it was said, sit with their legs dangling down behind; but Sir H. Blake and Chapman, who watched them carefully, say that the limbs are folded under the birds in the usual fashion. The nesting occurs about the end of May, the hatching about a month later. There is usually only one egg. One species (*Ph. ruber* or *antiquorum*) occurs in Europe, from spring to autumn, on Mediterranean coasts. It measures about 4 feet from bill to tail, and stands about 6 feet high from bill to feet. The male in full plumage is for the most part of a rose-red colour; the female, and the young for several years, are less brilliant. The young birds were among the delicacies of the ancients.

Flaminian Way (*Via Flaminia*), the great northern road of ancient Italy, leading from Rome to Ariminum (*Rimini*), was constructed by C. Flaminius during his censorship (220 B.C.) in order to secure a free communication with the recently conquered Gaulish territory, and was one of the most celebrated and most frequented roads of Italy during the Republic and of the Empire.

Flammarion, CAMILLE (1842–1925), French astronomer, was born at Montigny-le-Roi, entered the Paris Observatory in 1858, and shortly afterwards made a reputation by his popular lectures and books on astronomy. He wrote also on ballooning, on *The Unknown* (1900), on death and survival (1922), and edited an encyclopædic dictionary.

Flamsteed, JOHN, the first astronomer-royal of England, for whose use the Royal Observatory at Greenwich was built, was born near Derby in 1646. He early devoted himself to mathematics and astronomy with such success as to attract the notice of Sir Jonas Moore, and through him he was appointed astronomer to the king in 1675, in which capacity he endured the unhappy conjunction of too much work and too little pay. The year after, the Observatory at Greenwich was built, and Flamsteed began the series of observations that really commenced modern practical astronomy. He formed the first trustworthy catalogue of the fixed stars, and furnished those lunar observations on which Newton depended for the verification of his lunar theory. Extracts from the papers of Flamsteed, found in the Observatory by Francis Baily, and published by authority of the Admiralty in 1835, brought to light a very sharp quarrel that had taken place between Flamsteed and Newton and Halley with regard to the publication of the results of Flamsteed's labours. His great work is his *Historia Cœlestis Britannica*, an account of the methods and results of astronomical observation up to his time, published in 3 vols. in 1723. Flamsteed, while following his scientific pursuits, took holy orders, and in 1684 was presented to the living of Burstow, in Surrey, which he held till his death on 31st December 1719. See Baily's *Account of Flamsteed* (1835).

Flanders (Flemish *Vlaenderen*), the country of the Flemings, a territory lying adjacent to the North Sea, between the Scheldt and the Somme, which embraced the present Belgian provinces of East and West Flanders, the southern portion of Zealand in Holland, and the greater part of ancient Artois in France. This region was originally inhabited by Belgic tribes, on whose subjection by one of Cæsar's lieutenants their territory was incorporated in Roman Gaul. Under the supremacy of Rome they attained to a certain degree of civilisation, being renowned for their agriculture, their industry, and their commerce. The region was afterwards overrun by the Franks on their way to Gaul, many of them settling there permanently. By the Treaty of Verdun (843) Flanders was assigned to Neustria. The real nucleus of Flanders as a political state was the patrimony of a noble family whose possessions were grouped around Bruges and Sluys. In 862 the king of France, as suzerain, changed the title of the head of the family from forester or ranger to count. The first recipient of the honour was Baldwin I., Iron-arm (837–877), who was likewise invested with the maritime region of north-east France, on condition that he defended it against the Normans. His descendant, Baldwin IV. (989–1036), having seized upon the emperor's town of Valenciennes in 1006, and proving himself able to keep what he had

taken, was allowed to retain it (1007) as a feudatory of the empire. At the same time the emperor invested him with Ghent and the Zealand islands (Walcheren, Beverland, &c.). Thus the Count of Flanders held of the emperor as well as of the king of France. Under this count's son and successor, Baldwin V. (1036–67), the county of Alost (Aalst), Tournai, and Hainault were added to the principality. On his death the Netherlands portion of Flanders was erected into an appanage for his younger son, Robert the Frisian, who on the death of his elder brother, Baldwin VI. (1067–70), also wrested Flanders from Baldwin's widow Richilde, leaving to her and her son Hainault only. From this time down to the end of the 12th century the Flemish territories remained thus divided. The counts of Flanders of the 10th and 11th centuries were active in promoting the well-being of their people: they built churches and monasteries, and encouraged the industries of the towns, whereby Flanders rose to be the chief centre of woollen-weaving and fulling in Europe. At this period Ghent, Arras (the capital of the county), Courtrai, Rousselaere, Valenciennes, Cassel, Tournai, Lille, St Omer, Ypres, and Bruges were prosperous cities, the centres of the intelligence and public spirit of the country. Robert II. (1093–1111), son of Robert the Frisian, distinguished himself in the first crusade. His son, Baldwin VII. (1111–19), rigorously suppressed the private feuds of his nobles, and administered justice with Draconian severity. As he left no heir, the county was held by a succession of alien princes, as Charles of Denmark (1119–21); William, son of Robert of Normandy, till 1129; Thierry (Diedrich) of Alsace (1129–69), who took part in more than one crusade; and Thierry's son Philip (1169–91), who, besides championing the Christian faith against the Saracens, did much to foster industry and trade at home.

The accession of these foreign princes was turned to account by the Flemish cities, which extorted from them important charters of liberty and self-government. On Philip's death, Baldwin of Hainault reunited the two Flemish counties under one sceptre. But he had a rival for Flanders proper in Philip of France, who, having married Baldwin's own daughter, the niece of Philip of Flanders, claimed this district as her dowry; and Baldwin was constrained to buy off his more powerful antagonist by the cession of the county of Artois, a large part of southern Flanders, and the towns of St Omer, Hesdin, and some others. From this time forth Ghent superseded Arras as the capital. The next prince of Flanders was Baldwin IX. (1194–1206), son of Baldwin of Hainault, who, after winning back from France most of southern Flanders (though not Artois), took the crusader's cross and became the founder of the Latin empire of Constantinople. Baldwin was followed successively by his two daughters, Johanna (1206–43) and Margaret (1243–78), and by Margaret's son, Guy of Dampierre (1278–1305), who spent a large part of his life as a prisoner in France. Under these rulers the king of France first began to exercise a determining influence upon the government of Flanders. In 1256 the Zealand islands were given to the Count of Holland, and to Holland they have ever since belonged. The next century presents a series of disputed successions, mostly fomented by the kings of France, who made strenuous efforts to unite Flanders to the French crown. The country was in fact divided between two streams of preponderating influence: on the one hand the nobles, headed by the counts, were enamoured of France, and French society, and French institutions (*Leliaerts*); and on the other the burghers of the towns (*Claeuwaerts*) clung tenaciously to their national independence and municipal freedom. It was the latter party that constituted the backbone and strength of the country. From the middle of the 12th century the cities, growing more independent and more turbulent with the increase of wealth, began to play an increasingly important part in the politics of Flanders, warring one against another, and even waging civil strife within their own walls, taking up arms against their counts, and by their factions either consolidating or marring the fortunes of the rulers of the country. It was especially under Johanna and Margaret that the burghers of such cities as Bruges, Ypres, Ghent, and Lille made rapid progress in commercial prosperity and in the establishment of democratic principles of local government. Each of these cities possessed nearly 40,000 looms for weaving cloth; whilst Damme was a thriving seaport, doing a large shipping trade in wool, corn, cattle, wine, beer, &c. The struggle of the cities, represented chiefly by Bruges, Ghent, and Ypres, against the counts and other rulers, lasted more or less down to the Treaty of Utrecht (1713).

Philip IV. of France, having for some years steadily fanned the dissension in Flanders, at length got Count Guy into his hands and took possession of his country (1300), which he governed by means of a regent, Châtillon. This man's oppressive rule, however, provoked a general revolt of the Flemings, who in the battle of the Golden Spurs, fought near Courtrai on 11th July 1302, almost destroyed the army sent against them by the king of France. The contest continued until 1320, during all which time the Flemings successfully repelled the attempts of Philip to invade their country; and at last wholly shook off the claims of France. Under Louis, who became Count of Flanders in 1322, and who neglected his country to spend most of his time at the court of France, the cities frequently broke out into open revolt; Bruges even held Louis a prisoner for several months, nor were the rebels quelled except with the aid of a large French army (1328). In 1336 Jacob van Artevelde (q.v.), who had acquired supreme influence and power in Ghent, induced the chief cities, in defiance of their count, to make an alliance with Edward III. of England to help him in his quarrel with France. From this time down to 1345, when he was slain by a rival in Ghent, Van Artevelde was the real ruler of Flanders, though he found it an impossible task wholly to restrain the violence and disorder in the restless cities. Under Louis II., who succeeded his father, Louis I., in 1346, it was Ghent and Ypres that at first refused to submit to his rule. Then, in 1379, the keen rivalry of Ghent and Bruges came to a head in a civil war, which soon swelled into a general uprising of the entire country, led by the Ghent faction of the White Caps, against the count. The people of Ghent held out stubbornly under Philip van Artevelde, who, however, was slain in battle against the French, 27th November 1382, at Roosbeke. Two years later Count Louis III. died, leaving an only daughter, married to Philip of Burgundy (q.v.), with which duchy the history of Flanders became thenceforward intimately associated, until in 1477, by the marriage of Mary of Burgundy to Maximilian of Austria, both states passed to the empire, Flanders becoming part of Austrian Netherlands. Against this arrangement France vainly protested; and in 1526 she was compelled finally to renounce her claims as suzerain. With the accession of Philip II. to the throne of Spain the history of Flanders becomes identical with that of the Spanish Netherlands (see HOLLAND). By the Treaty of Westphalia Dutch Flanders was transferred to the United Netherlands, whilst by the treaties of the Pyrenees (1659), Nimeguen (1678), and Utrecht (1713) Louis XIV. succeeded in adding to France Artois and a large part of French Flanders. By

this last treaty and by that of Rastatt (1714) the rest of Flanders was assigned to Austria, and became known as the Austrian Netherlands. On the formation of the new kingdom of Belgium in 1831, the provinces of East and West Flanders were incorporated with it.

See Oudegherst, *Chroniques et Annales de Flandre* (1571); Warnkönig, *Flandrische Staatsgeschichte* (Tübingen, 1835–39); Conscience, *Geschiedenis van Belgie* (1845); and the more recent works of Kervyn de Lettenhove. For the Belgian provinces of East and West Flanders, see BELGIUM; for the Flemish language, see HOLLAND; and for the Flemish School of Painting, see PAINTING.

Flandrin, JEAN HIPPOLYTE, historical and portrait painter, was born at Lyons, 23d May 1809, the son of a miniature-painter. After studying in his native town, he proceeded in 1829 to Paris, where he attended the School of Fine Arts. But he also worked under Ingres, who was his true master; and from him he imbibed that love of severe and definite form and that classical feeling which he used for his own ends in his religious painting. He had a severe struggle with ill-health, and endured many privations; but in 1832 he won the *Prix de Rome* by his 'Recognition of Theseus;' and before his five years' residence in Italy was completed he had produced his fine rendering of 'St Clair healing the Blind,' now in the cathedral of Nantes. Henceforward he was mainly occupied with decorative monumental work, though he also executed many admirable portraits. In 1842 he began his great frescoes of 'Christ entering Jerusalem,' and 'Christ going up to Calvary,' in the sanctuary of the church of St Germain-des-Prés, Paris, deeply impressive works, which already entitled their painter to rank as the greatest religious painter of the century. The choir of the same church he adorned (1846–48) with figures of the Saints and the Virtues. He also decorated the church of St Paul at Nîmes (1847–49), the church of St Martin d'Ainay at Lyons (1855), and painted the frieze of St Vincent de Paul, in Paris, with a noble series of saints and martyrs. In 1855 he began his last great work in the nave of St Germain-des-Prés, consisting of subjects from the Old and New Testaments, of which some were left uncompleted at his death, at Rome, 21st March 1864. His *Lettres et Pensées*, with a memoir and a catalogue of his works, were issued by the Count Delaborde, in 1865. See also Lives by Poncet (1864) and Montrard (1876).

Flank ('the side'), a word used in many senses in military matters. *Flanks of an army* are the wings, or bodies of men on the right and left extremities. *Flank files* are the soldiers marching on the extreme right and left of a company or any other body of troops. *Flank company* is the company on the right or left when a battalion is in line. *Flanking parties*, or *flankers*, are cavalry or infantry marching some distance from the sides of the main column to prevent a sudden attack upon them.—Flank, as applied in Fortification, will be best described under that article. Generally it is any part of the works from which fire sweeps, or flanks, the front of any other part. The *flanks of a frontier* are certain salient points on it, strong by nature and art, between which an enemy dare not penetrate, at the risk of their garrisons attacking his rear, and cutting off communication between him and his base.—In manœuvring, 'to flank' is either to protect the flanks of one's own army by detached bodies of troops, or field-works, or to threaten those of the enemy by directing troops against them. To *outflank* is to succeed by manœuvres in overlapping the flank of an enemy who has been, on his part, endeavouring to flank one's own force.

Flannan Islands, or THE SEVEN HUNTERS, a small group of uninhabited (save for the four persons in the lighthouse) islets off the outer Hebrides, 20 miles NW. of Gallon Head in Lewis.

Flannel (unlike *flannelette*, an inflammable cotton fabric made in imitation of flannel), a woollen cloth manufactured much like other woollens (not worsteds). For flannel the wool, after passing through the preparatory processes of scouring and devilling, is carded, spun, woven, and fulled or milled. Those kinds with a fleecy pile on the surface are passed through the teazling-machine (see WOOLLEN MANUFACTURES). Yarn for ordinary flannel is loosely spun to impart softness to the fabric. Flannel wears better and shrinks less if the pile is slightly raised than if it is much raised, and it is better to get it of the natural white colour than slightly blued, as this tint gives way at the first washing.

Welsh flannel made from the wool of the Welsh mountain-sheep fetches the highest price. But it is well known that the supply of this wool is not nearly enough to make the quantity of flannel sent into the market as 'real Welsh.' Some of the Lancashire flannels made of other wools are hardly inferior to those made in Wales. Yorkshire flannels are lower in price than either of these. Special kinds of flannel are made, such as the comparatively firmly spun and closely woven flannel for cricket dresses and fancy shirts; thin all-wool gauze flannel for use in India and other warm countries; similar flannel made with a silk warp; domets made of wool and cotton; and gray, dyed, and printed flannels. The manufacture of flannels is chiefly carried on in England at various places in Lancashire and Yorkshire, and in Wales at Newtown, Welshpool, and Llangollen. Flannel shirtings are made on a considerable scale at Auchterarder in Scotland.

In the United States flannels are manufactured on a very extensive scale. In order to prevent shrinkage these are made of yarns more closely twisted than those used for English flannels. American flannels are also less highly fulled, and smoother in the face. The French excel in the manufacture of fine dyed flannels. On the Continent, also, a substitute for flannel is made of the fibre of the leaf-needles of the Scots Pine (see FIBROUS SUBSTANCES).

Flat, a musical character, shaped thus ♭, which, when placed before a note, lowers that note half a tone. The double flat, 𝄫, lowers a note two semitones. Singing or playing is called flat when the notes are at all below the right pitch.

Flat, a story or floor of a building, especially when fitted up as a separate residence for a family; four, six, or more such dwellings (often only half-floors) being approached by a common stair. This tenement system is much more common in Scotland and on the Continent than in England, though of late years it has been largely adopted in London, both in the richer and in the poorer districts. In New York and other large American towns, besides the older tenement houses, there are more expensive modern flats, often fitted with conveniences unknown in similar houses in Europe.

Flatbush, a former township of Long Island, adjoining Prospect Park, Brooklyn, with a lunatic asylum, was annexed to Brooklyn in 1894, and with it is now a part of greater New York.

Flat-fish (*Pleuronectidæ*), an important family of marine bony fishes, in the order Anacanthini, with the body compressed from side to side, and markedly unsymmetrical. The turbot (*Rhombus maximus*), the halibut (*Hippoglossus vulgaris*), the flounder, plaice, and other members of the genus Pleuronectes, and the soles (Solea) are well-known.

examples, valuable as food-fishes. There are about three dozen genera and two hundred species. They occur in all seas, and some thrive in fresh water. The adults keep to the bottom, especially on sandy coasts, and come nearer shore in the spring spawning season and during summer. They are all carnivorous. Many of them alter the colour of their exposed upper side in sympathetic and automatic adjustment to the nature of the ground on which they lie concealed. They are all destitute of a swim-bladder, but the most remarkable feature is the asymmetry of the skull, eyes, and musculature. Unlike the gristly skates, which are flattened from above downwards, the Pleuronectidæ are flattened sideways, and swim or rest on one side, either right or left. The under side is virtually uncoloured, the upper side is often markedly pigmented, and bears both the eyes. The young forms, however, are striking contrasts to the adults. They are almost transparent, occur in the open sea, are quite symmetrical, with an eye as usual on either side, and swim vertically. With increasing size the normal structure and habit are lost, the fishes become asymmetrical, and keep to the bottom. While the skull is still gristly and plastic it is twisted, and the lower eye comes to lie beside its fellow on the upper surface. The exact mechanism is not yet clear. See FISHES, FLOUNDER, PLAICE, SOLE, TURBOT, &c.

Flatheads, a term officially but incorrectly applied to the Salish Indians, a small tribe dwelling on Clarke's Fork, in Idaho. The men are industrious and willing to learn, and have become good farmers; preferring peace, they nevertheless make brave warriors, but have never fought against the whites. A grammar of their difficult language has been published by Mengarini (New York, 1861). The term Flatheads refers to the very ancient practice of flattening the skulls of young infants by various mechanical means, such as was prevalent in Peru, both before and after the arrival of the Incas, among the Caribs in Central America and Mexico, in Florida, and among the mound-builders of the Ohio and Mississippi valleys. Among modern Indians it is mostly confined to the Chinooks (q.v.) and other tribes of the north-west coast of North America.

Flattery, CAPE, a headland of Washington state, U.S., washed on the NE. by the Strait of Juan de Fuca, and on the SW. by the Pacific.

Flatulence, distension of the stomach or bowels by the gases formed during digestion. See INDIGESTION.

Flaubert, GUSTAVE, who is considered by competent judges the most remarkable French novelist of the second half of the 19th century, was born at Rouen on the 12th December 1821. He was the son of a physician of eminence, and inherited, though not wealth, a fortune sufficient to enable him to choose his own way of life. He hesitated long between his father's profession and literature; and in literature he began with poetry, which, however, he definitely gave up before long for prose. Flaubert's life was extremely uneventful in outward incident, the turning-point of it being, according to his intimate friend M. Maxime du Camp (whose account, though traversed by some of Flaubert's other friends, seems to be accurate in the main), the access when he was still a young man of some obscure form of brain-disease, which altered, and even to some extent arrested, his intellectual development. M. du Camp goes so far as to hold that almost all the original part of Flaubert's work was conceived, if not actually sketched, before this time. But however this may be, Flaubert was a very late producer, and his work, when it did appear, was marked by a very strong and somewhat morbid idiosyncrasy. He had comparatively early (before 1849) written some fragments of a work only completed much later on the Temptation of St Anthony, but his first published book was the famous novel of *Madame Bovary*, which appeared in 1857. This is the history of a girl of some education, with strong aspirations after elegance of life and depth of passion, whose fate condemns her to live in the country as the wife of a well-intentioned but utterly stupid and commonplace doctor. Her successive lapses into vice, her desertion by each of her lovers, her extravagance, and her final suicide form the central part of a story, the outline of which is filled up by a series of the most wonderful studies of scene and character, charged with satiric melancholy, and expressed in an extraordinarily careful and vivid style. Style, indeed, was the object of Flaubert's main devotion, and as he advanced in years he for the most part shut himself up in his small country-house near Rouen to wrestle, as his own favourite phrase expressed it, with the language which was to clothe his thought. Although *Madame Bovary* is not constructed according to English ideas of decorum, its license in that respect does not exceed what had long been common in French, and the author was most indignantly surprised at its prosecution as an offence against morals, a prosecution which did not succeed. His second work, *Salammbô* (1862), dealt with the last struggle of Rome and Carthage. The author had taken immense pains to study the locality and all the authorities; and he put into his book in consequence an amount of archæological detail and local colour which sometimes seems to overweight the story. *Salammbô* is moreover deeply tinged with the sombre horror which was one of Flaubert's notes.

In 1866 Flaubert was decorated with the Legion of Honour. Three years later *L'Éducation Sentimentale*, a much longer book, appeared, but was far less popular. No book of Flaubert's displays more accurate observation of life, but the absence of central interest and the disheartening effect of a mere succession of disillusions undergone by the hero make it a book for few. In 1874 appeared the splendid phantasmagoria of *La Tentation de St-Antoine*, worked up from the early fragments already referred to, and the masterpiece of its kind; while in the same year the author produced a play, *Le Candidat*, with little success, and of no merit. In 1877 there followed his last book (exclusive of posthumous work), *Trois Contes*, which represents all his best manners; the first tale, on the daughter of Herodias, being a *Salammbô* in little, *Un Cœur Simple* displaying all the power of *Madame Bovary* with a perfectly harmless subject, and *St-Julien l'Hospitalier* being in the same vein as the *Tentation*, with the addition of something like a central thread of interest. Flaubert died on May 9, 1880, and after his death appeared a novel, *Bouvard et Pécuchet*, which had not received his final revision, and which is somewhat undigested. It tells of the attempts of two retired men of the middle class to interest themselves in literary and scientific researches. There has been published (also posthumously; trans. 1922) an extremely interesting correspondence with George Sand; and other letters throwing much light on Flaubert's character have followed. In his last years he was a member of a small set of distinguished writers (the other three being the great Russian novelist Turgenieff, M. Daudet, and M. Zola), who frequently met, and who acquired the reputation as of a sort of headquarters-staff of what has been successively called realism and naturalism in fiction. Flaubert, however, never belonged to either of these schools, least of all to

that of naturalism. His minute and exhaustive description was indeed a point in common with both; but this description was always subordinated to a strictly romantic conception of the general scheme of story-telling. Flaubert was in fact a pure romanticist who came late and had engrafted on the earlier romanticism not a few characteristics rather inherited than borrowed from Balzac on the one hand, and Stendhal on the other. It is improbable that any more remarkable examples of this combined mode will ever be created than *Madame Bovary* and *Salammbô*, each in its kind, though from the mere fact of the combination it follows that some readers will fix their attention most on the realism, others on the romance. A splendid 'édition définitive' of Flaubert's works was issued in 1909–12. See work by J. C. Tarver (1895).

Flavel, JOHN, an English Nonconformist divine, born at Bromsgrove in Worcestershire, most probably in 1630, was educated at University College, Oxford, took Presbyterian orders in 1650, and had already held livings at Diptford (in Devon) and Dartmouth, when he was ejected by the Act of Uniformity of 1662. He continued to preach privately at Dartmouth, and after the Declaration of Indulgence (1687) was minister of a Nonconformist church there till his death at Exeter, 26th June 1691. He was four times married. His writings were long popular, and do not entirely deserve the neglect into which they have fallen. His best books are the *Treatise on the Soul of Man, The Method of Grace, A Token for Mourners*, and *Husbandry Spiritualised*. An edition in 6 vols. was issued in 1820.

Flavian Cæsars were Vespasian (q.v., Titus Flavius Vespasianus) and his sons and successors, Titus and Domitian.

Flavine, a concentrated preparation of quercitron bark imported from America. Until recently it was an important yellow dye, but cheaper colouring materials are now being substituted for it. See DYEING. It has been tried as an antiseptic for wounds, but with less satisfactory results than had been hoped for.

Flax (*Linum*), the typical genus of Linaceæ, a sub-order of Geraniaceæ, consisting of about 140 species of annual and perennial herbaceous plants, with a few small shrubs, all inhabitants of temperate climates, most abundant in Europe and northern Africa. Some are cultivated as showy

Common Flax (*Linum usitatissimum*).

garden annuals—e.g. *Linum grandiflorum*, &c., while the allied *Radiola millegrana* (Allseed) is the smallest of our phanerogamic weeds. *L. catharticum*, an annual weed, is the Purging Flax, long a standard resource of domestic medicine. But all essential interests centre round the Common Lint or Flax, well named by Linnæus *L. usitatissimum*, since in its importance for civilised man it rivals the staple food plants. There are two main varieties or sub-species—*vulgare* and *humile*—the latter distinguished by its shorter and more branched stems and rather larger leaves, but more easily by its larger capsules, which burst open when ripe with a characteristic sound, so scattering the seed. Though shorter, this yields the finer, softer, and whiter fibre. In both the flower is a loose corymb of beautiful blue flowers. *L. austriacum* is also cultivated in France, *L. maritimum* in southern Europe, and *L. Levisii* in North America, but all yield a coarser fibre. The flax of prehistoric times found in the Swiss pile-dwellings, and in the remains of the stone age in northern Italy, was derived from *L. angustifolium*, as not only the manufactured product but the actual remains of the stems, fruit, and seeds clearly show. The common lint of the Aryan peoples was, however, *L. usitatissimum*, and the occurrence of the name lint with little modification in all European languages is usually interpreted as indicating that its use dates from the remote antiquity of their common home. The same culture is shown by an examination of the mummy-cloths of Egypt, which are always of linen; and the species is also recognisably delineated upon the walls of the tombs.

The quantity of flax produced in Great Britain, once large, had become quite negligible before the war of 1914–18. Several thousand acres were grown under war conditions, but it seems doubtful whether the cultivation of the crop has been permanently re-established. In Ireland the area was much more considerable, but had sunk from over 300,000 acres in 1863 to about 50,000 before the war, practically all in Ulster. The area in Ireland was doubled during the war, but again it is doubtful whether the increase will prove permanent. Russia was by far the greatest flax-producing country before the war. The area exceeded 5,000,000 acres, and was increasing. Germany, Belgium, Holland, France, Austria, Hungary, and Italy all produced considerable quantities, ranging from 70,000 to 250,000 acres, but the areas in every case, except that of Hungary, were decreasing.

In Europe flax is cultivated both for fibre and for seed. In India, the United States, Argentina, and Canada the crop is grown mainly for seed.

For an account of the mode of preparation of its bast as a textile fibre, see below; for processes of manufacture, see LINEN; and for a description of the useful applications of its seed, see LINSEED, OILCAKE, OIL.

FLAX-DRESSING.—Growing stems of flax are not cut by scythe or reaping-machine, but pulled up by the roots. The best time for doing this is when the stalks begin to turn yellow at the base, and the seeds begin to change from green to a pale brown. A heavier crop is obtained when the plant is riper, but the quality of the fibre is injured. It is of importance that the stems of equal length should be separated, uniformity in this respect simplifying the dressing processes.

Rippling, the process of removing the seeds, follows the harvesting. The ripple, or rippling-comb, consists of a row of round iron teeth set in a wooden frame which is fixed to a plank. In length the teeth are about 18 inches, and at the pointed tops they are about half an inch apart. The rippler, taking up a bundle of flax, spreads out the tops like a fan, and generally draws first the one half of it and then the other through the teeth, a sheet being placed on the ground to receive the seeds or bolls as they fall. One or two machines

have been introduced for rippling flax. One of these removes the seeds by passing the stems between two cast-iron cylinders. Another performs the operation by means of beaters which loosen the seeds, and shakers which then shake them out of the bundles of flax-straw.

Retting is the name given to the next process in the treatment of the stems of flax. Its object is to facilitate the separation of the useful fibre from the boon or woody part of the stem through the removal, by fermentation, of the gummy or resinous matters present in the plant. This is done either by dew-retting or by water-retting with or without the aid of heat. Dew-retting consists in spreading the flax on the grass, and exposing it to the influence of dew, rain, air, and light for a considerable time. It is a method practised in Russia, and produces a soft and silky fibre. Water-retting or steeping is the plan most generally followed. Soft water is essential, and the dam or pond should not be more than four feet deep. In this the flax bundles or 'beets' are placed in rows, roots downwards, and then covered with weeds or straw weighted with boards and stones, or with turf and stones, to keep the flax below the water. If the weather is warm fermentation begins soon, a change which causes the flax to rise in the water, and it must then be more heavily weighted. The flax sinks again as the fermentation slackens, the extra weight being then removed. Great judgment is required to determine when the retting has proceeded far enough. The stems are examined with much care, and if one finds on breaking them at one or two places, or twisting them in the middle in opposite directions, that the woody core called 'shore' or 'shive' separates freely from the fibre, the flax is ready for removal from the pond. From ten to fourteen days are required for the process with water at ordinary temperatures. The smell that accompanies the process is most offensive, and water in which flax has been steeped is valuable as a liquid manure.

A quicker process of retting, in which water at a temperature of 75° to 90° F. is used, was introduced by an American, R. B. Schenck, in 1847. Wooden vats are employed, and the fermentation goes on so much more rapidly that the time of steeping is reduced to from 50 to 60 hours. By another invention (Pownall's) the flax is passed between heavy rollers after it is taken from the vats, clean water being kept flowing over the stems during the operation to remove the gummy matters. Schenck's method is not much favoured now.

Grassing follows the ordinary retting process. The flax stems are spread in rows of thin layers upon short grass for a few days, during which time they are sometimes turned with a pole; but if this is not done, the tips of the stems of one row should overlap the root ends of the next. The flax is lifted when it is found that a slight rubbing suffices to separate the woody core from the fibre.

Breaking.—After the retted stems are dried they undergo 'breaking' to prepare them for the scutching process. One simple and efficient machine for breaking consists of two pairs of horizontal fluted rollers—one pair having finer flutes than the other—mounted in a frame, and turned by the necessary gearing. There is also a feed-table. In passing between the rollers the brittle woody parts of the stems are broken throughout their length. Later breaking-machines have more numerous fluted rollers, some of which have a reciprocating motion. The more efficiently the breaking is performed the less will be the amount of scutching required.

Scutching.—The woody matter of the flax stems being broken up and ready to be separated from the fibrous portion, this is done either by hand-scutching or, as is chiefly now the case, by scutching-machines. In the hand-process the flax is hung up in such a position that it can be struck repeatedly with the blade of a scutching-knife, so as entirely to remove the woody portion. In scutching-mills—which are usually driven by water-power—the scutching is performed by a series of vertical wheels, on each of which are mounted a few wooden blades projecting considerably beyond the rim. These blades take the place of the scutching-knife, and work against wedge-shaped projections in a partition, striking the flax in the direction of its length, a workman sliding the 'broken' flax gradually forward as the scutching proceeds. Besides this arm-scutch in scutching-mills there are scutching-machines of more elaborate construction used in the dressing of flax. Brushing-machines are sometimes employed to give the flax a final cleaning before baling it for the market. For the manufacture of flax into cloth, see LINEN, and SPINNING.

Flax, NEW ZEALAND, a valuable fibre quite different from common flax, and obtained from the leaf of a monocotyledonous, instead of the stem of a dicotyledonous plant. The plant yielding it is *Phormium tenax*, often called New Zealand Flax, and sometimes Flax Lily and Flax Bush (Harakeke of Maoris). It belongs to the order Liliaceæ, and is an evergreen growing wild over large areas, and very easily cultivated, even upon the poorest soils; it has also been introduced into southern France and Dalmatia, and is familiar in colder climates as

New Zealand Flax (*Phormium tenax*):
a, inflorescence; *b*, separate flowers, enlarged.

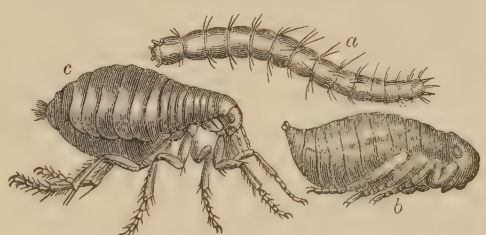
a decorative plant in greenhouses and sheltered gardens. Its leaves resemble those of an Iris, and are from two to six feet long and one to two or three inches broad. The flowers are produced in a tall branched panicle, and are numerous, brownish-yellow, and not very beautiful; the fruit is a three-cornered capsule, with numerous compressed jet-black seeds. The fibre of the leaves is both very fine and very strong, and was used by the New Zealanders, before their country was discovered by Europeans, for making dresses, ropes, twine, mats, cloth, &c. New Zealand flax is imported into Britain for making twine, ropes, sailcloth, and other uses to which its strength and durability alike well adapt it. To obtain the fibre the leaves are cut thrice yearly, and the fibre is easily separated by maceration. But the New Zealanders procure the fibre in its greatest perfection, very long and slender, shining

like silk, by a more laborious process, and without maceration, removing the epidermis from the leaf when newly cut, separating the fibres by the thumb-nails, and then more perfectly by a comb. The root-stocks are bitter and purgative, and have been used as a substitute for sarsaparilla. The leaves, when cut near the root, exude a viscid juice, which becomes thick and gummy, and is then eaten; the New Zealanders prepare a sweet beverage from the flowers.

Flaxman, JOHN, R.A., sculptor, was born at York, 6th July 1755. His father, a moulder of plaster figures, removed to London when his son was six months old; and the delicate, slightly-deformed child, confined to home-pleasures and stimulated by the works of art which surrounded him, soon developed a taste for drawing. Seated in his little chair behind the counter, with his crutches by his side, he attracted the attention of some of his father's customers. The Rev. Mr Mathew found him attempting to teach himself Latin, and forthwith befriended him, introducing him to his cultured and refined home-circle, where his wife read Homer and Virgil to the boy. At the age of ten his health greatly improved, and he devoted himself to art. In 1767 and 1769 he exhibited models at the Free Society of Artists, and in the latter year he was admitted a student of the Royal Academy, whose silver medal he won in 1770, when he began to contribute to its exhibitions. From this period he was constantly engaged upon works of sculpture; but patronage was long of coming, and from 1775 till 1787 his chief source of income was the Messrs Wedgwood, whom he furnished with exquisite designs and decorations for their pottery, work for which he was admirably fitted by his unrivalled skill in modelling in relief. In 1782 he quitted the parental roof, established himself in a small house and studio in Wardour Street, and married Ann Denman, a cultivated and estimable woman, who was his true helpmate for thirty-eight years. He now began to be employed upon monumental sculpture, into which he infused much of pathos and of grace. Among his works of this class may be named his monument to Chatterton, in St Mary Redcliffe, Bristol; to Collins, in Chichester Cathedral; to Mrs Morley, in Gloucester Cathedral; and to the memory of Miss Cromwell. By 1787 he had gained enough by his art to warrant a visit to Italy, and, accompanied by his wife, he proceeded to Rome, and studied there for seven years. During this period he executed a group of Cephalus and Aurora; his ill-remunerated group of 'The Fury of Athamas,' from Ovid; and his restoration of the Hercules torso; and began his great series of designs to the *Iliad* and the *Odyssey* (published 1793), to Æschylus (1795), and to Dante's *Divina Commedia* (1797), which were engraved in Rome by Piroli, under his own supervision, and widely extended his fame. They were followed by his designs to Hesiod, engraved by Blake in 1817. Returning to England in 1794, he occupied himself upon his fine monument to Lord Mansfield, in Westminster Abbey. In 1797 he was elected A.R.A., in 1800 R.A., and in 1810 he became professor of Sculpture to the Royal Academy. His lectures, which were collected in a volume in 1829, are judicious and well considered, but somewhat wanting in lightness, point, and charm of style. Among the works of his later life are his monuments to Sir Joshua Reynolds, to Lord Howe, and to Lord Nelson; 'Michael and Satan,' his most important example of ideal sculpture, executed for Lord Egremont; and his drawings and model for his great 'Shield of Achilles,' completed in 1818. He died 7th December 1826, and was buried in the church of St Giles-in-the-Fields, London.

Personally Flaxman was a man of extreme gentleness, modesty, and courtesy; simple and abstemious in his tastes; devout in spirit, a follower of Swedenborg. See Allan Cunningham's *Lives of the Most Eminent British Painters, Sculptors, and Architects*, vol. iii. (1830); and Sir Sidney Colvin, *The Drawings of Flaxman in Thirty-two Plates, with Descriptions and an Essay on his Life and Genius* (fol. 1876).

Flea, a name applicable to any member of the small order Siphonaptera or Aphaniptera, of which *Pulex irritans* is a familiar example. They are wingless insects, probably related to flies; with long, slender, serrate, piercing mandibles, an unpaired sucking tube (the labrum), and long labial palps, forming a sheath. It is believed that the irritation produced by a flea-bite is partly due to the introduction of micro-organisms which occur in the salivary glands of the flea. The compressed shape of the body, the long, powerful, bristly legs, which are able to take such relatively gigantic leaps, and the abdomen with eight rings bearing bristles may be readily perceived on the common species; while microscopic examination will show the biting and sucking mouth-appendages, the small eyes and minute antennæ, and two pairs of little bristly scales, like remnants of wings, on the second and third segments of the thorax. The eggs, usually not numerous, are laid in safe corners, or in the fur, feathers, &c. of the animal infested; the hatching is rapid (six to twelve days), and bristly, footless larvæ emerge; after a few (eleven) days' voracity



Metamorphoses of Common Flea (*Pulex irritans*), magnified:

a, larva; *b*, pupa or nymph; *c*, perfect insect.

these form cocoons, and so rest in pupa quiescence for variable periods. In summer the entire development of *Pulex irritans* occupies about a month. The larvæ feed on waste animal matter. The fleas are all ectoparasitic on warm-blooded animals, and the numerous species are more or less rigidly confined to particular furred and feathered hosts. The flea that chiefly troubles man is *Pulex irritans;* that of the cat and dog is *P. serraticeps* (which seems to be an intermediate host of a dog tapeworm); *P. avium* is common on birds. The rat-flea of India (*Xenopsylla cheopis*) seems to convey the bacillus of Plague (q.v.) from rat to rat, and from rat to man. The common English rat-flea (*Ceratophyllus fasciatus*) transmits a trypanosome from rat to rat. The muscular energy of these pests has been utilised in 'flea-exhibitions,' in which tamed captives drag miniature carriages, and perform similar exercises. As regards their leaping powers, Kirby and Spence have the following note: 'Aristophanes, in order to make the great and good Athenian philosopher, Socrates, appear ridiculous, represents him as having measured the leap of a flea. In our better times scientific men have done this without being laughed at for it, and have ascertained that, comparatively, it equalled that of the locust, being also two hundred times its (the flea's) length.' Where fleas prevail in spite of cleanliness, recourse may be had to insecticide

preparations, the modern substitutes for the old-fashioned fleabane and wormwood. The more formidable Chigoe (q.v.) or Jigger is separately noticed. See Taschenberg, *Die Flöhe* (1880).

Fleabane (*Pulicaria*), a genus of Compositæ (sub-order Tubulifloræ, family Inuleæ), readily recognised by a peculiar aromatic smell, sometimes compared to that of soap, which is said to be efficacious in driving away fleas. There are two British species, *P. vulgaris* and *P. dysenterica*, and the latter has a considerable reputation in diarrhœa and dysentery. *Conyza squarrosa*, also called fleabane, belongs to a closely allied genus.

Flèche, in French, a spire generally, is also used specially for the slender spire that sometimes rises from the intersection of the nave and transepts of large churches. For a good illustration, see Cologne.

Flèche, La, a town of France, in the department of Scarthe, on the Loir, 60 miles NW. of Tours by rail. It has manufactures of paper, starch, leather, and sabots, and since 1764 has been the seat of a famous military school (*Prytanée*), founded in 1607 as a Jesuit college, where Eugene of Savoy and Descartes were educated. Here, too, are the heart and a statue (1857) of Henri IV.; and here David Hume spent three years (1734–37). Pop. 10,000.

Fléchier, Esprit (1632–1710), Bishop of Nîmes (1687), was born at Pernes, and shone as a pulpit orator. See studies by A. Fabre (1882–86).

Flecker, James Elroy, poet and dramatist, was born in London, 5th November 1884. He was educated at Uppingham and Trinity College, Oxford, and at Caius College, Cambridge, where he studied Oriental languages. He entered the Consular service, lived at Constantinople, Smyrna, Beirut, and elsewhere in the East; but consumption drove him to Switzerland, and he died at Davos Platz, 3d January 1915. His works, influenced by the Parnassians, include *The Bridge of Fire* (1907), *Forty-two Poems* (1911), *The Golden Journey to Samarkand* (1913), *The King of Alsander* (1914), *The Old Ships* (1915), *Collected Prose* (1920), two plays: *Hassan* (1922) and *Don Juan* (1925). See J. C. Squire's introduction to the collected *Poems* (1916), books by Goldring (1922) and Hodgson (1925).

Flecknoe, Richard, a Roman Catholic, possibly an Irishman and a priest, who after some ten years' travels in Europe, Asia, Africa, and Brazil (1640–50) came to London, mingled in the wars of the wits, wrote plays, and died about 1678. His name is now remembered (apart from Marvell's satire) only as that of the stalking-horse over whom Dryden applied the merciless lash of his satire to Shadwell, the most virulent of his literary assailants. Dryden's famous satire, *MacFlecknoe*, is partly the model of Pope's more famous *Dunciad*. Flecknoe is represented as seeking for a successor to the throne over the realms of nonsense, on which he had long sat supreme, and as having fixed on Shadwell as the one of all his sons best fitted for it.

Fleet (that which floats), a collection of ships, whether of war or commerce, for one object or for one destination. 'Division,' 'subdivision,' and 'squadron' are portions of a fleet. In the royal navy of Great Britain a fleet is ordinarily the command of an admiral or vice-admiral, and should, strictly speaking, consist of ten ships or more of the first class, with an appropriate number of battle-cruisers, light-cruisers, torpedo-boat destroyers, submarines. Great Britain maintains a fleet in the Channel and another in the Mediterranean; whilst the number of her war-ships in the West Indies, India and China, and the Pacific enables these squadrons to assume the dimensions of a fleet by very trifling additions from other quarters.

Fleet Prison, a celebrated London gaol, which stood on the east side of Farringdon Street, on what was formerly called Fleet Market. The keeper of it was called the Warden of the Fleet. It derived its name from the Fleet rivulet (O.E. *flēot*, 'a bay;' afterwards applied to any shallow stream where small craft could float), which flowed into the Thames. The Fleet was the king's prison so far back as the 12th century. In the 16th century it acquired a high historical interest from its having been the prison of the religious martyrs of the reigns of Mary and Elizabeth; and the victims of the Star Chamber were confined here in the reign of Charles I., and numbers of Puritans in that of his son. Afterwards it became a place of confinement for debtors and persons committed for contempt from the Courts of Chancery, Exchequer, and Common Pleas. During the 18th century it was the scene of every kind of atrocity and brutality, from the extortion of the keepers and the custom of allowing the warden to underlet it. The Fleet was several times rebuilt; the last building was erected after the burning of the older one in the Gordon riots of 1780, the predecessor of which had been destroyed in the great fire of London in 1666. In 1776 Howard found here 243 prisoners, their wives and children numbering 475; there were also 78 outdoor *détenus* for debt, privileged to live within the 'rules.' In 1830–34 the annual number confined in the Fleet for debt ranged from 700 to 884. The prison was abolished in 1842, and the debtors transferred to the Queen's Bench, under the new name of the Queen's Prison. The buildings were demolished in 1845–46, and part of the site is now occupied by the Congregational Memorial Hall.

Fleet Marriages.—The practice of contracting clandestine marriages was very prevalent in England before the passing of the first marriage act (see Marriage). The chapels at the Savoy and at May Fair, in London, were long noted for the performance of these marriages; but no other place was equal in notoriety for this infamous traffic to the Fleet Prison. The first notice of a Fleet marriage is in 1613, and the first entry in a register is in 1674. Up to this time it does not appear that the marriages contracted at the Fleet were clandestine; but in the latter year, an order having been issued by the ecclesiastical commissioners against the performance of clandestine marriages in the Savoy and May Fair, the Fleet at once became the favourite resort for those who desired to effect a secret marriage. At first the ceremony was performed in the chapel in the Fleet, but by 10 Anne, chap. 19, sect. 176, marriages in chapels without banns were prohibited under certain penalties, and from this time rooms were fitted up in the taverns and the houses of the Fleet parsons for the purpose of performing the ceremony. Sir W. Besant's romance gives a vivid description of the persons who celebrated these marriages—real or pretended clergymen of the Church of England, who had been consigned for debt to the prison of the Fleet, and who shamelessly employed touters to bring to them such persons as required their office. The sums paid for a marriage varied, according to the rank of the parties, from half-a-crown to a large fee. During the time that this iniquitous traffic was at its height every species of enormity was practised. Young ladies were compelled to marry against their will; young men were decoyed into a union with the most infamous characters; and persons in shoals resorted to the parsons to be united in bonds which they had no intention should bind them. Registers of the marriages were kept by the various parties who officiated; a collection of these books, purchased by government in 1821, is deposited at Somerset House. In 1840 they were declared inadmissible as evidence in a court of law.

Various ineffectual attempts were made to stop the practice by acts of parliament, and at length, the nuisance having become intolerable, in 1753 an act was passed which struck at the root of the matter by declaring that all marriages, except in Scotland, solemnised otherwise than in a church or public chapel, where banns have been published, unless by special license, should be utterly void. The public, however, were unwilling to surrender their privilege, and on the 26th March 1754, the day before the act came into operation, there were no less than 217 marriages entered in one register alone. See Burn's *History of Fleet Marriages* (1833), and Ashton, *The Fleet: its River, Prison, and Marriages* (1888).

Fleetwood, or FLEETWOOD-ON-WYRE, a modern seaport and trawling centre of Lancashire, at the mouth of the Wyre, 21 miles NW. of Preston by rail. Founded in 1836, it has an excellent harbour, and is a favourite resort for sea-bathing. Steamers ply to Belfast and the Isle of Man. Within the town is a lighthouse, the light, 90 feet high, being visible for 13 miles. Rossall School (q.v.) is two miles to the south-west. Pop. (1851) 3121; (1911) 15,875; (1921, in holiday season), 19,448.

Flegel, EDUARD ROBERT, explorer, born of German parentage at Wilna, 13th October 1855, made it the principal object of his life to acquire for Germany the preponderating share of the commerce of the Niger. His first ascent of this river was made in 1879, in the steamer of the London Missionary Society, and his second a year later, when he reached Sokoto by a left-hand tributary of the river. But his next journey, in 1883, was the most fruitful in results, for during the course of it he discovered the sources of the Benuë, to the south of Adamawa. After a short visit to Europe, he again started for Africa in April 1885, having been commissioned by the German African Society and Colonial Company to explore the country stretching between the sources of the Benuë and the Cameroons; it was also his intention to penetrate from the Benuë to the Congo, but he was suddenly struck down by death, near the mouth of the Niger, on 11th September 1886.

Fleischer, HEINRICH LEBERECHT, Orientalist, was born at Schandau, in Saxony, 21st February 1801. Having studied theology and oriental languages at Leipzig, he was for some years after 1828 engaged in cataloguing the oriental MSS. in the royal library at Dresden, the catalogue being published at Leipzig in 1831–34. After acting for five years as teacher in a school at Dresden, Fleischer was appointed professor of Oriental Languages at Leipzig in 1836. He edited Abulfeda's *Historia Moslemica* (1831–34), the continuation of Habicht's edition of the original of the *Thousand and One Nights* (vols. ix.–xii. 1842–43), Ali's *Hundred Sayings* (1837), Baidhavi's *Commentary to the Koran* (1846–48), and wrote an account of the Arabic, Persian, and Turkish MSS. in the town library of Leipzig, printed in Naumann's *Catalogue* (1838); also a *Critical Dissertation on Habicht's Glosses to the First Four Volumes of the Thousand and One Nights* (1836). He died 10th February 1888.

Fleming, JOHN, naturalist, born near Bathgate, Linlithgowshire, in 1785, entered the ministry, was professor of Natural Philosophy at Aberdeen, 1832–43, and filled the chair of Natural Science in the New College, Edinburgh, from 1845 till his death in 1857. His works include the *Philosophy of Zoology* (2 vols. 1822), a *History of British Animals* (1828), and *Molluscous Animals* (1837).

Fleming, PAUL, German poet, was born 5th October 1609 at Hartenstein, in Vogtland. He studied medicine at Leipzig, and accompanied embassies sent by the Duke of Holstein to Russia and to Persia. He returned in 1639, married, and resolved to settle as a physician in Hamburg, but died there, 2d April 1640. Fleming stands at the head of the German lyric poets of the 17th century. His *Geistliche und weltliche Poemata* (1642) contain many exquisite love-songs, which for more than a century remained unequalled in finish and sweetness. Others are full of glowing enthusiasm, ardent patriotism, and manly vigour, while his sonnets are marked by strength and thorough originality. The most complete collection is that of Lappenberg (2 vols. 1866), who had already edited his Latin poems in 1863.

Flemings, Flemish. See FLANDERS, BELGIUM, HOLLAND (*Literature of*), PAINTING, and for Flemish Bond, see BRICKLAYING.

Flensburg (Danish *Flensborg*), a port in the province of Sleswick-Holstein, at the extremity of Flensburg Fjord, an inlet of the Baltic, 19 miles N. of the town of Sleswick. Its principal industrial establishments embrace iron and machine works, copper and zinc factories, shipbuilding yards, brick, cement, and lime works, and breweries; fishing and fish-curing are also carried on. Along with Sleswick-Holstein, Flensburg passed from Denmark to Prussia in 1864. It elected to remain German in 1920. Pop. (1875) 26,525; (1890) 36,894; (1919) 60,941.

Flers, a town of France, in the department of Orne, 41 miles S. of Caen by rail. It has large spinning, brick and tile establishments, and is the centre of a busy manufacturing district, where linen and cotton goods, especially fustian and tickings, are produced. It contains a sixteenth-century castle, which was burned down in the Chouan war, but since restored. Pop. 13,000.

Flesh. While in common parlance the term flesh is applied to those parts of the body composed of muscular tissue (see MUSCLE), it is, in physiological language, used as a term including all the living protoplasmic matter of the body which has a chemical composition closely resembling that of muscle. This use of the word (*Fleisch*) we owe chiefly to the Munich school of physiologists, who have done so much to advance our knowledge of the chemical changes in the tissues. In such investigations the terms loss of 'flesh,' gain of 'flesh,' &c. are to be understood in this inclusive sense.

This flesh has something of the following composition:

Water	75	per cent.
Solids	25	"
Inorganic	1	"
Organic	24	"
Proteins	16–19	"
(Nitrogen)	3·4	"

Flesh-fly. See BLUE-BOTTLE, and FLY.

Fleta, the title of an early treatise on the law of England, presumably written about 1290 by a judge who was confined in the Fleet prison. It consists of six books, the language being Latin. Selden edited it in 1647.

Fletcher, ANDREW, of Salton, a famous Scottish patriot, was born in 1655, the son of Sir Robert Fletcher, himself of English descent, and of Catharine Bruce, whose father, Sir Henry Bruce of Clackmannan, was directly descended from Robert Bruce. His father dying when he was still an infant, he was brought up under the care of the celebrated Gilbert Burnet, and early imbibed his preceptor's passion for political freedom, but not his prudence. After some years of continental travel, he sat in parliament in 1681 as commissioner for his native county, and offered so determined an opposi-

tion to the measures of the Duke of York that he found it necessary to flee to England, and thence to Holland. Here he formed fast friendship with the refugee English patriots, and on his return to England in 1683 shared the counsels of Russell, Essex, Howard, Algernon Sidney, and John Hampden, the greater patriot's grandson. Though a republican, Fletcher was very far from being a modern democrat, for one of his favourite schemes was to utilise the hosts of vagrants and paupers of the time like the slaves of ancient Greece and Rome. On the discovery of the Rye-house Plot, Fletcher fled to Holland, returned as a volunteer with Monmouth, but was obliged almost at once to leave the army for having at Lyme shot a fellow-campaigner in a personal quarrel about a horse. He now fled to Spain, but had no sooner landed at Bilbao than, at the instance of the English ambassador, he was flung into prison, from which he was soon mysteriously delivered by an unknown guide. In disguise he passed through Spain, not without further more than romantic adventures, in Hungary distinguished himself greatly as a volunteer against the Turks, and returned to Scotland at the revolution. He was the first patron of William Paterson, the founder of the Bank of England and projector of the Darien expedition, and it was the bitterness caused in Scotland by the base treatment the unfortunate Darien colonists received from King William's government that gave Fletcher and the nationalist party their strength in the struggle against the inevitable union with England. His famous 'limitations' aimed at constructing a federative instead of an incorporating union—a frail structure that would have borne neither the burden of recent irritation nor the weight of ancient hatreds. Fletcher's orations in the Scottish parliament still glow with eloquence, and carry the stamp of genuine sincerity, but the modern reader has feelings other than admiration for a statesman whose eyes were too much blinded by prejudice to recognise that the only salvation for a country distracted by intestine jealousies and hopelessly corrupt domestic government lay through incorporation with the larger and healthier life of the great southern kingdom. After the consummation of the union, Fletcher retired in disgust from public life, devoting himself to promoting agriculture. His fanners for winnowing corn and his mill for making *pot*-barley were better gifts to his country than all his speeches. He died at London in the September of 1716. His writings were collected and reprinted at London in 1732. Fletcher is described as follows by a contemporary pen: 'He is a low, thin man, of a brown complexion, full of fire, with a stern, sour look; of nice honour, with abundance of learning, brave as the sword he wears, a sure friend and an irreconcilable enemy, would lose his life readily to serve his country, and would not do a base thing to save it. His thoughts are large as to religion, and not such as can be brought within the bounds of any particular set, and his notions of government are too fine-spun, and can hardly be lived up to by men subject to the common frailties of nature.' Fletcher of Salton's name survives popularly only in the famous but usually misquoted saying, in his *Account of a Conversation concerning a Right Regulation of Governments for the Common Good of Mankind:* 'I knew a very wise man, so much of Sir Christopher's sentiment, that he believed if a man were permitted to make all the ballads, he need not care who should make the laws of a nation.' See the Life by G. W. T. Omond (1897).

Fletcher, Giles and Phineas, poets, were cousins of Fletcher the dramatist, and sons of Giles Fletcher, LL.D. (1549–1611), himself a poet and writer on Russia, and Queen Elizabeth's minister in negotiations in Germany and at the court of Russia.—Giles, the younger of the two brothers, was born about 1588, was educated at Trinity College, Cambridge, and died at his living at Alderton, in Suffolk, in 1623. Fuller tells us that his 'clownish low-parted parishioners, having nothing but their shoes high about them, valued not their pastor according to his worth, which disposed him to melancholy and hastened his dissolution.' His chief poetical work is a sacred poem, entitled *Christ's Victory and Triumph in Heaven and Earth over and after Death*, published at Cambridge in 1610. It is full of splendid versification and imagery, and is saved from the fatal dullness of most professedly religious poems by a quickening glow of genuine enthusiasm. It is of course based upon Spenser, and most of his distinctive characteristics are imitated and overdone. The metre is original and not entirely successful. Each stanza has eight lines, the last an Alexandrine, rhyming thus: *ababbccc;* and a lyrical interlude occurs here and there. The poem, although once admired, is now unknown to general readers, and is chiefly remarkable for having to some extent influenced the majestic muse of Milton. His poems were edited by Dr Grosart in 1868 and in 1876, by Dr F. S. Boas in 1908–9.—Phineas was born in 1582, educated at Eton and King's College, Cambridge, and in 1621 became rector of Hilgay, in Norfolk, where he died in 1650. His most important poem, the *Purple Island, or the Isle of Man*, was published in 1633, in twelve cantos of seven-lined stanzas, a regular elegaic quatrain taking the place of the irregular quintett of Giles's poem. It contains an elaborate description of the human body, given with great anatomical minuteness. The body is an island, the bones its foundations, and the veins the streams by which it is watered. The vices and virtues that affect it are similarly allegorised with laborious ingenuity. Although to a large extent formal and pedantic, the *Purple Island* abounds in fine passages. Phineas Fletcher's poetical works were edited by Dr Grosart in 1868, by Dr F. S. Boas in 1908–9.

Fletcher, John (1579–1625). See Beaumont and Fletcher.

Fletcher, John Gould, poet and art critic, born 3d January 1886, at Little Rock, Arkansas, studied at Harvard, lived for a time in Massachusetts, and settled in London in 1916. His earlier works—e.g. *Irradiations* (1915)—overflowing with fantasy, placed him among the Imagists. Later collections, such as *Breakers and Granite* (1921) are more human in interest.

Fleur-de-lis, a heraldic device representing the white iris, came to be the arms of the Bourbons and of France. The three heads of the fleur-de-lis have been said to typify the Trinity. See Pews.

Fleur-de-lis.

Fleurus, a town of Hainault, on the Sambre, 15 miles W. of Namur, the scene of three great battles: (1) in 1622, when the Germans, under the Duke of Brunswick and Count Mansfeld, defeated the Spaniards; (2) in 1690, when the French, under Luxembourg, routed the allied Germans and Dutch, commanded by the Prince of Waldeck; and (3) in 1794, between the French, under Jourdan, and the Austrians and their allies, under the Duke of Coburg, on which occasion the latter, although he had virtually beaten his antagonist, gave the signal to retreat.

Fleury, or Flory, in Heraldry, signifies that the object is adorned with fleurs-de-lis; a cross-fleury, for example, is a cross the ends of which are in the form of fleurs-de-lis. See Cross, Tressure, &c.

Fleury, André Hercule de, Cardinal, Louis XV.'s prime-minister, was born in 1653, at Lodève, in Languedoc, became in 1677 almoner to the queen, and after her death (1683) filled the same post under Louis XIV., who in 1698 made him Bishop of Fréjus. Under Louis's will he was appointed preceptor to the heir-apparent, a child of five years, who in 1715 succeeded as Louis XV. In 1726, at the age of seventy-three, Fleury was raised by the young king to be prime-minister; in the same year he received the cardinal's hat. Fleury was honest and well meaning, but not a statesman: the extortions of the farmers-general were not checked, although it was probably for the people's sake that the minister practised a rigid economy that approached avarice and even crippled the power of France; whilst in foreign affairs he was earnestly desirous of peace, and yet was dragged by court intrigues into two wars over the succession to foreign thrones (see Succession Wars). The war of the Austrian Succession was not finished when he died, 29th January 1743, in the ninetieth year of his age, leaving the king thenceforth to the unchecked guidance of his mistresses. Fleury was an academician, and the friend and patron of learning; he sent out two expeditions to measure arcs of the meridian, gathered rare MSS. from Egypt and Greece, and completed the Bibliothèque Royale (now Nationale). See Verlaque, *Histoire du Cardinal Fleury* (Paris, 1879).

Fleury, Claude, church historian, was born at Paris in 1640, and forsook the law for an ecclesiastical career. In 1672 he became tutor to the young Princes de Conti, and at a later period to the Comte de Vermandois, natural son of Louis XIV. After the death of the young count in 1683, the French monarch appointed Fleury abbot of the Cistercian monastery of Loc-Dieu, and afterwards, under Fénelon, tutor to the Dukes of Burgundy, Anjou, and Berri. He was elected to fill La Bruyère's place in the Academy in 1696; and ten years later, on the completion of the prince's education, he was rewarded with the priory of Argenteuil. The Duke of Orleans selected him for confessor to the young king, Louis XV., giving as his reason for so doing that Fleury was neither Jansenist, nor Molinist, nor Ultramontanist, but Catholic. He died 14th July 1723. Fleury was as learned as he was modest, and as mild and kind-hearted as he was simple in his manners and upright in his conduct. Among his numerous works may be mentioned *Mœurs des Israélites* (1681); *Mœurs des Chrétiens* (1662); *Institution du Droit Ecclésiastique* (1687); and, above all, the *Histoire Ecclésiastique* (20 vols. Paris, 1691–1720). On this work, really the first complete and systematic history of the church, its organisation, doctrines, and rites, Fleury laboured thirty years. It is marked by great learning, and, on the whole, by a judiciously critical spirit. The work was translated into many languages, and praised by orthodox and heretics, both for its matter and style. Fleury's own work only reached to 1414; it was continued to 1778 by Fabre, Lacroix, and others.

Flevo, Lake. See Zuider Zee.

Fliedner, Theodor, founder of the Protestant order of Deaconesses (q.v.), was born in Nassau in 1800, and in 1822 became pastor of Kaiserswerth, near Düsseldorf, where in 1836 he founded the first deaconesses' home and a seminary for infant-school teachers, besides other institutions. He died 4th October 1864.

Flies. See Fly, Angling.

Flight of Animals. (1) Birds.—Newton proved that the resistance of the air to a body moving through it increases as the square of the velocity. It is this characteristic of air that makes flight possible.

As gliding is simpler than flapping-flight, it will be best to investigate it first. If a bird has gained momentum by plying his wings and wishes to glide onward maintaining his altitude, he gives his wings their full spread and inclines his body and wing-surfaces slightly upward. The resistance of the air acts at right angles to a moving plane, so that in this case resistance will take mainly the form of support. As the angle of incline is reduced, the resistance becomes less, and the line which represents it approximates more closely to the vertical—i.e. the amount of *lift* becomes more and more disproportioned to the amount of *drift*. It might seem, then, that the bird might with advantage reduce the angle of incline almost to the vanishing point if only he could sufficiently increase his pace. But the question of friction comes in. When the angle is less than, approximately, 5°, with the necessary velocity, friction becomes so great that more power is required than when the angle is slightly greater. It is the anterior part of the wing that does most of the work. This part meets the air first and sets it in motion. The air, thus disturbed, passes over the posterior part and offers little resistance. When a bird wishes to glide downward, he partly flexes his wings; thus reduced in width, they give less support.

Owing to the curve of the wings from front to back (their camber), the support given by the air is much greater than it would be if the surface were flat. The big heavy flyers have less supporting surface per lb. weight than the lighter and smaller. In proportion to its weight, a gnat has a greater supporting-surface than a butterfly; the butterfly comes far ahead of the swallow. In this respect the gnat, the butterfly, the swallow, the pigeon, the stork must be arranged thus in descending scale. The reason is not far to seek. The swallow's wing, though much larger, relatively to the weight to be carried, than the stork's, is *absolutely* very small, and a small wing lets the air escape at the margins. If the swallow were put on a par with the stork in point of the wing-surface allowed per lb. weight, his power of flight would be gone.

Owing to the massing of the heavy flight-muscles on the breast, the bird's centre of gravity is placed low, and it has been maintained that this produces automatic stability. But this is not so. The elasticity of the feathers helps to produce lateral stability. If a sudden gust puts more pressure upon the right wing than on the left, the feathers, yielding and bending upward, reduce the wing area on that side, and so diminish the pressure. But equilibrium is maintained chiefly by voluntary adjustments, though these movements, no doubt, through habit become almost unconscious. If a gull hanging over the stern of a steamer is watched, it will be seen to be perpetually making slight adjustments. Some birds, notably pigeons, often glide with their wings sloped upwards, and this position may tend to preserve equilibrium. Photography, too, has shown that it frequently happens that the wings give unequal or different strokes. For fore-and-aft balance the tail is very useful; when it is expanded and lowered it follows that the hind-quarters are raised by the pressure of air while the head is lowered. Long-legged and long-necked birds can do much by extending or retracting their legs or necks. Webbed-feet can be used to some extent as the tail is used, and as they are heavy their retraction or extension may have some effect. It is remarkable that birds with long legs or webbed-feet have small tails. The contrast between a sparrow-hawk and a heron in this respect is very striking. In gliding the wings can be

effectively used: if they are partly flexed the centre of pressure moves backward; when they are fully extended again it moves forward.

In order to support and propel himself, a bird must move his wings with extreme rapidity. They are levers, and a fulcrum has to be found on the yielding air. If a very rapid stroke is given, the air resists and a fulcrum is obtained. As with most levers in living animals, the object is not to economise power, but to obtain rapidity of movement. The great muscle which lowers the wing springs from the breast-bone and the keel and attaches to the humerus not far from its near end. When it contracts the farther end of the wing moves with great velocity. When a stork is giving what seem very leisurely flaps, the bending back of the primary feathers proves with what speed and force they are being driven through the air. A fulcrum is being found, and mainly beneath the end of the wing. The muscle that raises the wing is, comparatively, quite small, and lies in the angle formed by the sternum and the keel. It attaches by a tendon to the front edge of the upper surface of the humerus, and its pull raises the wing on the pivot formed by the shoulder-joint. When once the bird has gained momentum, the elevator-muscle has little work to do, since, after the down-stroke, the resistance of the air carries the wing backward and upward. When the down-stroke is about to begin (see figure), the wing stands erect with its anterior edge turned to the front. Attaching to

Gull flying (after Marey), 25 photographs per second.
Reproduced by permission from Headley's *Flight of Birds* (Witherley).

the anterior edge of the humerus the depressor-muscle tends to lower the front of the wing more than the back, and the air, acting upon the large expanse of feathers behind the supporting bones, helps to bring this about. Since the resistance of the air acts at right angles to the wing, and since the wing is inclined, from front to back, upward, the bird is not only supported, but propelled; there takes place a resolution of forces. But the wing not only descends; it moves forward—the action of the air upon its inclined surface brings this about, and it results that the incline from tip to base is upward; for propulsion this is just what is wanted. In hurried flight this forward movement of the wing is very conspicuous; in leisurely flight the wing moves but little forward as it descends, the stroke being much shorter. When the down-stroke is over, the muscles relax, and the wing is immediately carried backward and upward by the force of the air. It is then moved forward edgeways and erected by the elevator-muscle. In the course of the up-stroke, the backward movement is sometimes checked for a moment, for photographs show the flight-feathers bent back. The object may be to prevent the bird dropping between the wing-strokes. During the down-stroke the flight-feathers rotate slightly, so that the inner web of each presses closely against the feather above it, with the result that the wing becomes impervious to air. This rotation is mainly due to the fact that the inner web is broader than the outer, and so is more strongly acted on by the air. In each feather the barbules (the secondary branches that spring from the barbs) interlock by means of barbicels or hooklets, and this interlocking gives to the feather its firm texture, and, in part, its elasticity.

Most birds have strong legs of some length, and this enables them to jump from the ground and start flying. The puffin, the swift, and the condor may be mentioned as birds which have difficulty in starting from the ground owing to shortness or weakness of leg. The stork, mounted on the top of his long legs, is able to move his wings freely from the first. But in all cases birds of great bulk have difficulty in mounting steeply upward. Their wing-strokes are, of course, comparatively slow. The buzzard, according to Marey, takes 3 per second to the sparrow's 13. The heron, as a rule, takes about 130 per minute. Thus, when he has but little way on, the bulky bird loses altitude between the strokes. He, therefore, gets up pace, ascending by a gentle incline. Moreover, most bulky birds are very stiff at the shoulder-joint and, were they to incline their bodies steeply upward with a view to a rapid ascent, their wings, not having sufficient power of rotation, would beat, not up and down, but forward and backward. The wings of most small and of some fair-sized birds have great freedom at the shoulder-joint—e.g. the pheasant, which has occasion often to rise almost vertically to an opening in the boughs overhead. On the other hand, the grouse and the gull, living as they do in the open, are stiff at the shoulder; they can afford to mount gradually.

A bird has various ways of steering. In order to steer to the left he will commonly fling himself on his left side, the left wing pointing downward and the right upward. His onward course in the former direction of his flight is checked by the expanse of his wings, and he travels onward head leading. The tail is also used in steering, one side or the other being lowered. Good steerers, such as the sparrow-hawk, have a far larger spread of tail than bad steerers, such as the duck. Unequal wing-strokes, which not unfrequently take place, must also play an important part in steering.

When a bird wishes to stop and alight, he suddenly drops his hind-quarters, and his wings are so orientated that their beating speedily checks his momentum. At the moment of alighting the wings are often given a final stretch as if to ease the muscles after their exertions. In the case of the tern, the lapwing, and even the domestic pigeon this is a beautiful sight.

Birds' wings vary much in form and efficiency. There is the short, broad, rather primitive wing which suffices for short flights—e.g. the jay's; for long-distance flight the narrow tapering wing with the camber vanishing towards the tip—e.g. the golden plover's; the broader but pointed wing of the great soaring birds.

Flight with Motionless Wings.—Gulls may often be seen hanging over the stern of a steamer, their wings outstretched and motionless, except for slight movements necessary for the maintenance of equilibrium, and keeping pace with the vessel. When this happens, there is a head wind, or one which strikes the vessel at a small angle. Impinging against the vessel's side, it is deflected upward, as can be shown by letting fly small pieces of paper, and the gulls poise upon the up-current. The air acts at right angles to the bird's expanded surface, which is inclined slightly down-

ward, and thus not only supports him but gives him headway. In hill country or over sun-heated plains big birds, such as kites, vultures, eagles, may be seen turning in spirals, sometimes rising not only when they are facing the wind, but throughout a complete turn of the spiral. If it is a left-handed spiral, the left wing is sloped downward and the right is in line with it. The primary wing feathers are bent upward. There is no flapping of the wings when the conditions are favourable. In the neighbourhood of hills there are, of course, up-currents at the service of the soaring bird, and the performance, however marvellous, has an obvious explanation. The circling keeps the bird within the region of the up-current or within range of some spot which he has under observation. From sun-heated plains the air rises, and may give the wind an upward trend. When clouds obscure the sun, kites and other soarers descend or resort to flapping flight. A good observer on the plain of Upper Assam states that there is always a wind when soaring takes place there. Dr Hankin (*Animal Flight*), who has made very painstaking observations in India, says that birds often soar when there is no wind. But apart from wind there may be a strong up-draught. In any case we cannot accept his testimony when he maintains that he has seen a bird rising with wings held motionless in a descending current. The upward bending of the primary feathers, always noticeable, can be accounted for only by an up-draught. There is no soaring over the sea, and there the up-currents due to heat are but feeble. The wind is deflected by waves, and this fact the shearwater and, probably, the albatross turn to account. Unequal velocities in a horizontal wind would not enable a bird to dispense altogether with the flapping of his wings. Near the ground the velocity of the wind increases rapidly with altitude. The snipe, when he rises facing the wind, profits by this; emerging from a slower current into a faster one, he has the inertia that he must have if a horizontal breeze is to help him. Yet he has to ply his wings vigorously. However, Lanchester, a high authority, holds that inequalities in the wind's velocity may be utilised by the soaring bird in addition to up-currents.

(2) BATS.—All five metacarpals and all the digits except the thumb help to form the framework of the bat's wing. Behind, it is attached to the leg, and this makes the bat a poor starter. The wing-strokes are rapid, and the flight quick.

(3) FLYING-FISH.—They often fly for a distance of 200 yards. Much longer flights are recorded. The fish jumps from the water propelled by a strong movement of his tail. Often he flies low over the water, propelling himself by the action of his tail, which at intervals is immersed in the water. But not seldom he makes higher flights, and sometimes lands himself on the deck of a ship. In these cases there is no doubt that the large pectoral fins are used, vibrating with great rapidity. Dissection has shown that the requisite muscles are strongly developed. No doubt flying-fish often take advantage of up-currents of air due to the deflection of the wind by the waves.

(4) INSECTS.—The flight of insects is in principle similar to that of birds. But the smaller area of the wings necessitates a very rapid stroke. Marey, as the result of ingenious experiments, gives the following rates per second: common fly 330, bee 190, wasp 110, humming-bird moth 72, dragon-fly 28, butterfly 9. Evidently the muscles of insects that fly are capable of much more rapid contraction than those of vertebrates.

Books to consult: *Le Vol des Oiseaux* and *Animal Mechanism*, by Prof. Marey; *Aerodonetics*, by F. W. Lanchester; *The Flight of Birds*, by F. W. Headley. For human flight see BALLOONS AND AEROPLANES.

Flinders, MATTHEW, an English navigator, who surveyed a great portion of the Australian coasts, was born at Donington, in Lincolnshire, 10th March 1774, and in 1790 entered the navy. Going out to Australia in 1795, he determined to investigate the coast south of Port Jackson, about 250 leagues of which were laid down in the charts as 'unknown.' With an equally daring and ambitious young surgeon in the ship, named Bass, he carried out a series of voyages, the most important result of which was the discovery of a previously unknown strait between Van Diemen's Land (now Tasmania) and the mainland of Australia, which was named after Bass. In 1801 Flinders obtained from the British government the command of a scientific expedition for the investigation of the Australian coasts and their products. Commencing his examination at Cape Leeuwin, Flinders in the course of two years gradually explored the coast to Bass Strait (q.v.), thence northwards—laying down carefully the Great Barrier Reefs—to the Gulf of Carpentaria, which he thoroughly surveyed across to Timor, then back to Cape Leeuwin, and round the south coast to Port Jackson (1803). On his way home he was first wrecked, and then detained a prisoner by the French governor of Mauritius, and not allowed to proceed to England until 1810. He gave the world the result of his explorations in *A Voyage to Terra Australis*, and died July 19, 1814, the day on which his book was published.—The coast of South Australia was long called after him Flinders Land. His name is still attached to the southernmost county in Eyre Peninsula, and to Flinders Island, off that coast; to the Flinders Range in South Australia, rising near the head of Spencer Gulf, and running north (highest peaks, 3100 feet); also to a town in Victoria, 61 miles SE. of Melbourne. See Life by Ernest Scott (1914).

Flindersia, a genus of trees of the order Rutaceæ, or, according to others, Meliaceæ, natives of eastern Australia, New Caledonia, &c. Some are valuable shade trees; some afford timber useful for cabinet-making. *F. Australis* is the Native Ash or Crow's Ash of Australia; *F. Oxleyana* (or *Oxleya xanthoxyla*), the Queensland yellow-wood or white teak.

Flint, a mineral which may be regarded as a variety of quartz, allied to chalcedony, consisting almost entirely of silica, with traces of carbonaceous impurities whose presence gives rise to the prevailing dark colour. It has a flat shell-like fracture, is translucent or semi-translucent, and varies in colour from a very dark brown, or almost black, to light brown, red, yellow, and grayish-white, and is sometimes veined, clouded, marbled, or spotted. Dark-coloured flints are most common in the chalk, in which principally flint occurs imbedded, forming tabular sheets and nodules of various sizes, sometimes large nodular masses, of irregular and often grotesque shape; but gravel formed of light-coloured flints is very common, and it is disputed whether or not a change of colour has taken place by exposure to atmospheric and other chemical agencies. Flint is sometimes found in beds or veins. It is very abundant wherever the chalk formation extends, in England and other countries; rolled flint nodules are also often found in conglomerate rocks, and in alluvial soils—vast alluvial tracts being sometimes full of them. Flint geodes often contain crystals of quartz. Flint nodules are usually moist in the interior if broken when newly taken from their beds.

Flint is sometimes harder than quartz, sufficiently so to scratch it. The readiness with which it strikes fire with steel is well known, and it would seem that the sparks are not all merely incandescent particles, heated by the friction, but that in some of them a chemical combination of silica and iron takes place, causing great increase of heat. The use of the flint and steel for igniting tinder was superseded by that of lucifer matches, and gun-flints gave place to percussion-caps—themselves now superseded. The most ancient use of flint was probably for sharp weapons and cutting instruments; and flint knives, axes, arrow-heads, &c. are among the most interesting relics of rude antiquity. In East Anglian churches squared flints have been used for centuries to ornament the porches, towers, buttresses, &c.; but at present the principal use of flint is in the manufacture of fine earthenware, into the composition of which it enters, being for this purpose first calcined, then thrown into cold water, and afterwards powdered.

The origin of flint is a subject of considerable difficulty. Siliceous deposits are sometimes the result of a purely chemical operation, as in the case of the siliceous sinter formed round the geysers of Iceland, from the evaporation of water largely charged with silica. But at the bottom of the sea, as no evaporation could take place, some other agent than springs of water saturated with silex must have supplied the materials. It is a fact of considerable importance in this inquiry that almost all large masses of limestone contain siliceous concretions, or flints. Thus, chert is found in Carboniferous and other limestones, and menilite in the Tertiary limestones of the Paris Basin. The conditions necessary for the deposition of calcareous strata seem to be those required for the formation of siliceous concretions. The materials of both exist in solution in sea-water, and, as it needed the foraminifer, the coral, the brachiopod, and the mollusc to fix the carbonate of lime which formed the chalk deposits, so the silex was secreted by innumerable diatoms and sponges, and their remains most probably supplied the material of the flint. The discovery by Dr Bowerbank and other microscopists of the spicules of sponges and the frustules of diatoms in almost every specimen of flint has clearly shown that flint to a large extent, if not entirely, owes its origin to these minute organisms. After the death of the organisms their silica appears to have been redissolved and redeposited, perhaps through the agency of decomposing animal matter, sometimes in the form of irregular concretions, and sometimes replacing the calcareous skeletons and exuviæ of other organisms. See FLINT IMPLEMENTS AND WEAPONS.

Flint, a borough and seaport in the east of Flintshire, North Wales, on the left side of the estuary of the Dee, 13 miles by rail NW. of Chester. In the vicinity are very extensive alkali-works, besides copper-works, collieries, and lead-mines. Pop. 6300. Till 1918 it united with Caergwrle, Caerwys, Holywell, Mold, Overton, Rhuddlan, and St Asaph in sending one member to parliament. Flint Castle, built by Edward I., captured by the parliament in 1643, and four years later dismantled, is a ruin. Here Richard II. surrendered to Bolingbroke, 19th August 1399. See Taylor's *Notes on the History of Flint* (1873).

Flint, a maritime county of North Wales, bounded on the NE. by the river Dee, on the E. by Cheshire, on the S. and W. by Denbighshire, and on the N. by the Irish Sea. The main portion of the county is 26 miles long by 10 to 12 broad, and the detached hundred of Maelor, lying 8 miles SE. of the main part, measures 9 miles by 5. Flintshire is the smallest of the Welsh counties, its area being 256 sq. m. The coast is low and sandy, but along the Dee estuary fertile. The county is bisected by a low range of hills, stretching almost due north. The geological basis consists of rocks of the Carboniferous series. Coal, iron, lead, copper, calamine, zinc, and limestone are the chief mineral products. Some chemical works and potteries of coarse clay give employment. There are numerous well-watered and picturesque valleys, the soil of which is for the most part fertile and well cultivated. The uplands afford good pasturage. The Dee in the east and the Clwyd in the west of the county are the principal rivers. Pop. (1801) 39,469; (1881) 80,587; (1911) 92,705; (1921) 106,466. Flintshire returns one member to parliament. The chief towns are Flint, Rhyl, Buckley, Connah's Quay, Mold, Prestatyn, St Asaph, Holywell, and Hawarden. Flintshire has traces of Roman lead-mines, and is traversed by Watt's and Offa's Dykes. In the 7th century Saxon invaders massacred all the Christian monks of the monastery of Bangor-iscoed (q.v.). Several barrows and menhirs occur in the county. See D. R. Thomas, *History of the Diocese of St Asaph* (1874).

Flint, capital of Genesee county, Michigan, on the Flint River, 64 miles NNW. of Detroit by rail, with numerous sawmills, and manufactures of automobiles and carriages, cigars, brass, axles, &c. There is a large state institution for the deaf, dumb, and blind here. Pop. (1890) 9803; (1910) 38,550; (1920) 91,599.

Flint, ROBERT (1834–1910), was born (March 14) at Dumfries, educated at the university of Glasgow, and ordained in 1859 to the East Church, Aberdeen, whence he was transferred in 1861 to the parish of Kilconquhar in Fife. In 1864–76 he occupied the chair of Moral Philosophy at St Andrews, and in 1876–1903 that of Divinity at Edinburgh. In 1865 he published a volume of discourses, *Christ's Kingdom upon Earth.* His *Philosophy of History in Europe* (vol. i., *In France and Germany,* 1874) established his reputation as a profound thinker and erudite scholar. Rewritten, part of this work appeared in 1894 as *Historical Philosophy in France and Switzerland. Theism* and *Anti-Theistic Theories* (1879–80) were the Baird Lectures for 1876 and 1877. Other works are a monograph on *Vico* (1884) and a treatise on *Socialism* (1895). See a Life by Dr Donald Macmillan (1914).

Flint Implements and Weapons of the primitive peoples of prehistoric times are commonly found in the graves or on the sites of settlements of the earlier inhabitants of almost every country in Europe. They also occur not only in the surface soil or *humus* and in peat-bogs, beds of rivers and lakes, but naturally imbedded in such superficial or quaternary deposits as the old terraces of river-valleys. These terraces, which are formed of gravel and sand deposited by the river, are the marginal remains of the old river-bed, which, having been gradually deepened by the erosion of the current, has left here and there portions of the fringes of earlier deposits on the slopes of the valley. Flint implements, however, are not universally distributed through the diluvial drifts; for, while they occur pretty generally over the south-eastern area of England, they have not been found in the northern and western areas, nor in Scotland. Similarly, on the Continent, although they are found somewhat abundantly in the north-western area of France, they do not occur in Denmark, Sweden, or Norway. The types of flint implements found in these river-gravels closely resemble those from the caves of Périgord in France, and from Kent's Cavern and other caves in England. Besides possessing similar typical forms, the

flint implements from the river-drifts and caves are in both cases found associated with the remains of animals which either are extinct or are no longer indigenous. For this reason, and also because the flint implements found in these associations are fashioned by chipping alone, they have been assigned to the earlier part of the Stone Age (q.v.). On the other hand, the flint implements, whether fashioned by chipping alone or finished by grinding and polishing, which are found in the surface soil, or in graves, or in lake-dwellings, &c., and in association with remains of the common domestic animals, are assigned to the later part of the age of stone. The types characteristic of these two divisions being thus distinguished by their form and finish, as well as by their associations, are classified by archæologists as palæolithic and neolithic implements.

The palæolithic implements of rudely chipped flint are reducible to three classes. The first or best finished is an oval, sharp-rimmed implement, with a cutting-edge all round, the second a long, pointed implement, and the third a tongue-shaped implement. They differ from the neolithic types most markedly in this, that they do not obviously reveal their special uses and purposes, and that their conceivable uses or purposes are few in comparison with those so obviously disclosed by the more specialised forms and the more elaborate finish of the neolithic types, which a glance suffices to classify as arrow and spear heads, daggers, knives, saws, borers, scrapers, chisels, axes, &c. Most of the neolithic implements are finely shaped and carefully finished, while some varieties, such as the long thin knife-blades and the handled dagger-blades of Denmark and Sweden, which are finished by chipping only, are perfect marvels of workmanship—so skilfully executed that experienced lapidaries and scientists can only speak of the process of their manufacture as a lost art. No modern savages or barbarous tribes of the historic period have produced anything approaching to the masterpieces of prehistoric flint-working. Flint, from its conchoidal fracture, is the only kind of stone that is capable of being readily worked into a variety of shapes by flaking and chipping, and this is probably the chief reason why the palæolithic implements have been formed almost exclusively of this material. The methods of manufacture seem to have been analogous to those employed in the manufacture of gun-flints and strike-lights of flint for export (the gun-flints chiefly to Africa, and the strike-lights to the East and to Brazil) carried on at Brandon (q.v.) in Suffolk, the principal differences being that steel tools are now used instead of tools of stone and bone, and that the finer processes of surface chipping and flaking are not now practised. Detailed descriptions of the various processes of flint-working, and of the ancient and modern methods of manufacture, are given in the first part of Sir John Evans's work on the *Ancient Stone Implements, &c. of Great Britain* (1872; new ed. 1897); the finer forms of flint implements are illustrated by Madsen, *Afbildninger af Danske Oldsager* (1869), and Montelius, *Civilisation of Sweden in Heathen Times* (trans. 1889).

Flintlock. See FIREARMS.

Flint River, in Georgia, U.S., rises about 10 miles S. of Atlanta, and unites, after a southerly course of some 400 miles (of which 150 are navigable for steamboats), with the Chattahoochee, at the south-west angle of the state, to form the Appalachicola (q.v.).

Flintshire. See FLINT.

Flinty Slate is an impure quartz, assuming a slaty structure. It contains about 75 per cent. of silica, the remainder being lime, magnesia, oxide of iron, &c. Its fracture is rather splintery than shell-like. It is more or less translucent. It passes by insensible gradations into clay-slate, with which it is often in most intimate geological connection. Lydian Stone is a variety of flinty slate.

Floating-battery, a hulk heavily armed and made as invulnerable as possible, for defending harbours or attacking marine fortresses. They were used by the French and Spaniards in 1779–83, when ten, carrying 212 large guns, were brought to bear on Gibraltar (q.v.); they had sides of great thickness, and were covered with sloping roofs, to cause shot to glance off innocuously. But General Eliott succeeded in destroying them with red-hot cannon-balls. Steam floating-batteries of iron were constructed for the war with Russia in 1854 by the British and French governments; but though they rendered good service, they were soon discarded. However, vessels of this class called Monitors were built for use by England and used successfully in the Great War. They were of light draught, had bulges on the sides to lessen danger of being sunk by torpedo. Some carried a 15-inch gun, anti-aircraft guns and armoured turrets, and steamed 7 to 10 knots. Monitors so called were first used in American Civil War by Southern and Northern forces. See NAVY.

Floating-islands are formed either by the aggregation of driftwood in the creeks and bays of tropical rivers and the deposition thereon of soil and vegetable matter, or by the detachment of portions of a river-bank or lake-shore, on which the interlacing roots of plants constitute a foundation sufficiently strong to support soil whereon herbage, and occasionally even trees, are able to grow. Such islands are sometimes seen 50 or 100 miles distant from the mouth of the large rivers of America, Asia, and Africa. Portions of the alluvial soil from river-deltas, held together by the roots of mangroves and other trees, are sometimes detached by hurricanes or typhoons and then swept out to sea; such islands have been met with in the Philippines, in the seas of the East Indies, and in the Pacific. A floating-island is mentioned by Herodotus as existing in Egypt. Others were known to Roman writers: Seneca speaks of them as being in the Vadimonian, Cutilian, and Stationian lakes in Italy; to these Pliny adds the islands floating on lakes near Cæcubum, Reate, and Modena, and two others in Asia Minor. Those on Lake Vadimona were, according to the Younger Pliny, capable of supporting sheep. Varenius, in the middle of the 17th century, cites a lake in Honduras with floating-islands. Passing over others in Prussia, Italy, and South America, we come to Great Britain, where we find it recorded that Loch Lomond long possessed a floating-island, which has now, however, disappeared or become attached to one of the stationary islands of the loch. In Ireland large masses of peat float about some of the bogs—the Bog of Allen, for instance. In England, in Derwentwater, there is an instance of an island which appears and disappears from time to time in the same spot. Perhaps the most satisfactory theory is that which attributes its rising from the bottom to the permeation of its mass by marsh-gas during hot weather, the upward motion being assisted by the growth of buoyant water-plants on its surface. The same seems to hold of those (sometimes as many as sixty) in the Lake of the Floating Islands in Yamagata, Japan, famous since the 14th century.

Between 1696 and 1829, similar islands were observed at irregular intervals, generally, however, after great droughts and violent storms, in Lake Rålang in the Swedish province of Småland. Oceanic

floating-islands sometimes perform important service in the transportation of vegetable seeds from place to place, also in the distribution of animal species, by carrying insects, land mollusca, and small mammalia, more rarely reptiles. Darwin met with islands floating on Lake Tagua-Cagua in Chile which passed from side to side of the lake and carried 'cattle and horses as passengers.' In the latter half of the 19th century the White Nile was rendered almost unnavigable owing to the accumulations of floating vegetable matter or 'sudd,' which had to be cut and removed on a very large scale in 1900–2. In some instances it gave rise to serious inundations. The vale of Kashmir contains many lakes, which frequently overflow and drown the surrounding country. This has taught the inhabitants to construct floating-gardens for the cultivation of their vegetables. The gardens are in reality portions of the marshy ground made to float artificially by cutting through the roots of the reeds and other plants about two feet below the surface. The Chinese, too, devote considerable attention to this style of horticulture, but more by way of ornamentation. Floating-gardens, or *chinampas*, also existed in Mexico before the Spanish conquest. Clavigero describes them as formed of wicker-work, the stems of water-plants, and mud, the largest sometimes having on them a tree or a hut. Both flowers and vegetables were grown on them.

Floatstone, a variety of silica, consisting of fibrous concretions of opal, aggregated so that the whole mass is sponge-like, and so light, owing to the air confined in the interstices, as to float for a while in water. It is found in a limestone of the chalk formation near Paris, in imbedded masses, or incrusting flint nodules.

Flodden, Battle of, fought between James IV. of Scotland and an English army under the Earl of Surrey, September 9, 1513, the most grievous defeat ever Scotland suffered. King James, with 30,000 men, had taken up a strong position on Flodden Hill, one of the east and lowest spurs of the Cheviots, about 6 miles south of Coldstream, and on the morning of the 9th the Earl of Surrey, with 32,000 men, advanced from the southeast, crossed the Till by a skilful movement, and thus cut off all communication between King James and Scotland. James neglected the opportunity of attack while the English were crossing the river, but, seeing that they were aiming at taking up a strong position to the north-west of Flodden Hill, ordered his tents to be set on fire, and advanced to the attack about four o'clock in the afternoon. The Earls of Huntly and Home, who commanded the left wing of the Scottish army, charged the English right, which was led by Sir Edmund Howard, and entirely defeated it, but Home's borderers threw away the advantage of their success by commencing to pillage the baggage of both armies. On the Scottish right the clansmen under Lennox and Argyll, goaded to fury by the English archers, rushed heedless of order upon their opponents, but were routed with great slaughter and put to flight. Meantime a desperate resistance was made by the Scottish centre, where the king fought on foot among his nobles. Night fell upon them still fighting heroically, the ring still unbroken, though within it the king lay dead. The Scots held the hill during the night, but at dawn retreated with a loss of from 5000 to 12,000 men, including the flower at once of bravery and of rank. The Archbishop of St Andrews and as many as twelve earls were among the slain, and long after, indeed, there 'was not a worshipful Scots family that did not own a grave on Brankstone Moor.' The English loss amounted at most to 4000; but Surrey's victory was so nearly a defeat that he was unable to prosecute the war with any vigour. The sixth canto of Sir Walter Scott's *Marmion* contains a splendid and fairly accurate description of the battle. See Robert White, *The Battle of Flodden* (Newcastle, 1859).

Flogging. Corporal punishment, which, in deference to public opinion, was abolished in 1881, had existed from time immemorial in the British army and navy. It was often inflicted upon slight occasion, and with barbarous severity. Thus, at the beginning of the 19th century court-martial sentences of a thousand lashes were very common for mutiny and other grave offences even in time of peace. After the Crimean campaign, however, it became usual, unless the troops were on active service, to remit the sentence of corporal punishment, which a court-martial could still legally award to the extent of fifty lashes. The Act of 1879 went further in this direction, and made it illegal to inflict corporal punishment, except on active service, for offences punishable by death, and limited the amount to twenty-five lashes. Finally this provision was repealed by the Army Act of 1881, and summary punishment provided as a substitute. This consists of hard labour, personal restraint by being kept in fetters, and, in its severest form, of being attached to a fixed object in such a manner as to be kept in a fixed position for two hours at a time. Boys were left punishable by birching or caning, but in 1906 birching was tentatively suspended, caning only being allowed. Soldiers are still liable to corporal punishment, limited to twenty-five lashes, when in prison, for an offence against the prison rules, and for highway robbery with violence.—In European armies recruited by compulsion from all classes of society, flogging is not a military punishment.

As a punishment for misdemeanours at common law whipping has never been formally abolished, though it has never been exercised in modern times except under the provisions of some special statute. Local police acts give power to whip juvenile offenders; and by a statute of 1863 (which does not apply to Scotland) flogging was made a competent punishment for certain forms of robbery with violence, as garrotting. Sir James Stephen says of this statute that it is 'an act so capriciously worded, that if a man beat a woman about the head with intent to rob her he may be flogged, but not if his object is to ravish or murder her.'

At common law the instrument to be used for whipping and the number of strokes are left to the discretion of the person who inflicts the punishment. When sentence of whipping is pronounced by justices, the order must specify the instrument and the number of strokes. If the offender is under fourteen years of age, the number of strokes must not exceed twelve, and the instrument must be a birch rod. Under the Act of 1863 a court may direct a person convicted of robbery to be privately flogged—not more than three times. If the offender is under sixteen, the number of strokes at each whipping must not be more than twenty-five; and, no matter what the offender's age, the number must not be more than fifty. In Scotland no offender above sixteen years can be whipped for theft or for any crime committed against person or property (Act 25 Vict. chap. 18, sect. 2).

Flood, Henry, Irish orator, was born in 1732, and educated at Trinity College, Dublin, and at Christ Church, Oxford. Elected to the Irish parliament as member for Kilkenny in 1759, and for Callan in 1761, he soon became a leader in the popular party. His oratory was vigorous and impressive, but was marked by all the offensive personalities of his time. In 1769 he was unfortunate enough to

kill an electioneering opponent in a duel, and was brought to trial, but acquitted. In 1775 he took office as vice-treasurer of Ireland, but was removed in 1781 on account of his strong nationalist sympathies. Disliking Grattan's Irish Bill of Right as not going far enough, Flood strove without success to carry a more sweeping measure, and became involved in a bitter quarrel with his former friend, which would have resulted in a duel but for the timely intervention of the authorities. In 1783 he was returned for Winchester to the English House of Commons, and two years later for Seaford, but he failed to make as great a mark at Westminster as in Dublin. He died at Farmley, his seat near Kilkenny, December 2, 1791, leaving £5000 a year to Trinity College, Dublin. See his *Life and Correspondence*, edited by W. Flood (Lond. 1838).

Floods and **Inundations** are caused by excessive rains, giving rise to an overflow of the rivers; by the bursting of the banks of rivers, lakes, and reservoirs; by the sudden melting of ice and snow; and by irruptions of the sea, produced by high tides, wind-storms driving the sea-water inland, earthquakes, volcanic outbreaks, and the bursting of sea banks. The felling of forest trees throughout extensive tracts of mountainous country also tends to make the rivers which have their origin there swell rapidly after a heavy rainfall; good and complete drainage of land has the same tendency. For the Noachian flood, see DELUGE. The subjoined list embraces some of the most disastrous floods and inundations of which we have record.

684 A.D. Japan; 780 sq. m. of Isle of Shikoku covered by sea.
968. Persian Gulf; many cities destroyed, and new islands formed by irruption of sea.
1014. Many English seaports destroyed by sea.
1098 or 1100. East of Kent inundated; Goodwin Sands formed.
1100 or 1108. Flanders inundated.
1161 or 1165. Sicily; irruption of sea; thousands drowned.
1170. Holland and Friesland; great flood.
1173. Holland; Zuyder Zee much enlarged.
1219. Nordland, Norway; lake burst; 36,000 people perished.
1228. Friesland; invasion of sea; 100,000 people drowned.
1277. Friesland; the Dollart formed.
1286–87. Holland on both sides of Zuyder Zee inundated in consequence of a storm.
1396. Holland; islands of Texel, Vlieland, and Wieringen separated from mainland, and Marsdiep, the channel between Texel and North Holland, formed.
1421 or 1446. Holland; 72 villages inundated, of which 20 permanently, about 100,000 persons drowned, Biebosch formed east of Dordrecht, and this town separated from mainland.
1521. Holland; 100,000 lives lost by an inundation.
1570. Holland; storm drove in the sea, destroying numerous villages and 20,000 people in Friesland.
1617. Catalonia, Spain; 15,000 perished in floods.
1629. Mexico (city) inundated.
1642. China, at Kaifong; 300,000 drowned.
1646. Holland and Friesland inundated; loss of life, 110,000.
1726. Floods and inundations all over Europe.
1745. Peru; Callao destroyed by irruption of sea caused by earthquakes.
1767. England; irruption of sea on east coast.
1782. Formosa; west side of island submerged, and Taiwan destroyed.
1787–88. Northern India; 15,000 lives lost by floods.
1791. Cuba; floods from excessive rain; 3000 drowned.
1811. Hungary; 24 villages swept away by overflow of Danube
1813. Austria, Hungary, Poland, and Prussian Silesia; floods caused by rains; 4000 perished in Poland, 6000 in Silesia.
1824. St Petersburg and Cronstadt; 10,000 lives lost from overflow of Neva.
1825. Denmark; sea broke through from North Sea to Limfjord, making northern Jutland an island; one-third of Friesland submerged by rising of sea and rivers.
1829. Morayshire.
1840. France; overflow of Saône and Rhone swept away many villages and inundated Lyons, Avignon, Nîmes, Marseilles, &c.
1851. Northern China; Yellow River burst its banks, and made a new outlet into Gulf of Pechili.
1852. Floods throughout Europe from Belgium to Switzerland.
1856. South of France; floods did damage to extent of £5,600,000.
1868. Peru; Arica and Iquique nearly destroyed by earthquake waves.
1874. United States; Mill River valley (Massachusetts) inundated by bursting of a dam; 144 drowned. Also floods in western Pennsylvania; 220 drowned.
1875. Disastrous floods throughout central Europe, in United States, Burma, India, and West Indies.
1876. China; floods in northern provinces; in Bengal 200,000 persons perished from inundation of a sea wave.
1883. Java and Sumatra; volcanic wave (see KRAKATAO).
1887. China; Hoang-ho flooded in Ho-nan; millions drowned.
1889. Johnstown, U.S.; reservoir burst; 2209 lives lost.
1891. Consuegra, Spain; 1200 lives lost.
1893. Queensland; great destruction of property.
1896. Japan; volcanic wave.
1903. Mississippi Valley.
1913. Ohio basin: Dayton suffered most in this appalling disaster.
1917. North China.
1923. Lake of Gleno, near Lago d'Iseo.
1924. North China, India.
1926. Holland, Belgium, &c.

Some parts of the world are periodically submerged, such as extensive tracks in Siam, Cochin-China, and Annam, &c.

Floor. The floors of the upper stories of ordinary houses are nearly always constructed of wood, but in many large public and other buildings all the floors are fireproof, some of these, for example, being formed of a series of flat brick arches between iron girders. Basement floors and others near the level of the ground are often laid with flagstones, tiles, or cement, but many of these are also of wood. According to the nature of their construction, wooden floors are of three kinds—viz. *single*, *double*, and *framed floors*. When the span between the walls does not exceed 15 feet, a single-joisted floor is sufficiently strong. Sometimes it is even adopted

Section of a Single Floor:

a, *b*, *c*, *d*, joists; *s*, strutting; *f*, flooring-boards; *p*, sound or deafening boarding; *y*, pugging or deafening; *m*, ceiling-lath; *n*, plaster.

for a 20-feet span. The annexed figure shows the section of a floor of this kind. The joists vary in section; but 9 inches by 3 inches for moderate, and 11 inches by 3 inches for larger spans are common sizes, and they should not be more than 16 inches apart from centre to centre. They are laid at the ends on wall-plates of wood. If their lengths much exceed 10 feet, joists should be strutted in order to stiffen them and keep them in position. This can either be done by herring-bone strutting, shown in the figure, which is the better way, or by key strutting with solid pieces of wood morticed through the joists with small tenons. The latter method is called 'dwanging' in Scotland, and the rows of dwangs or keys are usually nailed between the joists. The lines of struts or keys should be at intervals of about 7 feet. Flooring-boards are nailed on the top of the joists, and Laths (q.v.) on the bottom of them to support the plaster of the ceiling of the room below. To prevent the passage of sound to and from rooms between which the floor forms the horizontal partition, what is called 'pugging,' or (in Scotland) 'deafening,' is required. It consists of coarse plaster, &c., laid on rough boards or laths supported on fillets nailed to the sides of the joists (see BUILDING).

Double-joisted floors are constructed by laying strong timbers, called *binders* or *binding-joists*, from wall to wall, at a distance of about 6 feet apart; and a double set of joists, one above for the flooring-boards, and one below for the ceiling, are laid across these, and notched down upon them. Of these the upper ones are called *bridging-joists*, as they bridge over the interval between the larger binding-joists. A *bay* is the general name for the space between binders; if between a binder and wall, it is called a *tail bay*.

The *framed floor* is one degree more complex than the double-joisted. Binding and bridging joists are used in the framed floor, but the binding-joists cease to be the primary support, as for this purpose strong balks of timber, called *girders*, are used. They are laid across, at distances of from 8 to 10 feet, and the binding-joists are framed into them by a *tusk-tenon* joint. The bridging-joists are notched to these in the same manner as for double-joisted floors. When the span is too great for a wood-girder, either a girder wholly of iron is used, or one formed of a wrought-iron plate with wood on each side, all three pieces being bolted together. The latter is called in Scotland a 'sandwich beam.'

Flooring-boards are jointed in several ways. Perhaps the most common is the *grooved and tongued* joint, in which a tongue worked on one edge of a board fits into a groove in the next board. In a *ploughed and tongued* joint each board is grooved on both sides, and a separate tongue of wood or iron inserted. A *rebated* joint means that each board is checked along the edges, and these fit into reverse checks on the two adjoining boards. In a *dowelled* joint the edges of the boards are square and unbroken, and small oak pins or dowels are inserted at intervals in holes bored along the edges. Flooring-boards should not be more than 6 inches broad, and in the best floors they do not exceed 3 or 4 inches. They are from 1 inch to 1½ inch thick—very commonly 1⅛ inch. On the continent of Europe polished oak floors are very common. In America, and occasionally in Britain, two thicknesses of flooring-boards are used in floors of a superior description.

For fireproof flooring, see FIRE; and for special kinds of ornamental and other floors, see ASPHALT, CONCRETE, MOSAIC, PARQUETRY, and TILES.

Floorcloth. There are several kinds of floorcloth. Formerly the name was confined to painted canvas, which is now called oilcloth; but the more recently introduced linoleum and other fabrics in which ground cork bulks largely are now extensively used for covering floors.

Oilcloth.—The basis of oilcloth is a coarse canvas generally made of jute, but it is stronger when made of flax tow. It is woven into pieces often as long as 150 yards and as wide as 8 yards. The first step is to fix a piece of this, say 75 feet in length by 24 feet in width, upon an upright frame provided with screws by means of which the canvas can be uniformly stretched. Stages or platforms are placed at convenient heights to enable the workmen to cover the canvas. Before paint is applied the canvas receives a coating of size, the chief object of which is to prevent injury to the cloth by acid products arising from the oxidation of the linseed-oil with which the paint is made up. When the size is thoroughly dry and pumiced, a layer or coating of paint is put on with steel trowels like those used by plasterers. Yellow ochre is much used for this thick coating, which if unaided by artificial heat sometimes takes fourteen days to dry. A second coat is applied in the same manner to finish the back, but the face receives five or six trowel coats, the surface being once or twice pumiced between the coats. The wearing surface receives a coat of paint with a brush if some other colour than that of the last trowel coat is wanted for the ground shade. In the case of cheap oilcloths, the coats of paint, instead of being applied by trowels, are put on by a roller machine. A man keeps pouring the prepared paint out of a bucket on the moving canvas, and a long blunt knife-blade, almost touching its surface, regulates the thickness of the coat of paint. When made by this method, the oilcloth receives nine coats.

In printing, wood blocks are chiefly used, a separate one being required for each colour of the pattern. These are about 18 inches square, and the face is commonly made of pear-wood, with a pattern cut out by steel tools. There is an ingenious way of producing patterns on wood blocks by heated iron punches. Sometimes the raised portions of these printing-blocks consist of type-metal or brass. Fig. 4, A, B, C, D, of the article CALICO-PRINTING will give an idea of how the impressions from several blocks complete a pattern. Beside the printers there is a table upon which are placed the colour-pads. Another table, padded with felt or flannel, supports the floorcloth, each pattern block, charged with colour, being applied by means of a small screw-press. A machine is in use for printing floorcloth which to a certain extent imitates hand-printing. The blocks which form the pattern are depressed by cams carried on shafts. Roller machines are not applicable to this kind of printing, because the paint would 'run' on a revolving surface. The durability of oilcloth depends very much on the length of time given for the paint to harden, and also upon its quality.

Linoleum.—The floorcloth called by this name suits the purpose for which it is made admirably, being lasting, comfortable, and noiseless when trod upon. Its wearing face consists chiefly of pulverised cork and oxidised linseed-oil, with smaller quantities of common and kauri resin, all well mixed together, and made to adhere to canvas backed with size and pigment.

The chief operations in the manufacture of linoleum are based upon processes patented by F. Walton in 1860 (specification No. 209) and in 1863 (specifications No. 1037 and 3210).

Of these the more important are the preparation of the cork, the oxidising of the oil, the formation of the mixture of all the ingredients for the coating, and the application of this to the surface of the canvas. Pulverised cork, of which linoleum most largely consists, is obtained from waste cork-cuttings. These are exposed to the action of a series of toothed steel discs revolving on a shaft and working against steel plates, the ends of which have also teeth like those of a saw. By this machine the cork is reduced to the size of peas. It is afterwards ground with millstones.

The oxidised linseed-oil is produced by diffusing or 'flooding' the boiled oil in thin films upon the surface of long pieces of calico or scrim, placed in an upright position. This is repeated daily till the successive films of oil reach half an inch in thickness. It takes six or eight weeks to effect this, and the scrim with its many films is then called a skin. Owing to the injurious action upon vegetable fibre of the vapours given off during the oxidation of the oil the scrim becomes completely rotten. Even mineral substances are attacked by these vapours. The gain in weight shows that a large quantity of oxygen is absorbed by the boiled oil, and that a good supply of air in the oxidising buildings is therefore necessary. After being cut into small pieces the skins are ground by means of grinding-rollers. Care must be taken not to heap up the pulverised material, as in bulk it is very liable to char or ignite by the rapid oxidation of such particles as have not undergone this change previous to grinding.

A mixture is now made consisting of from 4 to 8 cwt. of the oxidised oil to 1 cwt. common resin and 1 cwt. kauri resin, the mixing operation being conducted in a pan with an outer jacket or casing containing steam. The pan has an air-tight lid, and at a valve at the bottom and inside there are stirrers. Resin is first put in and melted, the oil and kauri being separately added. As soon as the mixture is warmed the steam is shut off, the oxidation of

the materials keeping up a sufficient heat till the charge becomes homogeneous. The valve at the bottom of the pan is then opened, and the mixture, now called cement, passes down between grinding-rollers. The cement is next cooled, but before mixing it with ground cork it is again heated to at least 120° F. The proportions of these two ingredients are about equal, but sometimes the cork is rather in excess of the cement. The colouring materials (ochre and oxide of iron) are either added with the cork or previously to the cement.

There is still another mixing-machine—the most important of all. Here the material is fed by a hopper into a cylinder in which both fixed and revolving knives are placed. It has a steam jacket. When the linoleum mixture leaves this machine, the cork and cement are so thoroughly mixed that they are scarcely distinguishable by the naked eye. The next operation is to pass the mixed material between two rollers, one of which is steam heated, and the other kept cool by a current of cold water. Here it is formed into a sheet, which is then broken up by a similar arrangement of rollers, one of them being studded with points for the purpose of breaking up the linoleum material into small pellets. Finally the mixture is spread over and pressed into the canvas by a pair of rollers of chilled cast-iron heated by steam to a high temperature. The canvas afterwards receives a backing of size and pigment, and then the linoleum is finished if it is to be left plain. When a pattern is required it is printed in the same way as upon oilcloth. A mosaic linoleum, in which the pattern is made of cut pieces of coloured material fixed on a thin backing, was patented in 1882 by F. Walton. By the improved method perfected by the inventor, the pattern extends quite through the material, and shows exactly the same on both sides. The work is done automatically by a machine which mixes and manipulates the ingredients, rolls the material into sheets of various colours, cuts these sheets into pieces of the desired shapes, arranges them into patterns with unfailing accuracy, and finally rolls and solidifies the whole into a compact sheet with the required pattern.

Kamptulicon, which is made of ground cork and india-rubber, was introduced earlier than linoleum, but its manufacture has almost ceased.

Cork Carpet, a floorcloth manufactured since the middle of the 19th century, is made of cork bound with oxidised linseed-oil, but differs from linoleum in having the particles of cork larger and purer in colour, as no pigment is mixed with it. It has a canvas backing, and is the warmest kind of floorcloth.

Flora, an ancient Italian deity, the Roman goddess of flowers and vegetable productiveness, also of exuberant youthful vitality. At Rome she had two temples, one on the Quirinal, the other near the Circus Maximus. On the occasion of her festival (*Floralia*), held in the end of April, the dwellings were decked with flowers, whilst feasting, with dance and song, prevailed everywhere. Flora was represented as a flower-crowned maiden in the full bloom of maidenly beauty.—*Flora* is used botanically to designate the collective plants or vegetable species of a region, country, or district, or to any work containing a descriptive enumeration of these.—*Flora* is also the name of one of the minor Planets (q.v.).

Florence (Ital. *Firenze*), a city of Italy, capital of the former duchy of Tuscany, is situated in the valley of the Arno. It is about 150 feet above the level of the sea, 150 miles NW. of Rome, 50 E. of Leghorn. The population—100,000 by the 14th century—was 167,000 in 1871, and 253,565 (communal) in 1921. The Arno, spanned by four fine old bridges, divides the city into two unequal parts, the chief on the northern bank. Beyond the line of the ancient walls are thickly peopled suburbs, and a lovely, fertile, and salubrious neighbourhood, encircled by sloping hills, and studded with picturesque villas and fruitful vineyards and gardens. Florence and its environs, viewed from the heights of Fiesole, appear but one vast city. The influx of population consequent on the establishment here, in 1864–71, of the seat of the Italian government, necessitated a considerable extension of the city. Save on the left side of the Arno (*Oltr' Arno*), the ancient walls (13th to 14th century) were razed; but several of the old towers pertaining to the various gates are retained, and constitute an interesting historical feature of modern Florence and a useful topographical indication of the former limits of the city. Amongst modern improvements none ranks higher than the magnificent carriage-way known as the Viale dei Colli. It ascends from the Porta San Niccolo to the historic church and cemetery of San Miniato, and gradually slopes down to the Porta Romana. From the highest level of the drive, the Piazzale Michelangelo, the panorama of Florence, the Arno, with the surrounding hills and distant Apennines, is quite unique for beauty and variety of scenery. Fine new streets or quays (known as the *Lung' Arno*), which stretch along the Arno, also add much attraction to the town, and the hygienic (though not the artistic) conditions of Florence have been greatly improved by the laying out of wide avenues or *Viali* on the site of the old walls, by the opening of spacious squares and the erection of extensive new market-halls. The picturesque, if unsavoury, quarter around the Mercato Vecchio (the old Florentine *Centro*) has, since 1889, given place to the unsightly modern Piazza Vittorio Emanuele II. Notwithstanding a rather capricious climate, Florence, with its teeming artistic treasures, its scenic attractions, and its literary and historical associations, is a favourite place of residence for foreigners and of pilgrimage for countless tourists.

Florence—the Cathedral and the Palazzo Vecchio—from the Palazzo Pitti.

The massive and austere forms of Florentine architecture impart an air of gloomy grandeur to

the streets, for the most part regular and well kept. The chief building in the city is the Duomo, or Cathedral (*Santa Maria del Fiore*), the foundations of which were laid in 1298; while in 1887 the completed façade (designed by Emilio de Fabris) was uncovered in the presence of the Italian sovereigns. The Florentines having ambitiously resolved on erecting a monument which for architectural splendour and proportions should outvie all preceding structures, the honour of preparing the design was entrusted to Arnolfo di Cambio. Later, Giotto superintended the works; and many eminent architects were employed before this splendid edifice was completed. Brunelleschi conceived and erected the grand dome, which served as model for that of St Peter's. The church contains sculptures by Ghiberti, Luca della Robbia, Michelangelo, Sansovino, Bandinelli, and other famous artists. At the side of the cathedral rises the beautiful Campanile (q.v.) of Giotto, detached, according to the custom of the times. In front is the Baptistery of San Giovanni (rebuilt *circa* 1200), in form an octagon, supporting a cupola and lantern. All three edifices are entirely coated with a varied mosaic of black and white marble. Three bronze gates in basso-rilievo are a great additional adornment of the Baptistery; the two by Ghiberti (q.v.) were called by Michelangelo the Gates of Paradise. The church of the Santa Croce, the Pantheon of Florence (begun in 1294—architect, Arnolfo), contains, among others, the tombs of Michelangelo and Alfieri, and monuments to Galileo, Dante, Macchiavelli. The church of San Lorenzo was consecrated as early as 393 by St Ambrose, and rebuilt by Brunelleschi in 1425, by command of the Medici. The façade still remains naked and unfinished. San Lorenzo contains a monumental memorial of Cosimo il Vecchio, bearing inscribed the title *Pater Patriæ*. In the *Sagrestia Nuova*, or New Sacristy, added by Michelangelo, are that master's two famous monuments to Giuliano and Lorenzo de' Medici. The Medicean chapel, gorgeous with the rarest marbles and most costly stones, agate, lapis lazuli, chalcedony, &c., stands behind the choir, and contains the tombs of the Medici family. Annexed to the church of San Lorenzo is the Laurentian Library (also designed by Michelangelo), with its inexhaustible store of rare MSS. The beautiful church of Santa Maria Novella (1278–1350), formerly Dominican, has fine cloisters and famous frescoes by Orcagna, Filippino Lippi, and Ghirlandajo. The church of San Marco dates from 1436; adjoining it is the former monastery of San Marco, now secularised as the Museo Fiorentino di San Marco. Fra Angelico, Savonarola, and Fra Bartolommeo were inmates, and it is still adorned with the famous frescoes of Fra Angelico. Other outstanding old churches are the Annunziata, the Badia, Santa Maria del Carmine, San Miniato al Monte, Or San Michele, Santo Spirito, and Santa Trinità.

Amongst the numerous palaces *Il Bargello*, long a prison, but now restored and opened as a national museum (1865), is one of the most ancient, and was (1266–1502) the abode of the chief magistrate, the Podestà. The museum contains such masterpieces as Donatello's *St George* and *David*, and a remarkable portrait of young Dante in a fresco ascribed to Giotto. The Palazzo Vecchio, the seat of the republican government from its establishment till its abolition in 1530, is an imposing mass of building, surmounted by a lofty tower 260 feet high, the great bell of which used to warn the citizens of danger or summon them to defence. Beside the palace (now the town-hall) is the Piazza della Signoria, with some fine statues, and a noble arcade, the Loggia dei Lanzi, under the porticoes of which are magnificent groups of sculpture. In one of the halls of the Palazzo Vecchio there now stands a colossal statue of Savonarola a few paces distant from the spot where the reformer perished at the stake. The Palazzo degli Uffizi is a handsome building adjoining the Palazzo Vecchio, founded by Cosimo I., and erected by Vasari (1560–74). Here are deposited the state archives of Tuscany, also the Magliabecchi Library, now united with that of the Pitti Palace to form a Biblioteca Nazionale of 500,000 volumes and 20,000 MSS. On the second floor is the famous *Galleria degli Uffizi*, extraordinarily rich in paintings, engravings, sculpture, bronzes, coins, gems, and mosaics. A splendid apartment, known as the Tribuna, contains the rarest treasures of the collection. The Palazzo Pitti, from 1550 the grand-ducal residence, given to the nation by the king in 1919, also boasts of a superb gallery of paintings. Behind it are the beautiful Boboli Gardens. The Pitti and Uffizi palaces are connected by a covered corridor (built 1564), about a mile long, which crosses the Arno on top of the goldsmiths' shops which have flanked the famous Ponte Vecchio since the 14th century. The Palazzo Riccardi (once Medici) is the prefect's seat. The Palazzo Strozzi, a fine type of Tuscan architecture, and the Palazzo Corsini (with an art collection), are among the many notable private palaces. In the NW. lies the Cascine, a wooded public park. In the old Protestant cemetery are buried Walter Savage Landor, Mrs E. B. Browning, and Arthur Clough.

Although Florence has no university, the Instituto di Studi Superiori has adopted the ordinary university curriculum, and confers various degrees. It owes much of its success to the eminent historian, Professor Pasquale Villari. The School of Social Science was founded by the Marchese Alfieri di Sostegno. The hospital of Santa Maria Nuova contains an ancient college of medicine and surgery. The Confraternity of the Misericordia, who built the beautiful Loggia, called the Bigallo (*circa* 1358), still pursue their charitable duties in their picturesque black robes and face-concealing hoods. The Academy of the Fine Arts (with Michelangelo's great *David*, and many works of the early Tuscan masters) and the Museum of Natural History are of inestimable educational value. Florence has no fewer than four important libraries (National, Laurentian, Riccardian, and Marucellian); several museums (National, Natural History, Archæological, Opera del Duomo, &c.); and a Conservatorum of Music. The Accademia della Crusca (see ACADEMY) is entrusted with the care of sifting and preserving uncorrupted the Italian language. The Spedale degli Innocenti (foundling hospital) was built early in the 15th century. Florence is the see of an archbishop, the seat of a prefecture and of numerous provincial courts, headquarters of an army corps, and capital of a like-named province (area, 2260 sq. m.; pop. 1,000,000). Its railway communications are ample. Save catering for tourists, Florence has no big industries. The fabrication of silks and woollens (active in the Middle Ages) has declined. Strawplaiting (hats, fans, &c.) is sold in the 16th-century Mercato Nuovo. Jewelry, majolica, glazed pottery, *pietra dura* work, and *objets d'art* of local manufacture, are displayed everywhere. The Florentines are famous for their caustic wit and natural gifts of eloquence, as well as for their shrewd thriftiness and unflagging labour.

History.—The city of Florence sprang originally from Fiesole (q.v.), at the foot of which it lies extended. The inconvenient and hilly site of the Etruscan Fiesole, perched on the crest of an irregular height, rendered that town so difficult of access to the traders who resorted to its market-places with their varied merchandise that it was at length decreed they should assemble at the base of the hill,

in the fertile plain traversed by the Arno. The few rough shelters erected for the accommodation of these traders may be considered the original nucleus of the important and splendid city of Florence. It would seem that as early as the time of Sulla there was a Roman colony here; another was established after the death of Julius Cæsar, and it soon became a thriving town. The *Florentini* are mentioned by Tacitus, 16 A.D., as sending delegates to Rome, but it was not till the time of Charlemagne that Florence began to rise out of obscurity. It was now governed by a political head with the title of Duke, assisted by various subordinate officers, who were elected by the united suffrages of the duke and citizens. In the 11th century Florence and a great part of Tuscany were bequeathed to Pope Gregory VII. by his friend and partisan the Countess Matilda, who inherited from her mother, the Countess Beatrix, her jurisdiction over the city. Under the protection of Rome, Florence speedily adopted the forms and institutions of a free city; and the republican spirit which then arose amongst the people imparted an impulse to national life, and awoke a spirit of patriotism and enterprise. As early as the 11th century the Florentines were European traders and the possessors of commercial depôts in the seaports and cities of France and England, and their skill as workers in gold (see FLORIN) and jewels had grown famous. The 'arti' or trade-guilds were of great importance. In proportion as papal preponderance increased in Florence, that of the empire sank; and in 1113 the citizen forces routed the troops and slew the delegate of the emperor at Monte Cascioli, near Florence. During the bitter wars between pope and emperor which raged throughout Italy, Florence and all Tuscany seemed to have been saved from the feuds of Guelphs and Ghibellines —the former adherents of the papacy, the latter of the empire. But in 1215 Florence became involved in the great party struggle, owing to a private feud breaking out between two noble families, chiefs of the contending principals. A Guelph noble, Buondelmonti, mortally incensed the Ghibelline family of the Amidei, by breaking off his alliance with a daughter of their house, and contracting marriage with a member of a Guelph family. To avenge this insult the Amidei appealed to their powerful kinsmen, the Uberti, and in fact to all the Ghibelline party of Florence. Buondelmonti was stabbed to death as he crossed the Ponte Vecchio, and was speedily avenged by the Guelphs in the blood of his enemies. Thus for thirty-three years was Florence distracted by the deeds of bloodshed and violence of these two rival factions, who assumed the names and adopted the respective causes of Guelphs and Ghibellines. See GUELPH AND GHIBELLINE.

In 1250 the animosity of these parties seemed somewhat blunted, and public attention was directed to wise internal reforms. Twelve magistrates, or anziani, were appointed in place of the consuls, each of the six sections into which the city was divided being entrusted to two of these magistrates, whose tenure of office was annual. To avoid all local dissensions, two other magistrates, strangers by birth, were elected: the one, invested with supreme authority in civil and criminal cases, was called the podestà; the other, with the title of captain of the people, had the chief command of the militia, in which were enrolled all the youth of the state, who were bound, at the call of this magistrate, to join their company fully equipped for fight: twenty companies defended the town, ninety-six the country. After the death of the Emperor Frederick II., the great protector of the Ghibellines, the Guelph or papal party gradually rose in power in Florence, and during ten years of their predominance the city increased in grandeur and prosperity, until it stood not only the first in Tuscany, but one of the first of all Italy. Its forces successively humbled the adjoining towns of Siena, Arezzo, Pisa, and Pistoia, and in 1254 captured Volterra. In 1260 the standard of civil war was again raised by the Ghibellines of Florence, who, in league with Manfred of Naples, attacked the Guelphs, and cut their forces to pieces in the sanguinary battle of Monte Aperto. The conquerors entered Florence forthwith, and in the name of Manfred abolished all trace of the popular institutions, establishing an exclusively aristocratic executive; they even strongly advocated the entire destruction of the city, the hotbed of Guelphism. This barbarous scheme was indignantly repudiated by their own famous leader, Farinata degli Uberti, immortalised by Dante for his patriotism. He even declared his intention of heading the Guelphs, were such a sacrilege perpetrated by his own party.

Pope Urban IV., French by birth, summoned against the Ghibelline Manfred a French army, led by Charles of Valois, to whom he offered the prospective kingdom of the Two Sicilies. Manfred was defeated and slain in the famous battle of Benevento, and Guelph ascendency was restored anew throughout Italy and Florence. Charles restored to the Florentines their internal institutions, and received their allegiance for ten years in 1266. In 1282 a new executive power, the *Priori*, was established in Florence by the City Guilds; and in 1293, by consent of the Priori, a higher chief than their own order was elected, the *Gonfaloniere* of Justice. In 1300 Dante became one of the Priori, and the former feud was recommenced with new vigour between two factions, who now bore the names of Bianchi (Whites) and Neri (Blacks). Their dissensions were, however, interrupted by the appearance of Charles of Valois, sent by Boniface VIII. to restore tranquillity, in 1301. Charles espoused the part of the Guelphs or Neri, and sanctioned every outrage on the Bianchi, who were plundered and murdered barbarously, the survivors being exiled and beggared; among these were Dante and Petracco dell' Ancisa, the father of Petrarch. In 1306 Pistoia was besieged and taken by famine with great barbarity. In 1315 the Florentines met with a severe check from the Ghibellines of Pisa, under the command of Uguccione della Faggiuola; and in 1325 they were completely defeated by Uguccione's successor in command, the valiant Castruccio Castracani, in the battle of Altopascio. Florence, weakened by long dissensions, and alarmed by Castruccio's threat of marching on the city, appealed to the king of Naples for aid. They received joyfully an officer of the king, entitled the Duke of Athens, sent as viceroy; and, such was the public demoralisation of the moment, they proclaimed him dictator of the republic, unanimously suppressing the offices of priori and gonfaloniere. The intrigues of this ignoble schemer to overturn the republic being discovered, he was ignominiously expelled by a general popular rising, and barely escaped with his life. An attempt to admit a proportion of the nobles into the government signally failed at this time, and only led to renewed animosity between them and the citizens. This was the last effort of the nobles to secure power.

A terrible pest ravaged Florence in 1348, sweeping off 100,000 inhabitants (see BLACK DEATH, BOCCACCIO). The chief power about this time seems to have been alternately wielded by the democratic families, the Alberti and the Ricci, and by their patrician rivals, the Albizzi, who for the space of fifty-three years guided the republic in the path of progress. In 1406 the ancient and illustrious republic of Pisa (q.v.) fell under the sway of Florence, after a heroic resistance. From 1434 the history of Florence is

intimately bound up with the House of Medici, distinguished for their patronage of art and literature—especially Lorenzo the Magnificent (see MEDICI). The Medici were repeatedly banished from Florence for aiming at sovereign power; and to their intrigues Florence owes her final loss of republican rights and institutions. The extraordinary labours of Savonarola (q.v.), his trial and execution at the stake, belong to the last decade of the 15th century. Pope Clement VII., of the House of Medici, formed a league with the Emperor Charles V., by which the liberties of Florence were to be extinguished and the sovereign power to be invested in Alessandro de' Medici. In September 1529 an army of imperialists, under the Duke of Orange, entered Tuscany; and on the 8th August 1530 the siege of Florence terminated, after a defence of unexampled devotion and bravery.

Thus expired the proud republic of Florence. From this period Florence loses her distinctive history, and is only known as capital of the grand-duchy of Tuscany, Pope Pius V. having conferred on Cosimo de' Medici the grand-ducal dignity. On the extinction of the Medici in 1737, Tuscany fell to the Duke of Lorraine; and in 1808 was given by Napoleon to his sister Élise. Florence continued to be the seat of the grand-ducal court until 1859; and after the constitution of the united kingdom of Italy the city held the position of provisional capital of the country from 1864 until 1871. The departure of the court gave for a time an inevitable check to the prosperity of the town. In 1895 the city suffered from earthquakes, but the public buildings were hardly injured. The splendour of Florence as a republic may be judged from the facts that her capitalists were so enormously wealthy that they supplied the chief sovereigns of Europe with funds; her manufactures of wool, silk, and gold brocade were exported throughout the world; and she possessed great commercial establishments all over Europe.

In art Florence holds a unique place: the Florentine school of painting, from Cimabue to Andrea del Sarto, is admittedly the most important in Italy. In Italian literature the position of Florence is scarcely less conspicuous. In the Renaissance (q.v.) she played a leading rôle. Among the most eminent sons of Florence or of Florentines are Dante, Boccaccio, and Petrarch; Bartolommeo, Botticelli, Bronzino, Cimabue, the Gaddis, Giotto, Orcagna, Masaccio, Ghirlandajo, Leonardo da Vinci, the Lippis, Andrea del Sarto, Carlo Dolci; the sculptors Della Robbia, Donatello, Ghiberti, Bandinelli, Cellini, Verrochio, Michelangelo; the architects Arnolfo di Cambio, Brunelleschi; the musicians Lully and Cherubini; Machiavelli, Brunetto Latini, Galileo, and the historians Villani, Guicciardini; the navigator Amerigo Vespucci; the Medici, &c. Through the works of its writers the Florentine Italian, not that of Rome, became classical.

See the articles BOCCACCIO, DANTE, ITALY, MACHIAVELLI, MEDICI, MICHELANGELO, PAINTING, SCULPTURE, &c., and works there quoted; historical works by Capponi (1875), Perrens (1877–90; trans. 1893), Davidsohn (1896 *et seq.*), and especially Villari (trans. 1895); books on the city by Yriarte (1880), Grant Allen (1897), Hare (new ed. 1901), E. G. Gardner (1900), Hyett (1903), H. Vaughan (1911); E. V. Lucas, *A Wanderer in Florence* (1912); Ruskin's *Mornings in Florence;* and George Eliot's *Romola*.

Florence of Worcester, a chronicler who was a monk in the monastery of Worcester and died in 1118. His *Chronicon,* which comes down to 1116, in its earliest part is scarce more than a compilation from the Saxon Chronicle and Marianus Scotus; but about the year 1030 it becomes of greater value as an independent authority. It was edited by Benjamin Thorpe for the English Historical Society (2 vols. 1848), and translated by Forester (1847) and Stevenson (1853).

Flores, the name of two islands. (1) One of the Sunda islands in the East Indies, lying due south from Celebes. It is of an oblong shape, with an area of 6000 sq. m., is heavily timbered, and mountainous in the interior, forming, in fact, an eastward continuation of the Sumatra-Java volcanic girdle. It belongs to Holland. The western half, called Mangarai, is administratively attached to Celebes; the eastern half, known as Endeh, to Timor. Trade, principally in tortoiseshell, cinnamon, sandalwood, and edible birds'-nests, is almost exclusively in the hands of Bugis (see BONI).—(2) An island of the Azores (q.v.).—There is also an Uruguayan department of the name; pop. 25,000.

Flores, JUAN JOSÉ, first president of Ecuador, was born in Venezuela in 1800, and fought with distinction through the long war of independence. He was elected president of the new republic in 1830, resigning in 1835, and was re-elected in 1839 and 1843. He died in 1864.

Floret, a term applied to the flowers of any small and closely-crowded inflorescence which resembles at first sight a single flower—e.g. composites, teasels, scabiouses, grasses, &c.

Florian, JEAN PIERRE DE, a French novelist and fabulist, who was born in 1755, and died in 1794. He was a literary pupil of Voltaire, by whom he was held in very high esteem. He wrote two prose romances (*Numa Pompilius* and *Gonzalve de Cordoue*), and a number of pastorals, *nouvelles,* plays, and fables. He appears to most advantage in his *Fables,* which are neatly and often wittily turned. His romances are cold and languid in interest; they are fair examples, however, of the correct but colourless French prose of the 18th century.

Floriculture. See FLOWERS (FLORISTS'), GARDENING.

Florianopolis (formerly known as *Desterro* or *Santa Catharina*), capital and seaport of the state of Santa Catharina, Brazil, on the west coast of Santa Catharina island, 240 miles NE. of Porto Alegre; pop. 40,000 (including many Germans).

Florida is a large peninsular state in the extreme south-east of the United States, bounded E. by the Atlantic Ocean, N. by Georgia and Alabama, SW. by the Gulf of Mexico. It lies between 25° and 31° N. lat. and 80° and 88° W. long. The state is about 375 miles in length, and about 90 miles in mean breadth, its coast-line embracing about 1150 miles, and its area 58,680 sq. m., or 37,555,200 acres. About one-fifteenth of this area is water surface. Florida has nineteen navigable rivers, making an aggregate of 1000 miles; swamps and marshes are still extensive, though in many parts draining operations have been successfully carried out; lakes and isolated ponds number at least 1200. Of the lakes the largest is Okeechobee, a shallow fresh-water expanse of about 1000 sq. m., in the southern part of the peninsula. The Everglades (q.v.) form a delta-like expansion of this lake; more than five million acres were here originally under water, but drainage schemes have relieved great portions of land, which have proved peculiarly fertile. The geological formations of Florida have been found to be the equivalent of the Tertiaries of the Paris and Thames basins; there are indications that there is an upheaval of the land still in slow progress—a fortunate circumstance from the point of view of the draining engineers. The best bays, harbours, and estuaries are Fernandina, St John's River, St Augustine, Indian River, Key West, Caloosahatchie, Charlotte Bay, Tampa Bay, Cedar Keys, Deadman's Bay, Appalachee Bay, Appalachicola, St Andrew's Bay, and Pensacola Bay. The long coast-line is dotted

with very numerous islands of all sizes, from Santa Rosa and Key Largo, 30 to 50 miles long, to the smallest possible sandy keys.

In climate and products Florida is like a great tropical island. It is cooled by delightful sea-breezes from the gulf, making the climate remarkably equable and healthful; and the state is a favourite winter-resort, although malarial fevers prevail in some parts, and yellow fever has occasionally visited the seaports heavily. Even in the southernmost portions the summer heat is not extreme. The range between the mean summer and winter temperature is only about 20°. The soil, while much of it seems a sterile sand, is helped to fertility by the moisture, but more especially by the extensive use of artificial manures. Florida furnishes abundantly the rich fruits and valuable products of the tropics. Large areas are devoted to orange orchards, while lemons, limes, grapes, pine-apples, bananas, pears, guavas, &c. grow with equal luxuriance; and coffee, rice, cotton, and tobacco are natural products. Sea-island cotton, so valuable, and elsewhere limited to a few islands, here grows far inland. Coconuts also are grown in the subtropical region. Horticulture is one of the most profitable pursuits, and market-gardening has assumed considerable dimensions in many parts of the state. An abundance of fruits and vegetables may be had fresh every month in the year, and during the winter and early spring months they are in great demand in northern markets. Florida is not rich in minerals, the most important being the extensive deposits of lime phosphates found through a large part of the peninsula, and in places rich in mammalian and reptilian remains. The *coquina*, a shell conglomerate, furnishes an excellent building-stone; but concrete of sand, shells, and lime or cement is now more extensively employed, as in the vast hotel at St Augustine (q.v.). Mineral springs are numerous. Large tracts of alluvial swamp and shallow lake-lands are being reclaimed by drainage. Next to these are the low hummocks or bottom-lands, dry enough for cultivation, and producing large crops of cotton, sugar-cane, grain, fruits, and vegetables. The high hummocks have a dark, gray soil, very rich at first, but soon running out if not kept well fertilised. Then come first-class pine, oak, and hickory lands, sandy, but containing a good deal of lime. Oranges and other citrus fruits grow well on these lands. There is a second-class pine land that is barren, but supplies a tolerably good pasturage. The forest trees are live-oaks and other evergreen oaks, cypress, hickory, magnolia, holly, great dog-wood, bay-laurel, satinwood, lignum-vitæ, mahogany, palmettos, Jamaica kino, mangrove, manchineel, torch-wood, &c. Figs are grown in great abundance. Indian corn is largely raised. Numerous wild animals abound in the central and southern parts of the state, such as the black bear, the cougar, the panther, wild-cats, wolves, foxes, raccoons, opossums, fish-otters, deer, and smaller game; alligators are found in nearly all rivers, lakes, and swamps; turtles are taken among the keys; and manatees are found on the Atlantic side as far north as latitude 27°.

Among the industries of Florida is a large business in the production of pine and other lumber, and live-oak timber for shipbuilding. The preparation of naval stores, turpentine, tar, rosin, and pitch employs many hands; cigars are manufactured in large quantities; all along the coast there are valuable fisheries, oysters abound in many parts, and the inland waters also teem with fish; and the evaporation of salt, the production of cotton-seed oil and meal, the manufacture of fertilisers from the phosphate deposits, and sponge and coral fisheries are among the profitable industries.

The economic development of Florida dates from about 1885, when many energetic northern capitalists began to invest and settle in the country. The phosphate industry has shown very rapid growth; the making of cigars and cigarettes has greatly developed in the southern part of the state. The total manufacturing product of the state in 1920 was $213,326,800—about nine times what it was in 1890. The forest area, mainly in the north-west, yields a large part of the total manufacturing produce, in timber (pitch-pine), tar, turpentine, and rosin. Most of the 5200 miles of railway were constructed in and after 1880. Spite of a State university, many public schools, an agricultural college, and several military and other colleges and seminaries, education is not advanced in Florida, the large negro population being responsible for much illiteracy. Pop. (1830) 34,730; (1850) 87,445; (1870) 187,748; (1880) 269,493; (1890) 391,422; (1900) 528,542; (1910) 751,139; (1920) 968,470. Tallahassee, a small city, is the capital; Jacksonville, Tampa, Pensacola, Miami, and Key West are the largest towns.

Florida was discovered on Easter Day (*Pascua Florida*), 1513, by Juan Ponce de Leon (q.v.). In 1539 it was explored by De Soto (q.v.), and in 1565 a body of French Calvinists, who had established a settlement three years previous, were butchered or driven out by the Spaniards. The latter held possession till 1763, when Florida was ceded to England in exchange for Cuba. The Spanish regained the country in 1781, and two years later were confirmed in their occupation by the Peace of Versailles. Florida was ceded to the United States by Spain in 1819, received a constitution in 1833, and was admitted into the Union as a state in 1845. In 1835–42 it was the theatre of a desperate war between the aborigines (Seminoles, q.v.) and the white settlers, a war which was only terminated after a sacrifice of hundreds of lives, and at a cost to the United States government of over $20,000,000. Florida passed an ordinance of secession, 10th January 1861, siding with the Confederates; but the battle of Olustee in February 1864 was the only important fight within its boundaries. It was one of the first states to return to the Union, framing a new constitution in October 1865, but was not re-admitted till June 1868. It is represented in the United States Senate by two members, and in the House of Representatives by four. See Norton, *A Handbook of Florida* (1892); Whitehead, *The Camp-fires of the East* (1891); Powell, *The American Siberia* (1892); and works by Ward (1898), Simpson (1920), and Harper (1921).

Florida, capital of the Uruguayan department of the same name, 67 miles N. of Montevideo by rail; pop. 13,500.—The *department* has an area of 4700 sq. m., and a pop. of 66,000.

Florida Strait is the name given to the channel separating the American state of Florida from Cuba on the S. and the Bahamas on the E. It is 310 miles long, and varies from 50 to 100 miles in width, and from 2220 to 5070 feet in depth. The Gulf Stream flows through the strait at a rate varying from ½ mile to 5 miles an hour.

Florin was a gold coin first struck in Florence in the 11th century. It was the size of a ducat, and had on one side a lily, and on the other the head of John the Baptist. The silver florin, with the same designs as the gold florin, was first struck in 1181. These coins were soon imitated all over Europe. It was out of them that the German gold and silver gulden of the middle ages and the silver gulden of modern times arose. The gulden or florin was the unit of account in Austria. Till 1876 a florin or gulden of 1s. 8d. was the unit in the South German

States. The Dutch florin or guilder is also worth 1s. 8d. Edward III. of England issued a gold florin worth 6s. 8d. The English 2s. piece is called a florin; the 4s. pieces first coined in 1887 are double florins.

Florio, JOHN, the translator of Montaigne, was born in London about 1553. His father was a Protestant exile and Italian preacher in London, but his labours came to a discreditable conclusion. Wood says that for safety's sake he kept his family out of England till after the death of Mary. John Florio appears as a private tutor in foreign languages at Oxford about 1576, and two years later published his *First Fruits, which yield Familiar Speech, Merry Proverbs, Witty Sentences, and Golden Sayings,* accompanied by *A Perfect Induction to the Italian and English Tongues.* In 1581 Florio was admitted a member of Magdalen College, and became a teacher of French and Italian. He enjoyed the patronage successively of Leicester, the Earl of Southampton, and other noble persons. His next work was *Second Fruits, to be gathered of Twelve Trees, of diuers but delightsome Tastes to the Tongues of Italian and English men,* with, annexed to it, the *Garden of Recreation,* yielding six thousand Italian Proverbs (1591). His Italian and English dictionary, entitled *A World of Words,* was published in 1598. Florio was appointed reader in Italian to Queen Anne, and afterwards groom of the privy-chamber. In 1603 he published in folio his famous translation of Montaigne, of which it is praise enough to say that it is a version worthy of its original. A copy of this work in the British Museum bears the authentic autograph of Ben Jonson; another, that of Shakespeare, although its authenticity is more than dubious. At anyrate it is certain from the *Tempest* that the great dramatist was familiar with the book. It was long believed that the pedantic Holofernes in *Love's Labour's Lost* was a study after Florio; but it is satisfactory to lovers of Montaigne to know that for this there is no foundation. Florio died of plague at Fulham in 1625. Second and third editions of his Montaigne appeared in 1613 and in 1632. A reprint of this noble monument of Elizabethan English was issued in 1892–93, with Introduction by Mr Saintsbury. See a study by the Comtesse de Chambrun (1921).

Florists' Flowers. See FLOWERS (FLORISTS').

Florus, generally, but on insufficient evidence, called L. Annæus Florus, was a Roman historian who flourished in the reign of Trajan or Hadrian, but of whose life we know nothing. He wrote an epitome of Roman history (*Epitome de Gestis Romanorum*) based mainly on Livy, from the foundation of the city to the time of Augustus, in an inflated and metaphorical style.—To the African-born poet, Publius Annius Florus, a friend of Hadrian, the *Pervigilium Veneris* has been attributed.

Flory. See FLEURY.

Flotation, a method of separating ores from gangue by forming a froth in which the ore particles rise with the bubbles. See COPPER (METALLURGY).

Flotow, FRIEDRICH, FREIHERR VON, an operatic composer, born at Teutendorf in Mecklenburg, 27th April 1812. He was at first intended for the diplomatic profession, but on his arrival at Paris in 1827 his sense of his own musical abilities was awakened, and he began to study under Reicha. His reputation was made by his earliest operas, *Le Naufrage de la Méduse* (1839), *Stradella* (1844), and *Martha* (1847), the last two characterised by pleasing melody and by the light and lively character of the music. Of Flotow's later operas only three have attained marked success—*Indra* (1853), *La Veuve Grapin* (1859), and *L'Ombre* (1869). In 1856 he was appointed intendant of the theatre at Schwerin, but he resigned in 1863, and returned to Paris. He died at Wiesbaden, 24th January 1883. See Life by his widow (1892).

Flotsam, JETSAM, and LIGAN, terms of English law used to denote goods cast away from a ship that is wrecked or sunk. *Flotsam* is the term where the goods continue to float or swim upon the surface of the water; *jetsam*, where they are cast into the sea and sink; *ligan*, where they are sunk in the sea, but fastened to a cork, bladder, or buoy in order to be found again. Unless the owner appear to claim them within a year and day, goods in each of these states belong to the crown. Jetsam, flotsam, and ligan did not fall within the meaning of the term 'wreck' in its original meaning at common law. In that sense wreck was the part of the cargo of a lost ship that came to land and belonged to the crown. A grant of 'wreck' from the crown accordingly did not carry flotsam, jetsam, and ligan. At the present day, however, 'wreck' has come to include these classes of goods in the provisions of the Merchant Shipping Acts and other statutes. Statutory officers, called Receivers of Wreck, preserve wreck until it is claimed by the owner, or, if not claimed, sell it and pay the proceeds to the Exchequer. All such matters are under the general supervision of the Board of Trade. Jetsam must not be confounded with *jettison*, which means the throwing overboard of goods in order to save the ship, as where she must be lightened in a storm, or to gain speed to escape from capture, or for other good cause. In such a case the loss for the general good is apportioned by general average. See AVERAGE.

Flounder (*Pleuronectes flesus*), a common species of flat-fish, of wide distribution in the shallow waters round Britain and other north temperate countries. It is the Scots 'fluke,' and the Swedish 'flundra,' and differs but a little from the plaice and dab, two of the commonest neighbour-species. Like other flat-fishes, the flounder is asymmetrical, and swims or rests on one side, almost always the left, the eye of which is in early youth brought round to the upturned surface. It measures about a foot in length, and about a third as much between the dorsal and the ventral edge, without including the fringing fins. The colour of the eye-bearing surface varies in sympathetic adaptation to that of the sandy or muddy bottom on which the fish lives. The upper side is olive-green or brownish, sometimes with yellow spots; the blind side is yellowish-white, with small, dark points. The mouth-aperture is narrow; the teeth are conical, and most developed on the blind side; the dorsal fin begins at the eye; the scales are minute and smooth, but rough tubercles occur on the side of the head and along the bases of the dorsal and anal fins.

Of the two dozen related species, the Plaice (*P. platessa*), the Dab (*P. limanda*), the Smear-dab (*P. microcephalus*), and the Craig-fluke or Witch (*P. cynoglossus*) are the commonest. In the soles (Solea) the dorsal fin begins in front of the eye, and the upper eye is slightly anterior to the lower.

The flounders spawn at the mouths of rivers, and the young are hatched in May. The fish often leave the sea and go up the rivers, ascending the Avon to near Bath, and the Moselle as far as Trier. They are even able to thrive in ponds. Sea-birds prey largely upon them, breaking the bones to make swallowing possible. Though inferior to the plaice, the flounder is an esteemed food-fish. The Australian and New Zealand flounder is a Rhombosolea, and most excellent eating. See DAB, FLAT-FISH, PLAICE, SOLE.

Flour. See BREAD, FOOD, MILL, WHEAT.

Flourens, Marie Jean Pierre, a French experimental physiologist, was born on 15th April 1794, at Maureilhan, Hérault. An M.D. of Montpellier at nineteen, at Paris he became acquainted with the Cuviers, Geoffroy Saint-Hilaire, Destutt de Tracy, and Chaptal. He first attracted attention by a series of works dealing with the nervous system in its relations to the different sensations, wherein he sought to determine upon experimental grounds the specific sensational functions of the cerebellum, cerebrum, and corpora quadrigemina. After lecturing for Cuvier in 1828 and 1830, he received a professorship in the museum of the Jardin du Roi, and in 1855 at the Collège de France. In 1833 he was nominated perpetual secretary of the Academy of Sciences, and in 1840 he succeeded Michaud in the Academy. He also took some interest in politics; he was elected to the Chamber of Deputies in 1838, and was made a peer of France in 1846. He died at Montgeron near Paris, 6th December 1867. Flourens also wrote instructive books on the development and nutrition of the bones, on the skin and mucous membranes, on the longevity of man, on animal instinct and intelligence, on the works of his predecessors and contemporaries, Buffon, Cuvier, Geoffroy Saint-Hilaire, and Darwin, and a series of useful *Éloges Historiques* (3 vols. 1856–62).—His son, Gustave, born at Paris, 4th August 1838, first distinguished himself by his book, *Science de l'Homme* (1865), a series of lectures on the origin of the human race, delivered at the Collège de France in 1863. Of ardent republican sympathies, he took a very active part in the Cretan insurrection against the Turks in 1866, and subsequently in the Commune at Paris, fighting in behalf of which he met his death on 3d April 1871.

Flower. The observations of childhood, like the popular language in which these so largely tend to survive, are apt to deny flowers altogether to plants in which these are not conspicuous. Yet the unmistakable succession of the flower by the fruit and seed compels us in some measure to argue back from the presence of one or other of these to the previous existence of flowers, even where they may not usually have been noticed, as, for instance, in the oak. The observant walks of spring and early summer soon convince us that not one even of the soberest forest-trees but has its blossoming time, while no one can escape noticing in midsummer the abundant blooms of the grasses and nettles. Horticultural experience, too, convinces us that the overpowering majority of plants brought from other lands flower sooner or later if the right conditions can be insured them, and thus we gradually reach the generalisation that among the plants which exhibit stems and leaves, none save the mosses, the ferns and horse-tails, the club-mosses and selaginellas, with a very few other inconspicuous and unimportant forms, fail to agree in the production of flower and seed. We have here evidently a broad principle of classification, and if our knowledge of the reproductive function of the flower has meantime developed so far as to repeat the discovery of its definite sexuality, we shall feel the appropriateness of Linnæus's general term of *Evident-flowering* or Phanerogamia (q.v.), yet also approve the mingled caution and speculativeness which made him apply that of Cryptogamia (q.v.) to the latter, since it was reasonable to suppose that the reproductive process (Gr. *gamos*, 'wedlock') evident (Gr. *phaneros*) in the former might in the latter be concealed (Gr. *kryptos*).

The examination of so many flowers, or even of a few representative ones, will have shown us that the central organs in which the seed arises exhibit considerable variety alike in number and detail. Thus, distinguishing the essential 'seed-box' as the *ovary*, we find that there are many simple separate ones in the buttercup or the rose, while the apparently single ovary of the apple or the tulip turns out on section to be five- or three-celled respectively, each cell containing the future seeds or *ovules*. We find, too, above the ovary a surface usually viscid or hairy, to which pollen readily adheres, and this we call the *stigma*, noting also that while sometimes practically sessile upon the ovary, as in buttercup or poppy, this is oftener raised upon a column, the *style*.

Encircling the seed organs we find the *stamens*, their stalks or *filaments* bearing heads or *anthers*. We see the latter shedding forth a yellow dust, the *pollen*, the same as that which we have noted upon the stigma of some of the flowers. This suggests one or two simple experiments. If we cut off the stigma, or cover it so that pollen cannot reach it, the incipient seeds or ovules will never mature into seeds proper capable of germination. Conversely, if we remove the stamens of this and other flowers, so that the same isolation of the stigmas from pollen comes to pass, the same failure of the seed follows. Whereas, when pollination of any particular stigma is effected (whether by the natural agency of insects or the wind, or more convincingly, by the actual help of the experimenter), seed forthwith matures in the corresponding ovary. And if the pollen be from a plant exhibiting some characteristic varietal difference, the resulting seed, when grown in its turn, will show the influences of this 'crossing' in a more or less marked degree (see Hybrid, Heredity). In this way the conception of sex in flowers, of immemorial date as respects those of the Date-palm (q.v.), has been extended in quite modern times. The carpels and stamens being thus the 'essential organs,' we recognise as merely 'accessory organs' the parts lying external to these, despite their frequent conspicuousness and beauty. In both monocotyledons and dicotyledons we have usually two circles or *whorls* of these parts, but in the former they are usually very similar, and so are usually spoken of merely as inner and outer *perianth-whorls* respectively, and their parts as *perianth-segments*. In most dicotyledons the corresponding whorls are known as *corolla* and *calyx*, since the colour and magnificence of the blossom usually depend upon the former (Lat. *corolla*), while the latter is commonly reduced to a mere verdant cup (Gr. *calyx*). The parts of the corolla or *petals*, and those of the calyx (*sepals*) are hence usually recognisable at a glance, as in the buttercup or rose. Yet the corolla may be reduced to inconspicuousness, as in the Christmas rose or globe-flower, or even vanish altogether; while the calyx may assume splendours which would be noteworthy even for a corolla, witness the marsh-marigold or garden clematis. Petaloid characters may be even assumed by Bracts (q.v.). Sepals, and still more frequently petals, may become more or less completely *united*, as so familiarly in the common primrose. In monocotyledons both whorls of the perianth may unite, as in the lily of the valley. Peculiar specialisations of form also abound, especially in the corolla, witness pansy or balsam, dead nettle or snapdragon. The calyx, too, may have its peculiarities, as in wallflower or poppy. The very modes of their arrangement in the bud differ widely (see Æstivation); while the position and arrangement of the separate flowers opens up a new field of study (see Inflorescence).

Applying to the essential parts corresponding collective names, we have then innermost of all the *pistil* or *gynœcium* (its separate or constituent members being termed carpels); next the *andrœcium* of stamens. We have thus four whorls of organs, each presenting apparently independent

and often wide differences in different flowers; hence we understand how in the attempt conscientiously to take note of all this multiplicity of floral detail the nomenclature of descriptive botany almost inevitably became so intricate and cumbersome (see BOTANY) as to obscure and retard that very progress towards the recognition of the order and unity of the floral world which it was the aim of the whole science to reach. Keeping this aim, however, in view, we are compelled to rise from the description of separate plants to the problem of classifying them into groups (species, genera, orders, classes, &c.) according to the degree of their common resemblance. It soon becomes evident, as it did to the earliest systematists, that it is mainly upon the flowers that our classification must depend. And having seen the multifariousness of these, we are in a position to appreciate the aid of the Linnean or 'Artificial System' of orders and classes, when to ascertain or record all that is known of a new plant our primary task is but the simple one of noting the number of its carpels and stamens. We comprehend better, too, the reluctance with which the claim of the 'Natural System'—that classification must depend upon the sum of like characters—was conceded, since this principle leads us back to unravel all the perplexing intricacies of which the device of Linnæus so summarily cut the knots.

A principle of fundamental importance for the natural system was however reached, and descriptive botany made a vast step, from the empirical to the rational level, as the conception of the morphology of the flower (see MORPHOLOGY) became gradually established. Sepals and petals, stamens and carpels thus lost their utter distinctness, and fell into a single category with the leaves as the *appendages* of an *axis;* their differences thus becoming understood as specialisations for their respective physiological purposes, in no way inconsistent with fundamental unity of structure and development. The simplest observer soon realises that a sepal is a sessile leaf, and a stamen a stalked one, and only needs to dissect a double rose or a white water-lily to convince himself by the discovery of a perfect series of transitional forms between petal and stamen of the essential unity of these. The spiral instead of whorled arrangement which we find in some simpler floral types (Ranunculaceæ, &c.) is thus immediately intelligible as a transition to the ordinary phyllotaxis of leaves. But the botanist has hardly yet exhausted the more refined applications of this principle; thus, since a leaf may not only have stalk and blade, but side pieces or stipules, we have frequently to take note of these in the flower, just as in the analogous case of leaves reduced as bud-scales (see BUD). Nor does the utmost detail fail us: thus, since the stipules of opposite leaves, although normally separate (nettle), constantly tend to unite (wood-geranium) or may even develop like the ordinary leaves (bedstraw), so it happens in many flowers. What the descriptive botanist empirically termed the outer calyx or epicalyx of a strawberry or lady's mantle is thus rationalised as the united stipules of adjacent sepals; and similarly the perplexing whorl of external yet younger stamens in the Geraniums (q.v.) and a few other types is easily interpreted as similarly united stipular developments of the ordinary whorl of stamens. By help of the leaf, in short, we are learning more and more completely to interpret and unify the peculiarities of floral structure.

Returning to simpler cases, the union of sepals and petals not only recalls that of opposite leaves, but anticipates what we exceptionally find among stamens, as in the filaments of the mallows, or the anthers of the composites; or among the carpels in a majority of orders. That in the types with united corolla such union of the inner parts should also be more frequent and thorough than in those of separate parts is not to be wondered at; hence, for instance, the clubbed stigma of the lily of the valley as compared with the distinctly lobed—i.e. more separate stigma of the tulip.

Another great series of structural differences becomes cleared up when we bear in mind that appendages, however crowded and united, must arise upon an axis, however shortened. One or more internodes of the floral axis are, indeed, occasionally well developed, as in a lychnis or a passion-flower; but, generally speaking, their growth is checked at a quite embryonic stage. Since the early days of the natural system great attention has been paid to the position and origin of the floral parts. In the lily or the buttercup the stamens are seen to arise directly under the gynæcium, and are accordingly described as *hypogynous;* in the strawberry they arise in a circle at about the same level as the bases of the young carpels, and are consequently termed *perigynous;* while in the iris or the rose they seem perched upon the very top of the ovary, which is hence described as *inferior.* From the distinctness of the floral axis (then termed *thalamus*), the orders of hypogynous dicotyledons with separate parts became grouped as *Thalamiflorœ,* while those with perigynous or epigynous stamens and separate parts were termed *Calyciflorœ,* from the apparent origin of the stamens upon what was commonly regarded as a united calyx. All this, however, becomes intelligible when we combine the study of vertical sections of the adult flowers with the facts of their development. In the simplest hypogynous type we see the whorls of floral appendages standing in regular succession upon the conical floral axis just as they developed; the internodes having all developed equally. In the perigynous type, however, we see that the growth of the upper portion of the floral axis has been outstripped by that of its lower and as it were more vegetative region, which hence grows up around it; the epigynous type thus being only the extreme case of this, just as in inflorescences the spike becomes flattened into a capitulum, and this finally hollowed at the apex, or rather raised at the circumference into a cup, or even flask, as in the case of the fig. See INFLORESCENCE.

The large body of dicotyledonous orders in which the petals were united were grouped as *Gamopetalæ,* and finally the small and apparently degenerate types in which calyx, corolla, or both were absent were termed *Incompletæ.* The convenience of this system is so great that it is still retained in the *Genera Plantarum* of Bentham and Hooker. Its importance, but also its dangers, may be well seen by comparing fig. 1, in which figures of types of as many well-marked Thalamifloral, Calycifloral, and Gamopetalous orders are paralleled within the single order Liliaceæ (fig. 2), when with these we reckon the closely allied Amaryllids. In the same way the wide contrast between the usually splendid Calycifloral or Gamopetalous and the inconspicuous Incomplete type might be paralleled within the range of a single order, witness rose and lady's mantle (Rosaceæ), or lilac and ash (Oleaceæ).

Though thus losing an absolute principle of classification, we gain a conception of simplicity underlying floral differences. From the mere empirical description of flowers as we find them we begin to penetrate the rationale of their development, to comprehend something of what we may call the principles of flower-making. Starting again from a simple and tolerably central type like that of the lily, we find among its immediate allies types here of increasing floral magnificence, there of diminished splendour and size; witness tulip and lily of the valley. We see how

the more magnificent types tend to be always few or single-flowered, while the smaller and more modest types bear flowers in abundance; how the former are more individualised examples of the ordinal type, while the latter seem more embryonic. The one type tends to be richly coloured, often indeed complexly marked; the other tends to be paler, even white or positively greenish. When departures from regularity of form occur it is the more splendid forms which become bilaterally

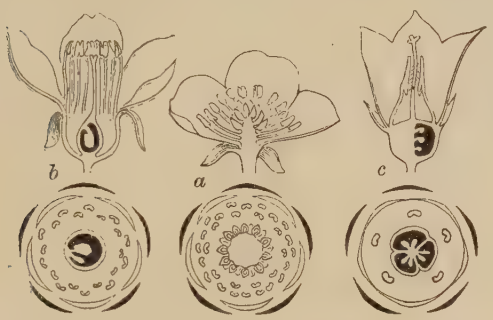


Fig. 1.

a, vertical section of buttercup (Ranunculaceæ), showing *hypogynous* arrangement (Thalamifloræ); *b*, cherry (Rosaceæ), showing *perigynous* arrangement (Calycifloræ); *c*, bell-flower (Campanulaceæ), showing *epigynous* arrangement (here occurring along with the united petals of Gamopetalæ). Each section is accompanied by its corresponding ground-plan or 'floral diagram.'

symmetrical; and conversely it is among the more embryonic types that the petals or other parts become united. The more vegetative habit of the lily of the valley as compared with that of the tulip is here of interest, since we can correlate this obvious constitutional difference with the facts already outlined, or with such an otherwise incomprehensible detail as the production of many ovules by the tulip, but of few by the more vegetative and consequently less reproductive blossom of the lily of the valley. Even were such facts comparatively isolated they would be suggestive; but a wider examination of the monocotyledons brings us face to face with the existence of the same contrast in groups of all extent. Those extreme types, as it would seem, at once of floral differentiation and of vegetative habit, which we know as grasses and orchids, are alike clearly referable to the simple liliaceous ground-plan of structure (see the floral diagrams in fig. 3), and the question hence arises—must we not regard these simply as extreme variations, greater in degree, but of no different kind than those which we have

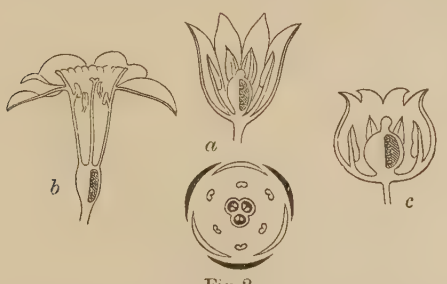


Fig. 2.

a, vertical section of tulip, with parts all separate; *b*, narcissus, with inferior ovary; *c*, lily of the valley (Convallaria), with united perianth and adherent stamens. The floral diagram of the tulip, however, applies to all.

recognised among the Liliaceæ proper? An examination of the orchids or the grasses themselves, still better of the arums, yields a similar result: the floral orchids have their degenerate vegetative types, small, many-flowered, few-seeded, it may be even green; while even the typically crowded and degenerate florets of the arums may obtain, by the production of a highly coloured spathe, no small measure of floral magnificence. Passing to the dicotyledons we find the same result in reviewing them order by order, often indeed genus by genus (e.g. Clematis, Thalictrum, Delphinium, and Senecio). We thus comprehend the otherwise perplexing fact that of all supposed natural alliances it is that of the Incompletæ which has most broken down, their 'orders' having long been recognised as the degenerate (i.e. vegetative) representatives of many widely distinct orders. The bearing of these considerations upon our theory of variation and consequently upon our general conception of evolution cannot here be entered upon: it must suffice if the existence of order and simplicity amid the infinitude of floral detail has been rendered more apparent.

The problems just now raised will be found more fully discussed under VARIATION, &c.; for the classification of flowering plants, see some of the books noted under VEGETABLE KINGDOM. The structure of the stamen, with the development of its pollen, are naturally described under STAMEN, and the process of fertilisation of the ovule under OVULE; while that deepest interpretation of the flower which compels us to view the phanerogam as not only the most evolved of the cryptogams, but really the most profoundly cryptogamic of them all, is necessarily given under GYMNOSPERMS, since a knowledge of these in relation to the higher

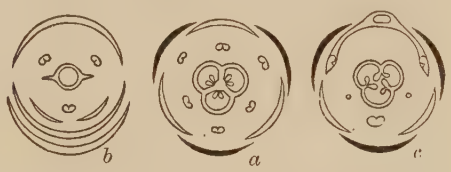


Fig. 3.

a, floral diagram of Liliaceæ; *b*, reduced modification of this usual in Grasses (q.v.); *c*, specialised modification usual in Orchids (q.v.).

cryptogams is indispensable. It remains, however, to glance briefly at the flower from the physiological side, in its adaptations to fertilisation.

Fertilisation of the Flower.—From the frequent separation of the sexes in flowers borne upon the same individual (*monœcism*—e.g. Begonia), or upon different individuals (*dicœcism*—e.g. nettle, dog-mercury, red or white campion), it is evident that pollen must somehow be borne from male to female flowers. The artificial assistance of the wind-fertilised Date-palm (q.v.) has been already referred to as indicating some comprehension of the process from immemorial times. The hermaphroditism of most flowers, however, long misled botanists into thinking of the flower as normally fertilised by its own pollen; and so obstinate was this error that even the publication of Sprengel's *Secret of Nature Discovered*, with its wealth of careful observation even supported by accurate figures, failed to dispel it (see BOTANY); and this admirable book fell into oblivion until its rehabilitation by Darwin, followed by Delpino, Hildebrand, Fritz Müller, and many subsequent investigators.

Just as the familiar spores of ferns or horse-tail are scattered by the wind, so it is with the pollen of such primitive flowers as those of Conifers and Cycads (see GYMNOSPERMS). In the cryptogams, however, germination of the spores takes place upon the ground apart from the parent plant altogether; but in the flower, since the female spore or embryosac is always retained within its sporangium or ovule, and this in turn in monocoty-

ledons and dicotyledons (angiosperms) within a carpellary leaf which usually does not even open until the maturation of the fruit (see FRUIT), it is manifest that only those male spores (pollen grains) can be effective which are conveyed to the receptive surface (stigma) of the carpellary leaf, and there germinate until they succeed in penetrating as far as the ovule and embryosac. Hence the utility of wind or insects for the transport of pollen. In this regard it is evident that the help of spore-eating insects might early have been of service, since spores might readily thus be conveyed adhering to their bodies. It has been already noted (see CHLOROPHYLL) that the colouring matter of flowers, like that of vernal and autumnal leaves, may be associated with phases in the constructive or destructive changes of chlorophyll. Since the reproductive process especially checks those of vegetation, we have here an agency for the production of floral colour, which, by rendering the reproductive shoots more conspicuous to insects, would be constantly aided by natural selection. Upon the latter process, indeed, the customary explanation of the origin of floral colour and markings solely depends. An analogous advantage for the attraction of insects would be given by the overflow as 'nectar' of any excess of the sugary sap so largely used up by the flower itself, or similarly by the disengagement of perfume. A constant adaptation between flower and insect being in such ways established, further specialisations arise. Thus, while in many flowers—e.g. crucifers, the stamens and stigmas are ripe simultaneously, a 'want of time-keeping' is frequently observed, the stamens becoming *protandrous*—i.e. ripening before the stigmas, as typically in Geranium (q.v.), so that self-fertilisation is impossible, and a physiological separation of the sexes (*dichogamy*) is thus insured. Or where the ripening remains simultaneous, two or even three forms of flower (*dimorphism*, *trimorphism*) may occur in different individuals of the same species, so rendering cross-fertilisation by insects indispensable (see PRIMROSE, LYTHRACEÆ). The individual flower may also become peculiarly specialised: thus, the nectary may become so deep as to be accessible only to insects with long proboscis, as bees to the exclusion of flies, butterflies and moths to the exclusion even of bees, it may be even to some particular species only. Birds, too, may replace insects (see HUMMING-BIRD, HONEY-EATER). Mechanical adjustments are also to be found in many of the more specialised types, witness the stamens of the sage, which are rocked forward by the bee on entering the flower so as to dust his back with pollen just where it will be rubbed off upon the stigma of another flower. The most extraordinary variety and complexity is, however, that presented among the Orchids (q.v.).

How some flowers (e.g. Stapelia, Rafflesia) attract the services of flesh-flies by the odour and even colour of carrion; how others like Arum and Aristolochia may entrap and detain the fertilising insect until well dusted with pollen, are examples which can but be mentioned. Nor can we describe the defences of flowers from rain or from ants, &c. (see, however, CATCHFLY, HEATH, &c.).

In wind-fertilised plants the flowers are usually comparatively small and inconspicuous, but numerous and closely aggregated, often in spikes, heads, or catkins; the floral envelopes are usually small and greenish; one or both whorls are indeed frequently absent (Incompletæ). The stamens are few but often versatile as in grasses, the ovary reduced, commonly only one-seeded, but with one or more styles and stigmas, the latter often exuberantly branched or feathery, so catching the small pollen-grains. The stigmas are ready before the pollen is shed (*protogynous dichogamy*); and flowering often takes place as in many forest-trees before the development of the leaves. The pollen grains may be lightened with air-sacs as in the pine, may be helped by gravitation as in maize and bulrush, where the male inflorescence grows higher than the female, or may be scattered explosively as in the nettle or artillery plant. The utility of all these special characters of wind-fertilised flowers is thus no less obvious than that of the peculiarities of those dependent upon the visits of insects, and the natural selectionist is hence accustomed to draw from both of these remarkable sets of adaptations many of his strongest arguments for the development of even the most complex organic structures through the cumulative selection of minute spontaneous varieties (see DARWINIAN THEORY). Some facts, however, such as the repeated development of the characters of wind-fertilised flowers in quite unrelated types, seem rather to indicate the possibility of a constitutional interpretation similar to that indicated on the previous page (see VARIATION).

It is thus manifest that the flowers of every species in nature thus invite and reward an observant interest far other than that of the mere collector, systematist, or even morphologist. Further information will sometimes be found under individual headings—e.g. CAPRIFICATION, GERANIUM, &c.

See Müller's *Fertilisation of Flowers* (trans. 1882); Knuth's *Handbook of Floral Pollination* (1906–8); Kerner's *Natural History of Plants* (trans. 1902); Henslow's *The Origin of Floral Structures through Insects and other Agencies* (1888), and *The Making of Flowers* (1891); Eichler's *Flower Diagrams;* several of Darwin's works; also PHYSIOLOGY (VEGETABLE) and books there noted.

Flower, SIR WILLIAM HENRY, K.C.B. (1892), was born at Stratford-on-Avon in 1831, served as assistant-surgeon in the Crimea, and afterwards became demonstrator of anatomy at the Middlesex Hospital. He was appointed in 1861 conservator of the Hunterian Museum, in 1869 Hunterian professor of Comparative Anatomy and Physiology, and in 1884–98 was director of the natural history departments of the British Museum. F.R.S., LL.D., and president of the British Association (1889), he wrote on human nerves (1861), on the osteology of the mammalia (3d ed. 1885), on the horse, on museums, on the Monotremata and the marsupials, and on the brain of apes and lemurs. He died 1st July 1899. See Life by Cornish (1904).

Flower-de-luce, the old name for the common species of Iris (q.v.), or for the heraldic emblem conventionalised therefrom. See FLEUR-DE-LIS.

Flowering Currant, an ornamental shrub, *Ribes sanguineum*, whose flowers change from white to pink. See RIBES.

Flowering Plants. See PHANEROGAMIA, and articles there referred to.

Flowering Rush (*Butomus umbellatus*), a monocotyledonous plant usually reckoned under the order Alismaceæ, easily recognised by its large linear three-edged leaves (which are said to cut the mouths of cattle, whence the Greek form of the generic name), and by its umbel of rose-coloured flowers, which Ovid tells us render the plant a special favourite of Flora. The bitter rootstock was formerly officinal, and was also used (as still in some parts of eastern Europe) as a source of starchy flour, and the leaves are sometimes plaited. It is not uncommon in ponds and wet places, and is well worth introduction where such conditions are present.

Flowerless Plants. See CRYPTOGAMIA, and articles there referred to.

Flower-lore. See PLANT-LORE.

Flower of Jove (*Agrostemma flos-Jovis*), a pretty caryophyllaceous plant, with heads of purple

or scarlet flowers, and leaves silky white with hairs. Other species are common in gardens—e.g. *A. cœli-rosa* (Rose of Heaven), and *A. coronaria*. The genus, also known as Rose campion, owes its technical name to the ancient use of the flowers in crowns and garlands.

Flower-pots are utensils of culture whereby plants are rendered portable at all seasons. They are used in one form or another in all countries where gardening as an art is practised. In Britain and on the Continent they are made in all sizes, from the *thumb-pot* of 2 inches in depth used for potting tiny seedlings and delicate cuttings, to extra large ones of 3 feet to accommodate large palms, tree-like camellias, &c. Their diameter is usually equal to their depth. They are glazed or unglazed, it being immaterial to their utility whether they are so or not; and are plain or ornamental and artistic according to taste and the purpose for which they are intended. In order to be healthy receptacles for the roots of plants, they must be provided with perforated bottoms to admit of the free egress of water from the soil. Saucers are made for all ordinary sizes of flower-pots for use in rooms and other places where drip would be inconvenient or undesirable.

Flowers, in Chemistry, is a term originally given by the alchemists to the sublimates which arose, or appeared to grow, from certain bodies capable of undergoing volatilisation when subjected to heat; thus, *flowers of antimony*, *flowers of arsenic*, *flowers of benjamin* or *benzoin*, *flowers of sulphur*, *flowers of zinc*, &c. See ANTIMONY, &c. The word is also applied to fungous growths, as *flowers of tan*. See MYXOMYCETES.

Flowers, FLORISTS', are those numerous forms of flowering plants which, having an inherent tendency to vary in the colour and size of their flowers and in habit when reared from seed, have received special attention in cultivation and in selection with the view of bringing their floral qualities up to ideal standards of excellence formed by the common consent of florists for each particular variety. Thus, for instance, the pansy, one of the most familiar of florists' flowers, is in all its wonderful variety the progeny of *Viola tricolor*, a widely distributed native of Britain. Its natural tendency to seminal variation rendered it a very facile subject in the hands of the florist, as may be seen by comparing the puny, unequal, and flabby flowers of the natural forms of the species with the large, circular, substantial, and brilliantly coloured blooms of the florists' varieties. This has been achieved by the intelligent application of the principle of selection, the object being the attainment of a given ideal respecting the size, form, substance, and colour of the flowers. The petals are the only parts affected in this case; they are enlarged in breadth and length, their substance or thickness is increased, and their outline is rendered more symmetrical, but the other organs of the flower are not changed. As with the pansy, so it has been with every other kind of plant bearing single flowers in the florists' category. It is different with those kinds whose flowers are double, such as the carnation, anemone, hollyhock, ranunculus, rose, &c. In these the essential organs of the flowers have been wholly or partially metamorphosed into petals. But the so-called double flowers of dahlias, chrysanthemums, and other forms of the natural order Compositæ are not really double in this sense; the fertilising organs are not changed to petals in their case; but the tubular florets of the disc assume the strap-like shape of those of the ray, and hence the semblance of double flowers in such cases.

The Dutch were the first among European nations to cultivate systematically florists' flowers: to them is due the merit of having brought the Tulip (q.v.), the hyacinth, the anemone, the ranunculus, and the rose to the high degree of perfection their numerous varieties now present. The French florists have also had a large share in the improvement of the three last-named classes. British florists have distinguished themselves more particularly in the production of auriculas, polyanthus, the phlox, pentstemon, carnation, pink, hollyhock, dahlia, pansy, pelargonium, &c. But the Chinese and Japanese appear to have fostered the culture of many flowers in the same way as the European florists, long prior to the latter having done so. Camellias, azaleas, and tree-peonies were some of their favourite florists' flowers long before Europeans had much intercourse with the Chinese.

New varieties are obtained chiefly from seeds, but some also are obtained by *sports*, which, in the language of the florist, mean freaks of nature. Thus, the flowers on a certain shoot of a plant may perhaps exhibit features of a kind novel and distinct from those of the parent, and the variety, if worthy of being perpetuated, is propagated by cuttings or by grafting, according to the mode best adapted to the kind. If the variation becomes *fixed* or permanent a new sort is thereby obtained without direct seminal intervention; but this does not always follow, although a keen florist will never allow such an opportunity to escape without an attempt to improve it. Varieties of special merit in any class of florists' flowers can only be perpetuated by cuttings, layering, grafting, or division, because they cannot be relied upon to reproduce themselves from seed.

Fludd, ROBERT, an English physician and mystic, born at Milgate in Kent in 1574. After studying at Oxford, he spent some years travelling on the Continent, where he became acquainted with the writings of Paracelsus. On his return to England he settled as a physician in London, where he died in 1637. Fludd (Lat. De Fluctibus) was the author of a theosophic system, the distinguishing features of which were the conception of man, the microcosm, as an analogy, in a physico-spiritual sense, of the universe or macrocosm, and the belief that the laws of the physical universe were dominated by two fantastic principles called the 'northern or condensing power,' and the 'southern or rarefying power.' His views called forth adverse criticisms from Gassendi, Kepler, and others.

Flue. See CHIMNEY, WARMING.

Flüelen. See LUCERNE (Lake of).

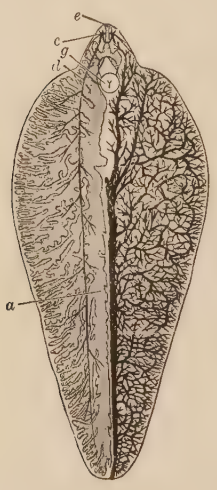
Flügel, JOHANN GOTTFRIED, German lexicographer, born at Barby in 1788, travelled as a merchant to North America, and in 1824 was appointed *lector* of the English language at Leipzig, where in 1838 he became United States consul, and in 1848 agent in Germany for the Smithsonian Institution. He died 24th June 1855. He prepared a standard dictionary of English and German (1830; 4th remodelled edition, by his son Felix, 1891). His son Ewald Flügel (1863–1914), born at Leipzig, was professor of English Philology in Stanford University, and began a *Chaucer Lexicon*.

Fluid. In a solid body the constituent particles never move far from a certain position of equilibrium. In a fluid the particles can move about with greater or less freedom from one part of the body to another. All liquids, vapours, and gases are therefore known as fluids. All fluids are perfectly elastic; but liquids are highly incompressible, while gases can easily be compressed. In every actual fluid there is more or less frictional resistance to the molecular motions; but it is often advantage-

ous to consider theoretically the properties of frictionless, or, as they are called, 'perfect' fluids.

There is no sharp distinction between the solid state and the liquid state. Much depends upon external circumstances, such as temperature or the intensity of gravity. Some substances splinter under the action of sudden intense stress, while they flow like viscous liquids when exposed to long-continued gentle stress.

Fluke (*Fasciola* (or *Distomum*) *hepatica*), the parasitic worm which causes the 'liver-rot' of sheep. It belongs to the class of Trematodes (q.v.), and to a large genus of about three hundred species, if the two titles Fasciola and Distomum be regarded as identical. The adult fluke, which occurs in numbers in the bile duct of the sheep and other domestic animals, has a flat, oval, or leaf-like appearance, the broader end being anterior. It usually measures nearly an inch in length by half an inch across at its broadest part. The colour varies from reddish-brown or orange at the sides, to grayish-yellow, sometimes with dark spots, in the middle. There are two suckers, as the word Distomum suggests—one at the head end, perforated by the mouth; the other imperforate, on the ventral surface, also in the middle line, a little farther back. The food is blood sucked in from the liver. The internal structure is complex. There is a much branched blind alimentary canal penetrating the whole animal, which is without any distinct body-cavity; the nervous system is a ring round the pharynx, with nerves running fore and aft; there are no sense organs, though the larva has eye-spots to start with; the muscular system is well developed; the excretory system consists of two very much branched vessels opening at a posterior pore; the reproductive system is hermaphrodite and complex.



Fasciola hepatica, from the ventral surface (after Sommer):

The alimentary and nervous systems only are shown on the left of the figure; the excretory system alone on the right side; *a*, right main division of the alimentary canal; *c*, lateral ganglion; *d*, lateral nerve; *e*, mouth; *g*, ventral sucker.

Life-history.—The history of the fluke is happily an intricate one and full of hazards. The ova are probably fertilised by male elements from the same animal, a very unusual occurrence, all but exclusively restricted to certain parasitic flat-worms. The eggs are furnished with nutritive capital from a yolk gland, are surrounded by a shell, and begin to develop a little within the parent animal. After extrusion from the latter they may be found in the bile ducts in enormous numbers, each fluke being said to produce about fifty thousand. Such prolific multiplication is a very frequent characteristic of parasitic animals, and is probably associated with the abundant and at the same time stimulating food. Its utility in securing the continuance of the species in face of the numerous risks of failure is obvious. From the bile duct of the sheep the segmented ovum enclosed in its shell passes to the exterior. The embryo develops for two or three weeks, and the successful result eventually becomes free in water. In swims for some hours by means of a covering of cilia, but its sole chance of life appears to lie in meeting and attaching itself to a small water-snail (*Limnæus truncatulus*), into which it bores its way. Having established itself, the embryo fluke loses its cilia, and is metamorphosed into what is called a *sporocyst*. This may divide transversely into two; but usually certain cells within the sporocyst behave like parthenogenetic ova, and develop into a fresh generation or several generations known as *rediæ*. The rediæ burst out of the sporocyst, and migrate into the liver or some other part of the snail, killing their host if they are very numerous. Like the sporocyst, they give rise internally to more embryos, of which some may be simply rediæ over again, while others develop into tailed embryos or *cercariæ*. These emerge from the rediæ, wriggle out of the snail, swim freely in the water, climb up grass stems or such like, swing their tails off, and encyst. If the encysted cercaria on the grass stem be eaten by a sheep it grows into the adult and sexual fluke. To recapitulate, the developing embryo becomes a free-swimming form; this bores into a snail and changes into a sporocyst; from certain cells of the latter asexual rediæ arise; these eventually give origin in a similar way to tailed cercariæ, which, eaten by a sheep, grow into flukes. There are thus several asexual generations interrupting the ordinary sexual process, illustrating what is known as 'alternation of generations.' After reproduction the adult flukes may die *in situ* or may migrate from the liver and pass out of the sheep. The life-history was independently worked out by Leuckart and Thomas.

Practical Importance.—The disease of liver-rot in sheep is widespread and disastrous, sometimes killing a million sheep in a year in the United Kingdom. But it is no longer so serious as it used to be. It is especially common after wet seasons, and in low, damp districts. The external symptoms are described as 'emaciation, tenderness in the loins, harshness and dryness of the wool, and a scaly condition of the skin.' A swelling ('watery poke') below the lower jaw is very diagnostic. The preventives suggested are drainage of pastures and dressings of lime or salt; destruction of eggs, infected manure, and badly fluked sheep; giving the sheep salt and a little dry food. The same fluke sometimes occurs in horse, deer, goat, pig, and rarely in man. Many other species and related genera are likewise of serious importance as parasites. See also ANCHOR, FLOUNDER.

See PARASITIC ANIMALS, BILHARZIA; also Leuckart, *Parasiten des Menschen* (1863; new ed. 1879 *et seq.*, trans. by Hoyle); Thomas, *Quart. Jour. Micr. Sci. XXIII.* (1883); Braun, *Animal Parasites* (trans. 1906).

Fluorescein. See DYEING.

Fluorescence is the term applied to a peculiar blue appearance exhibited by certain substances exposed to sunlight, and especially observable in a dilute solution of sulphate of quinine. See PHOSPHORESCENCE.

Fluorine (sym. F, eq. 19) is an elementary substance allied to chlorine. Its principal natural source is the mineral fluor spar, CaF_2, although it is also found in minute quantities in the igneous rocks, natural waters, plants, the bones and teeth of animals, as also in milk, blood, &c. All attempts to isolate fluorine in vessels of glass, gold, platinum, &c. long failed, owing to its powerful action on these substances and its readily forming compounds with them. But in 1888 it was obtained pure in a vessel made of an alloy of platinum and iridium; and in 1893 Moisson again isolated it. It is a gas with properties like those of chlorine, but differing in energy of action. The compounds of fluorine are not numerous, but are important. *Hydrofluoric acid*, HF, is generally prepared by heating gently in a lead still a mixture of one part

of fluor spar, CaF_2, with two parts of sulphuric acid, H_2SO_4, when the vapours of hydrofluoric acid, HF, are evolved, whilst sulphate of lime, $CaSO_4$, is left in the still. The dense acid vapours are conducted through a lead pipe into a lead receiver or bottle surrounded by a freezing mixture of ice and common salt. The acid is generally mixed with water when desired to be kept for some time. When the most concentrated hydrofluoric acid is required, the still and receiving vessel must be made of platinum. The other metals are not suitable for such apparatus, as they are rapidly corroded by the acid. When prepared in its strongest form, hydrofluoric acid has the density of 1·060, and is a colourless, fuming liquid of great volatility, which boils at 67° (19·4° C.). Not only does hydrofluoric acid corrode and dissolve the ordinary metals (excepting lead and platinum), but when placed on the skin it produces a severe burn owing to its caustic nature. The most important property which hydrofluoric acid possesses is its power of eating into and dissolving glass, which admits of its application in the etching of characters upon glass, as in thermometer tubes, and for eating away greater or less thicknesses of plates or sheets of coloured glass, so as to produce a variety of shades. See GLASS, and GLASS-PAINTING. The acid may be kept without any difficulty in bottles made either of paraffin-wax or gutta-percha.

Fluorotype, a photographic process, suggested by Robert Hunt in 1844, in which salts of fluoric acid were employed; but, as the impression was not very strong, the plate had to be afterwards steeped in a weak solution of proto-sulphate of iron.

Fluor Spar (FLUORITE, BLUE JOHN, DERBYSHIRE SPAR) is the only common mineral in which fluorine is present in any large proportion. The fluorine is combined with calcium, and forms *calcium fluoride*, $CaFl_2$, consisting of 48·9 calcium and 51·1 fluorine; occasionally it also contains some calcium chloride, and now and again organic matter, which is sometimes so abundant that when the mineral is struck with a hammer it emits a fetid odour—hence the name *fetid-spar* (Ger. *stink-fluss*). Fluor spar occurs both crystallised and massive, the massive varieties exhibiting a crystalline structure; the crystals appear usually in groups, sometimes of the primary form, which is a cube, but often of secondary forms, of which there is great variety, as the octahedron, rhombic dodecahedron, &c. Fluor spar is sometimes colourless, but often green, blue, yellow, or red, more rarely gray, or even black, different shades of colour frequently appearing in the same specimen, and in the massive varieties beautifully intermixed. Its colours often rival those of the most beautiful gems; but it is of very inferior hardness, being scratched even by quartz. Its specific gravity is 3·15 to 3·20. It generally becomes phosphorescent when heated, although this is more remarkably the case with some varieties than with others; it is decomposed by heated sulphuric acid, with evolution of hydrofluoric acid as a pungent gas; and, this having the property of acting upon and corroding glass, fluor spar is used with sulphuric acid for etching on glass. Fluor spar is also used for ornamental purposes, being wrought into vases, &c., for which it was in high esteem among the ancients. But the greater abundance in which it is now obtained has diminished the value of ornaments made of it. It is very commonly associated with ores of tin, silver, lead, and copper, occurring chiefly in veins, but is also found by itself in drusy cavities in granite and in veins in crystalline schists, slate, limestone, and sandstone. It has been met with also in volcanic tuff in Italy and in cannel-coal in the United States, where it occurs in Illinois, Jefferson Co., N.Y., Franklin Furnace, &c. It is found only in a few places in Scotland, and in insignificant quantity, but is nowhere more abundant than in England, particularly in Derbyshire and in Cornwall. In Cornwall it is used as a flux for reducing copper ore. In Derbyshire the blue massive variety is known to the miners as *Blue John*. The manufacture of ornaments of fluor spar is carried on to some extent in Derbyshire; and fluor spar is often called Derbyshire spar. It is also used for optical purposes.

Flushing (Dutch *Vlissingen*), a strong fortress and seaport of the Netherlands, in the province of Zealand, is situated on the south coast of the island of Walcheren, at the mouth of the Western Scheldt, which it commands. Formerly an important naval station, it was converted into a commercial harbour in 1865–73, and carries on an active trade with Java, England, and South America. A daily service of steamers connects Flushing with Queenborough (Kent) in England. There are outer and inner harbours, and, since 1875, a large floating-dock. Doubling of the harbour accommodation began in 1920. The inhabitants (22,500) are occupied mainly in shipping pursuits. Shrimps are taken. The town capitulated to the Earl of Chatham in 1809.

Flushing, formerly a post-village of Queens county, New York, but since 1897 included in the City of New York. It is situated on Flushing Bay, a branch of the East River.

Flustra, or SEA-MAT (q.v.), one of the commonest genera of marine Polyzoa (q.v.).

Flute (Fr. *flûte*, Ger. *flöte*, Ital. *flauto*), one of the oldest of wind-instruments, which originally had several varieties: one, in more modern times called *flûte à bec*, now developed into the Flageolet (q.v.); another, which was sounded by means of a hole in the side like the modern flute; and a third, used by the ancient Egyptians, in which the sound was produced by blowing into the open end of the tube. A modification of this last instrument is used still by the peasantry along the Nile.

The modern cone-bore flute consists of a tapered tube, in which the sound is produced by blowing with compressed lips into a large orifice near the top or wider end, which is stopped with a cork. Six holes in the lower end, to be covered by the first three fingers of both hands, serve to make the scale, supplemented by keys numbering from one to fourteen. The flute is what is called an octave-scaled instrument—i.e. by covering all the holes and lifting the fingers one by one in regular order, beginning at the bottom, the notes from D below the stave to C♯ are made; then, by repeating this process and blowing a little sharper into the mouth aperture, the same notes, *an octave higher*, are produced. Another octave can be produced by cross-fingering, the total compass being about three octaves. Two additional keys at the bottom of the tube, worked by means of levers by the little finger of the right hand, give the notes C♯ and C♮ below the stave.

The faults of this flute are that, as the holes must be placed where the fingers can reach them, they are not always in the exact places to be perfectly in tune, and the notes are not equal in quality. To meet these defects the flute has undergone more changes and improvements in modern times than any other musical instrument. The most important of these have been the cylinder bore and the system of fingering introduced by Theobald Boehm in 1832, and patented in England by Rudall and Rose in 1847. The mode n cylinder flute, from the head downwards, is cylindrical, or all one width of bore, while the head-piece has a slight parabolic taper, and when combined with the Boehm finger-

ing it forms a nearly perfect instrument, with all the notes in tune and of practically equal quality of tone. The holes are placed where they make the correct notes, and to facilitate manipulation they are stopped by means of keys which can be worked conveniently by the fingers. The fingering of the scale on the Boehm flute is quite different from the ordinary flute; and many other modified systems, more or less founded on the old, have been devised, among which may be mentioned those of Siccama, Clinton, and Carte. It would occupy too much space to describe their methods in detail. The general appearance of the Boehm cylinder flute may be seen in the figure.

Flutes are usually made in cocoa-wood, ebonite, silver, and gold, and vary in price from a shilling or two to about £180 for one made in 18-carat gold. The Boehm flute is very often made in silver, which is easily sounded and gives a fine liquid tone; it costs about 30 guineas. The ordinary cocoa or ebonite Boehm flute costs from 18 to 30 guineas, according as it is mounted in German silver or silver. Except for military flutes, which are still made conical, the cylinder has almost completely superseded the cone bore.

The flute described above is what is known as the concert flute; but flutes are also made in a variety of smaller sizes for various purposes in E♭, F, B♭, and C; there are also D, E♭, and F piccolos or octave flutes, which are much used in modern orchestral music. In construction, however, they are all much alike, and need not be further described. A bass flute, too, is sometimes used, the Boehm variety being simply a large flute, 32 inches long and 1 inch in diameter, and having a compass from the upper G of the bass stave upwards. Also, see FIFE.

The concert flute, from the sweetness of its tone and the comparative simplicity of its execution, is extremely popular as an amateur instrument, and a great variety of music is published arranged for flute and pianoforte; and, as it plays the same notes as the voice and piano, it can be made useful in all kinds of music. The flute is made great use of in classical music; Bach, Haydn, Handel, Mozart, Beethoven, Mendelssohn, and all the later writers giving it a leading part in their works; while Quantz, Kuhlau, and many others devoted themselves almost specially to writing for it. See T. Boehm's *Essay on the Construction of Flutes*, and C. Welsh's *History of the Boehm Flute*.—The so-called 'flute-stop' is one of the many stops of the Organ (q.v.).

Flute-mouths (*Fistularidæ*), a family of marine fishes, nearly allied to sticklebacks, remarkable for the elongation of the front bones of the head into a pipe bearing the small mouth at its apex. They live near the shore, and are widely distributed in the warm parts of the Atlantic and Indo-Pacific. There are but few species—e.g. *Fistularia tabaccaria*, and *Aulostoma chinense*. The Snipe-fish or Trumpet-fish (q.v., *Centriscus scolopax*) belongs to an allied family (Centriscidæ).

Fluting, the mouldings in the form of hollows or channels cut vertically on the surface of columns. The idea is supposed to have been originally derived from the bundles of reeds tied together which formed the early columns of the Egyptians. Flutes were adopted by the Greeks as ornaments to their Doric, Ionic, and Corinthian columns, and were retained by the Romans in their architecture. The Tuscan is the only style without flutes. In Doric (fig. 1) there are twenty flutes on the circumference, and the curves meet with a sharp edge.

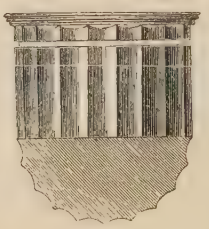


Fig. 1.

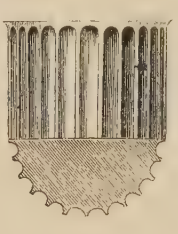


Fig. 2.

These curves are supposed, in Greek Doric, to be elliptical, and they are carried up across the necking to the base of the cap. In the other styles there are twenty-four flutes on the circumference (fig. 2). These are semicircular and separated by a small fillet, and, before reaching the necking and the base, are terminated with semicircular top and bottom.

Flutes are said to be cabled when they are filled in to about one-third of their height from the base with a convex bead. This is done to strengthen the column and protect the flutes. In countries where Roman remains are abundant, as in the south of France, fluting was sometimes adopted by the early medieval architects, as at Arles and Autun. In Italy also traces of this decoration are visible during the middle ages; but the flutes are not limited to the vertical form—in Romanesque Architecture (q.v.) they assumed many varieties of forms, such as curves, zigzags, &c., twisting round the shafts.

Flux (Lat. *fluxus*, from *fluo*, 'I flow'), a discharge generally from a mucous membrane. The term is applied more or less frequently to all preternatural fluid evacuations from the body, but especially to those from the bowels and from the uterine organs. Dysentery (q.v.) was long termed the bloody flux to distinguish it from simple diarrhœa. See also CATARRH, DISEASE, MEDICINE.

Flux is the term given to the substances employed in the arts to assist the reduction of a metallic ore and the fusion of the metal. *White flux* is an intimate mixture of ten parts of dry carbonate of soda and thirteen parts of dry carbonate of potash, and is mainly instrumental in removing siliceous impurities by combining with the silica to form a fusible glass; *black flux* is prepared by heating in close vessels ordinary cream of tartar (bitartrate of potash), when an intimate mixture of finely-divided charcoal and carbonate of potash is obtained. The latter flux, when mixed with finely-divided metallic ores, and the whole raised to a high temperature in a furnace, not only is useful in removing the silica by the action of the carbonate of potash as above described, but the charcoal withdraws the oxygen from the metallic oxide and causes the separation of the pure metal. For economy, limestone is employed in the smelting of iron ores. Fluxes are also employed in the operations of brazing and soldering to keep the surfaces to be joined free from oxide. Fluor spar, borax, protoxide of lead, and other basic substances are also used for fluxing. See IRON AND STEEL, COPPER, &c.

Fluxions. The method of fluxions and fluents was the name given after Newton to that branch of mathematics which with a different notation is known after Leibniz as the differential and integral calculus. Newton, representing quantities in the manner of Euclid and others by lines, looked upon

them not with Leibniz as made up of very small parts, but as described by a continuous motion. 'From considering,' says Newton in the introduction to his *Tractatus de Quadratura Curvarum* (1704—the first formal exposition of fluxions published), 'that quantities increasing in equal times and generated by this increasing become greater or less according as the velocity with which they increase and are generated is greater or less, I was in quest of a method of determining quantities from the velocities of the motions or increments with which they are generated; and naming the velocities of the motions or increments *fluxions*, and the quantities generated *fluents*, I came little by little in the years 1665 and 1666 upon the method of fluxions.' Instead of referring the rate of change of a dependent variable y directly to the independent variable x, as in the differential calculus, the method of fluxions refers each to time (t) considered as a uniformly flowing quantity. Thus, the fluxions of y and x, denoted by $\dot{y}$ and $\dot{x}$, correspond to $\frac{dy}{dt}$ and $\frac{dx}{dt}$ respectively. The fluent of any quantity, say y, was denoted sometimes by $\boxed{y\dot{x}}$, sometimes by y'. The notation adopted by Newton was on the whole clumsy, and has been abandoned for that of the differential calculus. In the method of fluxions the notions of prime and ultimate ratios take the place that limits hold in the differential calculus. The most logical and complete, as well as the most bulky, treatise that has ever appeared on fluxions is that by Colin Maclaurin (Edin. 2 vols. 4to, 1742; 2d ed. 2 vols. 8vo, 1801). See also CALCULUS, NEWTON (SIR ISAAC).

Fly, a popular name best restricted in its simplicity to the insects forming the order Diptera, but often so widely used with a prefix—e.g. butterfly, dragon-fly, may-fly—as to be virtually equivalent to insect. The flies properly so called have two delicate, unfolded wings with predominant longitudinal veins, hind wings modified into balancers (*halteres*) or rarely absent, and mouth parts in general adapted for sucking. The larva is usually a legless maggot, or has secondary 'false' legs. Gnats, midges, daddy-long-legs, gall-flies, blow-flies, bluebottle-flies, bot-flies, forest-flies, and house-flies are noticed separately. The 'Spanish fly' or Cantharis (q.v.) is a beetle.

Fly, a river of New Guinea, draining a considerable area in the centre of the island. In the upper part of its course it forms part of the boundary between British and Dutch New Guinea, afterwards flowing south-east to the Gulf of Papua, on whose shores it forms a wide delta. In 1875 Macfarlane and D'Albertis ascended it for 90 miles, and Everill in 1885 penetrated 200 miles to the junction of the Strickland, its chief tributary, up to which point the tidal influence is felt. Its total length within British territory is about 620 miles, and its discharge into the gulf is estimated at over two hundred thousand million gallons per day.

Fly-catcher, a name applicable to any of the numerous birds which make up the Passerine family Muscicapidæ. The family includes a large number (over 40 genera and 280 species) of usually small-sized and often brightly coloured forms, very abundant in the warmer parts of the Old World and Australia, scarcer in temperate and colder regions, and wholly absent from North and South America, where they are represented by the Tyrant-shrikes or Tyrannidæ. The nature of the bill is a distinctive feature; it is strong, short, and somewhat swallow-like, laterally compressed towards the slightly hooked point, and with bristles on the broad and flat basal portion. The common British Fly-catcher (*Muscicapa grisola*) is a tiny brownish-gray bird, which reaches our shores from Africa in early spring, and leaves again with its brood in autumn. The upper surface is mouse-coloured, the under side is whitish, with brownish-gray longitudinal spots. Its cry is a monotonous chirp; its habit, like that of its neighbours, is jerkily active. It remains quietly seated till an insect is observed, makes a successful dart, and

Spotted and Pied Fly-catchers (*Muscicapa grisola* and *M. atricapilla*).

returns to its perch. In nesting it is nowise shy; a beam in an outhouse, the side of a timber-stack, the branch of a tree trained on a building, and even a lamp-post are among the sites recorded. The parents have been seen to visit their nest with food for the young not less than 537 times in a single day, which indicates a marvellous quickness of movement and adroitness in food catching. The Pied Fly-catcher (*M. atricapilla* or *luctuosa*), with different colour, is common in south Europe, and has been recorded in Britain. There are ten other species in Europe and Africa. Among the other fly-catchers outside the genus Muscicapa are the Fantails (Rhipidura), with spreading tails, in oriental and Australian regions; the beautiful long-tailed Paradise Fly-catcher—e.g. *Terpsiphone paradisi* of the East Indies; the important genus Myiagra of Australia and the Moluccas; the interesting Australian 'Grinder' (*Seisura inquieta*), which 'hovers' like a kestrel, descends rapidly to the ground upon insect prey, and emits a curious noise (comparable to that made by a grinder at work) just before alighting, or when poising a few feet from the earth.

Flying. See FLIGHT.

Flying Animals, in the strict sense, include most insects, birds, and bats, and these only. In past times there were 'flying reptiles' (Pterodactylus, Rhamphorhynchus), in which the outer finger was enormously elongated, and supported a wing-like expansion of the skin. In several ways these extinct forms were prophetic of birds, and certainly must be said to have had wings; but to what degree they were able to progress like birds in the air we do not know. For the true fliers, and for their interesting contrasts—e.g. between the wing of an insect and that of higher forms, or between the 'arms' of bat and bird—the relevant articles must be consulted; the present is devoted to a quite different set of animals, which are popularly called 'flying animals,' though they do not beat the air with wings.

(1) Among fishes, two very distinct genera (Exocœtus and Dactylopterus) have the power of

skimming for considerable distances above the surface of the water, their expanded pectoral fins forming a parachute (see FLYING-FISH). (2) Some species of lizards in the genus Draco—e.g. *D. volans*—take short swoops through the air, the skin being stretched on several much elongated ribs, so as to form a sort of half kite on either side (see DRAGON). In some Geckos (q.v.)—e.g. the Californian *Phyllodactylus tuberculatus*—there is not a little membranous fringing of body, tail, and limbs. The flying powers of Wallace's 'flying frog' (Rhacophorus) have not been certainly established. (3) It is, however, among mammals that attempts at parachute flight are most frequent, and that not in one order but in three: Marsupials (Petaurus), Rodents (Pteromys and Sciuropterus), and Insectivores (Galeopithecus).

FLYING PHALANGER, or Flying Opossum (*Petaurus*), a genus of marsupials, natives of New Guinea and Australia, where they are called Flying Squirrels, Sugar-squirrels, &c. Nearly allied to the Phalangers, they are distinguished by a hairy membrane or fold of the skin extending along the flanks, and used as a parachute to enable them to leap to great distances. This membrane extends along both fore and hind legs almost to the toes, but does not appear behind the hind-legs, nor include the tail. They are capable of modifying their course in the air, although not of true flight; and their aërial evolutions are very graceful. They repose during the day, and become active in the evening, feeding on fruits, flowers, leaves, insects, &c. A New Guinea species is as large as a cat;

1, Flying Phalanger (*Petaurus taguanoides*);
2, Flying Mouse (*Petaurus pygmæus*).

one of the Australian species is scarcely larger than a mouse, and is called Flying Mouse. The genera Belideus and Acrobata have also parachutes. See PHALANGER.

FLYING SQUIRREL (*Pteromys* and *Sciuropterus*), two genera of squirrels (Sciuridæ), the members of which have a fold of skin extended from the flanks between the fore and hind legs, by means of which they are enabled to take extraordinary leaps, gliding for a great distance through the air. The tail may also aid to support them in the air, as well as to direct their motion, its hairs being often extended laterally in a sort of feathery expansion, as in some of the flying phalangers. The genus Pteromys is especially well represented in the Indian region; Sciuropterus predominates in the north. The commonest Old-World species, the Polatouche (*S. volans*), from north-eastern Europe and Siberia, is about the size of a rat, grayish-ash colour above, white below, the tail only half the length of the body. It lives solitarily in the forests where birches abound, is nocturnal in habit, vegetarian in diet. The most common North American species, the Assapan (*S. volucella*), abundant from the Gulf of Mexico to Upper Canada, is fully 5 inches long, with a tail of 5 inches additional, fur included. The general colour is brownish-gray, lighter beneath. In gliding from tree to tree it descends obliquely and with very rapid motion, perhaps for a distance of 20 yards, and always lands of course at a considerably lower level than that at which it started. The flying squirrels are all arboreal and nocturnal, and feed not only on nuts and young shoots of trees, but also on small birds. Some forms are readily

Flying Squirrel (*Sciuropterus volucella*).

domesticated; the fur is sometimes substituted for that of other squirrels. See SQUIRREL.

FLYING LEMUR, or Colugo (*Galeopithecus*), an aberrant Insectivore, with a parachute provided with special muscles, and even more efficient than in the preceding mammals. The hairy fold of skin begins behind the throat, includes fore and hind limbs as far as the claws, and extends along the tail to the tip. The animal has been observed to swoop over a distance of 70 yards. The claws are used in climbing; the lower front teeth are remarkably comb-like; the general colour is said to resemble mottled bark; the brain is very small.

Flying Lemur (*Galeopithecus volans*).

The flying lemurs are about 20 inches in length, are natives of the Indian Archipelago, inhabit lofty trees in dense forests, and feed chiefly on leaves and fruits, though said at times to eat

insects, eggs, and even small birds. They are nocturnal in their habits, and very inoffensive, scarcely attempting to bite even when seized. Their voice resembles the low cackling of a goose. The female bears a single young one at a birth, and has a pair of teats on each side near the armpits. The Pelew islanders greatly esteem them as food, but they have a rank, unpleasant smell. The zoological position of Galeopithecus is difficult to determine; it has been referred to the lemurs, to the bats, and with most justice to the Insectivores, while Wallace regards it as 'a lateral offshoot of some low form, which has survived during the process of development of the Insectivora, the Lemuroidea, and the Marsupials, from an ancestral type.' Two species (*G. volans* and *G. philippinensis*) are usually distinguished. The flying foxes (Pteropidæ) are true bats and true fliers. See BAT, BIRD, DRAGON, FEATHERS, FLIGHT, FLYING-FISH, INSECT, PHALANGER, PTERODACTYL, SQUIRREL.

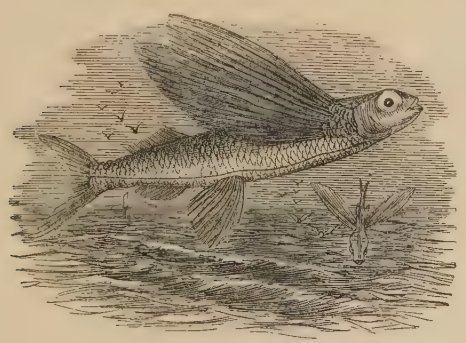
Flying Bridge. See FERRY.

Flying Buttress. See BUTTRESS.

Flying Column. See ARMY.

Flying Dutchman, a Dutch captain, Van Straaten, who was condemned, as a penalty for his sins, to sweep the seas around the Cape of Storms (the Cape of Good Hope) unceasingly, without ever being able to reach a haven. Seamen who saw his black spectral ship on the horizon quickly changed their course, and hastened to flee from his fatal influence. The notion that gave foundation to this legend is widespread in German mythology. The dead crossed the water in boats, and northern heroes were sometimes buried on land within their ships, sometimes placed in a ship which was taken out to sea and allowed to drift with the waves; while the same story is localised in the German Ocean, where Herr von Falkenberg is condemned to beat about the ocean until the day of judgment, on board a ship without helm or steersman, playing at dice with the devil for his soul. In the form of the legend chiefly current in England, the impious seaman's name is Vanderdecken, while his ship, which continually scours the seas, is, in all respects but reality, the image of a real ship. The legend gave Wagner the subject for his well-known opera, *Der fliegende Holländer*.

Flying-fish, species of Exocœtus and Dactylopterus, bony fishes which, though not indeed true fliers like birds or bats, are able to progress for some distance in the air, quite above the



Flying-fish (*Exocœtus volitans*).

surface of the water. The genus Exocœtus is included in the family Scombresocidæ not far from the Pikes; while the genus Dactylopterus is referred to the Cataphracti, nearly allied to the Gurnards.

(1) *Exocœtus* (Flying Herrings).—There are over forty known species of this genus, mostly in the warmer seas. Two have occasionally been seen near British shores, one of which (*E. evolans*) ranges from Australia through the Indian Ocean, while the other (*E. volitans*) is common in the Mediterranean. The long pectoral fins, which extend to the anals or even to the tail, form the most characteristic feature. The usual length of the body is about a foot. Their 'flight' has been much discussed, with the following general results. The fins are kept distended like a parachute, and are not moved like the corresponding appendages of birds or bats; deviation from a straight course, whether lateral or vertical, is due to air-currents, except when the animals in their progress dip their tail into the water and give a stroke; 'their flight is rapid, but gradually decreasing in velocity, greatly exceeding that of a ship going 10 miles an hour, for a distance of 500 feet;' they 'fly' most in rough weather, and farthest when more or less against the wind; in a calm their course is parabolic like that of a projectile, and close to the water, but they are liable to be lifted by the air-pressure over high waves, or by the wind on to the decks of ships; they leave the water when frightened, but also apparently from the mere exuberance of their constitutional activity. They swim and often 'fly' in shoals, and are chased by coryphenes (so-called 'dolphins') and other fishes, as well as by sea-birds. They are good for eating, and are often netted by the natives of the South Sea islands and elsewhere.

(2) *Dactylopterus* (Flying Gurnards).—Of this genus three species are known, abundant in the

Flying Gurnard (*Dactylopterus volitans*).

Mediterranean, the tropical Atlantic, and Indo-Pacific. The young have comparatively short pectoral fins, and cannot lift themselves, but the adults 'fly' after the above-described fashion. They are larger and heavier than the Exocœti.

See Günther, *Study of Fishes* (1880); Möbius, *Fliegende Fische* (1878); and the article FLIGHT OF ANIMALS.

Flying Foxes. See BAT.

Flying Lemur. See FLYING ANIMALS, INSECTIVORA.

Flying Machines. See BALLOONS AND AEROPLANES.

Flying Squid (*Ommastrephes*), a genus of decapod Cuttle-fishes (q.v.). The body is long, cylindrical, and pointed posteriorly, with two triangular fins, by help of which the animal can jerk itself out of the water, sometimes so high as to fall as a 'sea-arrow' upon a ship's deck. Like other cuttle-fish, they swim rapidly by forcibly ejecting water from their mantle or gill cavity. They are included among those Cephalopods which have the cornea of the eye open, so that the sea-water reaches the lens. Their internal shell or 'pen' is furnished with three diverging rays, and a hollow conical appendage. The species vary in length from 1 to 4 feet. Gregarious in their habits, they prey upon

shoals of mackerel and other fishes, and are themselves devoured by dolphins and other cetaceans, as well as by sea-birds. One species (*O. sagittatus*) is used very abundantly for bait in the Newfoundland cod-fisheries.

Flying Squirrel. See FLYING ANIMALS.

Fly Poison. This term includes the various preparations which are sold for the purpose of killing flies. Formerly powders on papers containing arsenic, and sweetened so as to attract the flies, were in general use. Since it has been found that paper dipped into a sweetened solution of quassia is equally efficacious, the poisonous article has been partly superseded.

Fly-trap. See DIONÆA.

Fly-wheel, a large wheel with a heavy rim fitted to steam-engines, or other machinery, in order to equalise the effect of the driving effort. Its action depends on the principle that matter in motion possesses kinetic energy—e.g. a body in having its velocity reduced is capable of doing work. The amount of work it can do depends directly on the mass of the body, and on the difference of the squares of its initial and final velocities, and is numerically equal to $\frac{m(v_1^2 - v_2^2)}{2}$. A heavy wheel thus becomes a reservoir of work when set in motion.

There are two principal cases in which the fly-wheel is commonly applied: (1) where the driving effort is intermittent or irregular, while the resistance to be overcome is for the time practically constant; and (2) where the resistance or work to be done is intermittent or irregular. The crank in a foot-lathe is a good example of the first case; the driving effort of the foot is only applied to the treadle on the down stroke, and the crank must rise independently of the effort. A fly-wheel attached to the crank-shaft effects this, the motion it acquires while the foot is acting gives it energy, and in virtue of this it is able to bring the crank up again into the proper position for the foot to act on the treadle. In single-crank engines the fly-wheel carries the crank over the dead centres (see CRANK), and whenever used in engines its function is to keep the speed steady during each revolution of the crank—i.e. to prevent unsteadiness during each turn; this it does by storing up energy during parts of the revolution when the effort is greater than the mean resistance, and giving it up again during those parts of the revolution when the effort falls below the resistance. In the gas-engine, where the effort (explosion) is often only applied during part of every second or third revolution, it does very important work. Its action must be clearly separated from that of the governor, whose function is to determine the mean speed or number of turns the engine shall make per minute; this the fly-wheel cannot in any way do—it can only keep the speed steady during each turn.

The second case is illustrated by a punching-machine. The engine need not be of sufficient power to directly force the punch through the metal, but with the aid of a fly-wheel it easily does it. The machine is so arranged that the actual part of each revolution spent in punching is very small; all the rest of the revolution the fly-wheel is storing up energy, nearly all the effort going in this. Then at the proper moment the work stored up is added to the direct work of the engine, and the punch forced through, the speed of the fly-wheel being proportionately reduced.

The principle of the fly-wheel is sometimes applied in other forms than that of a wheel—e.g. in fly-presses for stamping or coining metals, in which two heavy balls are fixed at the ends of a long lever, which is made to swing round with considerable velocity. The accumulated energy is given up at the moment of impact of the die upon the metal, and a force of great intensity called into play to compress the latter. Fly-wheels are not required in locomotives or marine engines (see STEAM-ENGINE).

Foch, FERDINAND, marshal of France (1918), was born at Tarbes in 1851, and educated at Metz. He served in the war of 1870, was professor at the École de Guerre in 1896–1901, and a brigadier-general in 1907. In the Great War he distinguished himself at the Marne, Ypres, and the Somme, became chief military member of the Supreme War Council, and as supreme head of the allied armies (1918) brought the war to a conclusion. He wrote *The Principles of War* and *The Conduct of War*.

Fochabers, a village of Elginshire, on the Spey, 9 miles ESE. of Elgin. Milne's Free School (1846) is the chief edifice. A mile north is Gordon Castle, the old 'Bog of Gight,' and the seat, since 1449, of six earls and four marquises of Huntly, five dukes of Gordon (the fourth of whom almost rebuilt it towards the close of the 18th century), and now of the Duke of Richmond and Gordon.

Focşani, or FOKSHANI, a town of Rumania, near the border-line between Moldavia and Wallachia, is in the former province, on the Milkoff, a tributary of the Sereth, about 100 miles NNE. of Bucharest. There is considerable river trade with Galatz, especially in grain. Near Focşani the Turks were defeated by the allied Austrians and Russians, 1st August 1789. Pop. 25,000.

Focus, in Optics, is a point in which several rays meet and are collected after being reflected or refracted, while a *virtual* focus is a point from which rays tend after reflection or refraction. The principal focus is the focus of parallel rays after reflection or refraction. See LENSES, MIRROR, OPTICS, PHOTOGRAPHY. For the focus of geometry, see ELLIPSE, HYPERBOLA, PARABOLA.—The *Focimeter* is an instrument for assisting in focusing an object in or before a photographic camera; it is usually a lens of small magnifying power.

Fodder (O.E. *fódor*, cog. with Ger. *futter*), the food collected by man for the use of the domestic herbivorous quadrupeds. In English the term is commonly restricted to dried herbage, as hay and straw; but in other languages it is more comprehensive, and includes all the food of cattle, except what they gather for themselves in the field.

The principal part of the food of the domestic herbivora is furnished by grasses, most of which are eaten by them when fresh and green. Besides the surplus of corn cultivated for human food, they are also, to a considerable extent, dependent on the *straw* or dried herbage of the corn-plants for their winter provender; and that of many other grasses, cultivated on this account alone, is converted into *hay* for their use. Hay, being cut and rapidly dried before the nutritive substances have been collected in the seed, contains more nutritious matter than the ripened straw of the cereals. The most important perennial fodder grasses of Britain are Timothy, Foxtail, Cocksfoot, Tall Fescue, Meadow Fescue, and Hard Fescue. Perennial ryegrass, under certain conditions, may be added to the number. They should be all represented in ordinary mixtures for seeding land down to permanent grass. Italian ryegrass surpasses the perennial in its power of yielding a large crop under favourable circumstances in a rotation. In the United States the best grasses are Timothy, Red Top, or Rhode Island Bent, White Top, Orchard Grass, and June Grass or Kentucky Blue Grass.

Next to the grasses are ranked the Leguminosæ,

affording food for cattle in their seeds—as beans, peas, lentils, lupines, &c.—and in their herbage, on account of which many of them are cultivated, as clover, lucerne, vetch, tares, sainfoin, &c. When consumed green, the produce of these crops is usually termed forage or green forage. Some of them enter also largely into the composition of hay, being cut and dried with the grasses along with which they have been sown. Some of the Cruciferæ are cultivated to a considerable extent as forage-plants, cattle being fed on their green herbage, although they are not suitable for drying as fodder. Among these are kale and cabbage, rape, &c.

In some parts of the world cattle are not unfrequently fed on the leaves of trees, as in the Himalayas, where the leaves of different species of Aralia, Grewia, elm, and oak are chiefly employed for this purpose, and are collected, dried, and stacked for winter fodder. In seasons of drought in India cattle are kept alive on the green leaves and pods of Acacia and *Inga dulcis*. See CLOVER, GRASSES, PASTURE, &c.

Fœtus, the term applied in Medicine to the mammalian embryo, especially in its more advanced stages. In the human subject we usually speak of the embryo at and after the end of the fourth month as a fœtus.

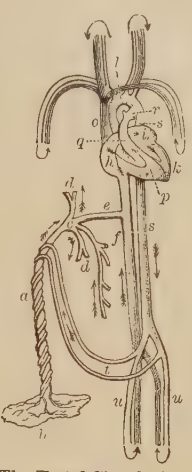
The weight and length of the fœtus at full term —nine months—vary within considerable limits. Observations on a very large number of cases have shown that this variety is related to several conditions—e.g. sex, race, number of previous pregnancies of the mother, &c. Male children are from 8 to 12 oz. heavier than female; children born in Britain are heavier by 3 or 4 oz. than those born in France, and first-born children are 4 to 6 oz. lighter than subsequent ones.

On an average the fœtus at birth weighs from 6½ to 9 lb. But a healthy child may weigh as little as 5 or 5½ lb., and cases are on record where the child has weighed 17½ and 18 lb. Children under 5 lb. weight at birth rarely live, and when they do are puny. The length of the fœtus is 17 to 21 inches, occasionally being as much as 24 inches.

There are certain points in which the fœtus at the full period differs anatomically from the child shortly after birth. The bony skeleton is very incomplete, cartilage occurring in the place of many bones. Indeed, complete ossification (viz. of the vertebræ) is not finished until about the twenty-fifth year, and the only bones completely ossified at birth are the minute ossicles of the ear. The difference between the fœtus and the child in this respect is, however, only one of degree.

During pregnancy a temporary organ, termed the placenta (popularly known as the after-birth, from its being thrown off shortly after the birth of the child), is developed on the inner wall of the uterus (see *b* in the figure). This organ is mainly composed of vessels, and there proceeds from it the structure known as the umbilical cord, *a*, in which lie the umbilical vein, which conveys arterial blood to the fœtus, and the two umbilical arteries, which return the blood to the placenta. This umbilical cord conveys these vessels to the umbilicus or navel. Before tracing the course of the blood through the fœtus, we must notice the chief anatomical peculiarities presented by the vascular or circulating system before birth.

(1) In the heart we find a communication between the two auricles by means of an opening termed the *foramen ovale*. (2) In the arterial system we have to notice first the *ductus arteriosus* (see *r* in the figure), which is a large communicating trunk between the pulmonary artery, *q*, and the descending aorta, *s*, *s*; and, secondly, the branches given off by the internal iliac arteries, which go under the name of hypogastric as long as they are within the body of the fœtus, and of umbilical when they enter into the structure of the cord, are continued from the fœtus to the placenta, to which they return the blood which has circulated in the fœtal system. (3) In the venous system there is a communication between the umbilical vein, *c*, and the inferior vena cava, *f*, called the *ductus venosus*, *e*.



The Fœtal Circulation.

Pure blood is brought from the placenta by the umbilical vein, which passes through the umbilicus, and enters the liver, where it divides into several branches, *d*, *d*, which are distributed to that viscus, the main trunk or *ductus venosus*, *e*, passing directly backwards, and entering the inferior vena cava, *f*. The pure blood here becomes mixed with the impure blood which is returned from the lower extremities and abdominal viscera, and is carried into the right auricle, *h*, and from thence, guided by the Eustachian valve (which is situated between the anterior margin of the inferior vena cava and the auriculo-ventricular orifice, and is of relatively large size in the fœtus), passes through the *foramen ovale*, into the left auricle, *i*. From the left auricle it passes into the left ventricle, *k*, and into the aorta, *l*, whence it is distributed by the carotid and subclavian arteries principally to the head and upper extremities, which thus receive comparatively pure blood. From the head and arms the impure blood is returned by the superior vena cava, *o*, to the right auricle; from the right auricle it is propelled, as in the adult, into the right ventricle, *p*; and from the right ventricle into the pulmonary artery. In the adult it would now pass through the lungs, and be oxygenised; but in the fœtus it passes through the *ductus arteriosus* into the commencement of the descending aorta, where it mixes with that portion of the pure blood which is not sent through the carotid and subclavian arteries. Some of this mixed blood is distributed by the external iliac arteries, *u*, *u*, to the lower extremities, while the remainder (probably the larger portion) is conveyed by the hypogastric or umbilical arteries, *t*, to the placenta.

From the above description we perceive: (1) That a considerable quantity of the pure blood from the placenta is at once distributed to the liver, which accounts for its large size at birth as compared with the other viscera. (2) That a double current meets in the right auricle, one stream, guided by the Eustachian valve, passing through the *foramen ovale* into the left auricle, the other through the auriculo-ventricular opening into the right ventricle. (3) That the comparatively pure blood sent to the head and arms, as contrasted with the impure blood sent to the lower extremities, causes the relatively greater development of the former organs, and prepares them for the functions they are called upon to perform; the development of the legs at birth being slight as compared with that of the head or arms.

Almost immediately after birth the *foramen ovale* becomes closed by a membranous layer, and the *ductus arteriosus* and *ductus venosus* degenerate into impervious fibrous cords. The lungs, previously to the act of inspiration, are dense and solid in structure, and of a deep-red colour, and lie far back in the chest. Their specific gravity is greater

than water, in which they (or portions of them) consequently sink, whereas lungs (or portions of lungs) that have respired float in that fluid.

Although nine months is the normal period of fœtal development *in utero*, it is possible for a fœtus to survive though born much within this period. When a child is born in a state of development sufficient to enable it to survive, it is said to be *viable*. A fœtus born at 4½ months may give evidence of life, such as movement of limbs, attempts at respiration, &c., but of course cannot survive, and hence is not viable. Several instances have been recorded in which the fœtus survived after birth at 6½ months. At seven months viability is established, and with reasonable care—particularly the employment of suitable 'incubators' or other means to keep the infant in an even warm temperature—a large proportion of children born at this time survive. Such children may become perfectly healthy and strong, both mentally and physically. It is said that Sir Isaac Newton was born at the seventh month. A child born after an abnormally prolonged gestation is apt to be so large that its birth is dangerous to itself and its mother. More especially does this apply to the head, which is apt to be not only too large, but too much ossified and so too hard to pass safely through the birth passages.

This article would be imperfect without a notice of the question—What constitutes live-birth? This is a point on which the most distinguished obstetric authorities have differed: some holding that where there is muscular movement there is life; while others maintain that where respiration has not been proved to have taken place the child was still-born. A scientific definition of live-birth is that it is 'the complete expulsion from the maternal birth-canals of a child which, whilst it loses pulsation in the cord, adds on to the other characters of ante-natal life the special sign of post-natal vitality, viz. pulmonary respiration.'

In English law, however, as it at present stands, respiration is not necessary to establish live-birth (cf. Brook *v.* Kellock, 1861), and the same holds good in France and the United States. In Scotland, on the other hand, the law requires that a child shall not only have breathed, but actually cried; and accordingly a child which was born, breathed, and died of convulsions at the end of half-an-hour was declared to have been born dead. See EMBRYOLOGY, and other articles cited there; also GESTATION, PREGNANCY.

Fog, or MIST. Water vapour is always present in the atmosphere, and it condenses either as rain, mist, or fog when the state of saturation is reached. In some cases dust-particles condense moisture from non-saturated air, and this produces what is known as a *dry* fog. Condensation of moisture takes place on a drop more readily the larger it is (see CAPILLARITY), and experimental proof was given by Dr John Aitken in support of the theory that no condensation can occur without the presence of a nucleus. Such a nucleus is furnished by the visible or invisible dust-particles in the atmosphere. The amount of vapour present and the number and size of the dust-particles in part determine whether fog, mist, or rain will be formed, under given conditions of temperature and pressure; but the gathering of moisture into drops sufficiently large to fall as rain seems not to depend merely on the number and size of the particles on which condensation occurs. When a stratum of warm, dusty air gets cooled, a fog may be produced. The great amount of smoke-particles and dust-particles present in the air of large towns furnishes the conditions, in certain states of weather, that give rise to the intense fogs often prevalent in large cities. A morning fog disappears as the temperature rises, because of evaporation of the moisture from the nuclei. A fog is often produced in the evening over the surface of water or moist ground, because the air is sufficiently cold for condensation of vapour to occur. The fogs on the coasts of Nova Scotia and other places are caused by currents of warm air moving over cold water; so also the fogs caused on the coasts of Oregon and California by west and north-west winds. On the outskirts of an anti-cyclone fogs of immense breadth sometimes stretch for hundreds of miles lengthwise. Aitken pointed out that dust-particles are probably efficient in the production of fog or rain in another way besides acting as nuclei. He believes that dust is a good absorber, and therefore a good radiator, of heat; for he has shown that, on equally clear days, the sun's heat is strong if the number of particles per unit volume of the atmosphere is small, but is weak if the number is large. Hence, when the sun's rays are withdrawn, the air surrounding the particles is rapidly cooled, and its moisture condenses.

Clouds, whether of fog, mist, or rain, though apparently suspended in the air, are in reality falling with extreme slowness. The force which causes drops to fall is their own weight, which is proportional to the cube of their diameter. The force acting upwards is the resistance of the air, which is proportional to the diameter. Hence, if the diameter of a drop becomes $\frac{1}{10}$ of its original value, the resistance is reduced to $\frac{1}{10}$ only of its value, while the weight becomes $\frac{1}{1000}$ of what it was before, and so the drop falls far more slowly.

One of the worst fogs on record, alike for its density and protractedness, occurred in London from the beginning of November 1879 to the following February. The deaths for the six weeks ending February 21st were 1730, 1900, 2200, 3376, 2495, and 2016, the deaths in the fourth week being thus nearly double those of the first. Of all diseases the deaths from asthma were most directly influenced in fatality by the fog. In the first three weeks of 1880, when London was largely cleared of fog, the deaths fell 30 per cent. below the average; but in the end of January, when the fog again became severe, the deaths rose to 43 per cent. above the average. Bronchitis, pneumonia, pleurisy, other lung diseases, and whooping-cough, though not showing so strict an obedience to the varying density and persistence of the fog, rose to a much greater fatality, the death-rate from bronchitis rising to 331 per cent. and whooping-cough to 231 per cent. respectively above the averages of these diseases. Fogs are worst in the low-lying districts which are on the lee-side of the city, with respect to the direction of the light drift of the wind at the time, and least felt in the higher districts on the windward-side, the amount of suffering and number of deaths being proportioned to the density and persistence of the fog.

Fogazzaro, ANTONIO (1842–1911), an accomplished Italian poet, novelist, essayist, and writer on various themes, was born at Vicenza, studied law at Turin, and became a follower of Giacomo Zanella. He won fame by a narrative poem, *Miranda* (1870), and by *Valsolda* (1876) and *Profumo*, volumes of lyrics. Among his novels—many of which have been translated—are *Malombra* (1882), *Daniele Cortis* (1887), *Eva* (1892), *Alla Vigilia* (1896), *Il Piccolo Mondo Antico*, *Il Piccolo Mondo Moderno*, and *Il Santo* (1905). This work, depicting modernism, was placed on the *Index Expurgatorius*. Fogazzaro submitted, lost such sympathy as he had had with the extreme modernists, and in *Leila* (1910) modified the position that had given offence to the Church. See Life by Gallarati-Scotti (1920; Eng. trans. 1922).

Foggia, capital of an Italian province, is situated in a fertile district 76 miles NW. of Bari, with a cathedral, commenced in the Norman style in 1172, but partially destroyed by an earthquake in 1731, and afterwards rebuilt in a different style. Foggia, which is the most important mart in Apulia, was a favourite residence of the Emperor Frederick II. Pop. 90,000.

Fog-signals, audible warnings used on board ships, on the sea-coast, or on railways, during fogs and mists, or at any other time when lights or ordinary daylight-signals are not available (see SIGNALLING). An international code of fog-signals, recognised since 1861 and revised in 1897, is used at sea all the world over; the prescribed signals in vessels under way being made in steamers by a steam-whistle or siren, in sailing-vessels and vessels being towed by a mechanical fog-horn, and in all vessels at anchor by a bell. They are as follows: In fog, mist, falling snow, or heavy rain-storms, whether by day or night, a steam-vessel having way upon her shall sound at intervals of not more than two minutes a prolonged blast. A steam-vessel under way, but stopped and having no way upon her, shall sound at intervals of not more than two minutes two prolonged blasts, with an interval of about one second between them. A sailing-vessel under way shall sound at intervals of not more than one minute, when on the starboard tack one blast, when on the port tack two blasts, and when with the wind abaft the beam three blasts. A vessel when at anchor shall, at intervals of not more than one minute, ring the bell rapidly for about five seconds. A vessel when towing, a vessel laying or picking up a telegraph cable, and a vessel under way which is unable to get out of the way of an approaching vessel through being not under command or unable to manœuvre as required by these rules, shall, instead of the prescribed signals, at intervals of not more than two minutes, sound three blasts in succession—one prolonged blast followed by two short blasts. A vessel towed may give this signal, and she shall not give any other. Sailing-vessels and boats of less than twenty tons gross tonnage shall not be obliged to give the above-mentioned signals, but if they do not they shall make some other efficient sound-signal at intervals of not more than one minute. There are fog-signals on light-ships and at shore stations on the coasts of all civilised nations; these are usually either horns (reed or siren) or explosives (see articles SIREN and LIGHTHOUSE); but the best of these are not to be trusted to implicitly in fog—they may be heard, *but may not*. The natural law governing the aberrations of signals in fog is not understood; the mariner who expects to hear a shore fog-signal should, if he does not hear it, at once have recourse to the lead.

The fog-signals used on railways are small cases charged with detonating powder, and laid upon the rails. They explode loudly when the wheel of an advancing train comes upon them. They are used not merely in fogs, but in all cases of danger from obstruction of the line, or in other cases of urgency when a train has to be stopped without delay. Station-masters and railway police are furnished with them.

Föhn. See WIND.

Föhr, a fertile island in the North Sea, off the west coast of Sleswick, to which it belongs. Area, 28 sq. m.; the inhabitants, Frisians by race, are principally engaged in fishing and fowling. The chief town is Wyk.

Foil (Lat. *folium*, 'a leaf') consists of metal reduced to very thin sheets, intermediate between the extremely thin leaf metal, such as gold and silver leaf, and sheet metal. There are two distinct classes of foil in common use—the foil which in tenuity approaches leaf metal, and the much stouter tinsel foil used by jewellers, and for theatrical ornaments, &c.

Tinfoil is made by rolling bars of tin down to fine sheets, which are further attenuated by being laid in piles and beaten with a wooden mallet. Formerly tinfoil was very largely used for the 'silvering' of mirrors, by amalgamation with mercury; but that process is now little employed (see MIRROR). The chief consumption of tinfoil is now in connection with the wrapping up of chocolate and other confectionery, and of tobacco and other products which must be kept from drying in the air. It is also largely used for lining small boxes and cases, and in the preparation of Leyden jars and other electrical apparatus.

The bright foil used by jewellers and for theatrical and other ornaments, under the name of 'tinsel,' is made of copper, tin, tinned copper, or silvered copper. The last is now chiefly used by jewellers. The metal is rolled in a flatting mill, and the requisite brilliancy of surface is produced by finishing between burnished rollers and polishing. The various colours are produced by coating the white metal with transparent colours mixed in isinglass size. A similar varnish without colour is laid over the white foil, to prevent tarnishing. The socket or setting in which a stone or paste is mounted is lined with the foil, which, by reflecting from the internal facets the light that passes through the stone, adds considerably to its brilliancy. The natural colours of real stones are sometimes heightened or modified by coloured foil, and factitious colours are thus given to the glass or 'paste,' as it is called, of which spurious precious stones are made.

Foil. See FENCING.

Foix, capital of the French department of Ariège, lies in a Pyrenean valley, 44 miles S. of Toulouse by rail. Of the ancient castle of the counts of Foix (1362) there remain only three towers, all dating anterior to the 15th century. The town has iron and steel works. Pop. 6000.

Foix, an old French family, which took the title of count from the district of Foix (now the department of Ariège), in the south of France. The first who bore the title was Roger, who died in 1064. Roger Raymond accompanied King Philip Augustus to Palestine and distinguished himself at the taking of Acre. Afterwards, on his becoming an adherent of the Albigenses, his estates were confiscated by Simon de Montfort. He was a patron of the Provençal poets, and died in 1223. The next succeeding counts held their lands of the king of France; they were principally engaged in waging a feud against the House of Armagnac, and in fighting for the French king in the English wars. Gaston III. (1331–91), called, on account of the beauty of his person, Phœbus, was noted for his knightly love of splendour and military prowess. For his assistance to the king against the English in 1345, he was made governor of Languedoc and Gascony. In 1356 he took part in a crusade against the heathen Letts of Prussia, and in 1358 rescued certain members of the royal family out of the hands of the Jacquerie insurgents. On being supplanted in the governorship of Languedoc by the Duc de Berri, Gaston maintained his position by force of arms, and defeated the duke at Revel. He left a work on hunting, *Miroir de Phébus*, whose bombastic style became a byword (*faire du Phébus*). After his death without children, in 1391, the estates and title went to a collateral branch of the family. Gaston IV. rendered good service to Charles VII. in his wars against England. In 1455 his father-in-law, John II., king of Navarre, named

him his successor, and the French king invested him with the seigniory of Carcassonne and the countships of Roussillon and Cerdagne. He died in 1472, when the family possessions were again divided. His grandson, Gaston (1489–1512), whose mother was Marie d'Orléans, sister of Louis XII. of France, received from his uncle the title of Duc de Nemours in 1505. In the Italian wars Gaston displayed such brilliant genius and bravery as to earn the title of 'Thunderbolt of Italy.' He twice overthrew the Swiss, at Como and Milan (1511); chased the papal troops from Bologna; seized Brescia from the Venetians; and won the battle of Ravenna over the Spaniards, 11th April 1512, in which, however, he fell, at the early age of twenty-three. On his death the estates and title went to the king of Navarre. Finally Henry IV. of Navarre attached the county of Foix to the French crown.

Fokshani. See FOCŞANI.

Folcland, or FOLKLAND, used to be explained as the public land of the nation in old English times, what remained to the nation over and above what was possessed by individuals, families, or townships. It was under the control of the king and witan, and, after England was consolidated into one kingdom, was very large. But it was always diminishing, portions being granted to individuals for services rendered, and to the church, &c.; the land so alienated from the public became Bócland (q.v.). Sir P. Vinogradoff, however, showed strong reasons for believing that folkland was rather land held by folkright, or common law, while bookland was held by charter. See LAND LAWS.

Földvar, or DUNA-FÖLDVAR, a town of Hungary, and a steamboat station on the Danube, 48 miles S. of Budapest, with sturgeon-fishery, vineyards, and manufacture of matches; pop. 15,000.

Foley, JOHN HENRY, R.A., sculptor, was born in Dublin, 24th May 1818, became a student of the Royal Academy in 1835, and first exhibited in 1839. His 'Ino and Bacchus' (1840) attracted much notice, and was followed by a succession of admirable classical and ideal works, including 'A Youth at a Stream,' 'Caractacus,' and several excellent subjects from Shakespeare. The most noteworthy feature of his work, however, was his careful and artistic execution of his statues and busts, which included the Hampden and Selden figures in St Stephen's Hall, Westminster; Goldsmith, Burke, and O'Connell, in Dublin; and the equestrian statues of Lord Hardinge and Sir James Outram, for India, which rank among the finest equestrian sculptures of modern times. The statue of the Prince Consort for the Albert Memorial is also Foley's work. He died 27th August 1874, and was buried in St Paul's Cathedral.

Fol'gore, an Italian poet who flourished at the end of the 13th century, the dates of whose birth and death and the incidents of whose life are unknown. He wrote a number of sonnets, all of which have been translated into English by Dante Rossetti and J. A. Symonds. Their poetic merit is far from contemptible, and they are particularly interesting from the vivid light which they throw on Italian society. Their prevailing tone is one of refined epicureanism, and their style is mainly remarkable for affluence of imagery. 'Every line,' says Symonds, 'presents a picture, and each picture has the charm of a miniature fancifully drawn and brightly coloured on a missal marge.' See Rossetti's *Dante and his Circle* (1874), and Navone's *Le Rime di Folgore* (Bologna, 1880).

Foliation, a term restricted by Darwin, and subsequently by geologists, to the alternating and more or less parallel layers or folia of different mineralogical nature, of which the crystalline schists are composed. It differs from Cleavage (q.v.), which is applied to certain superinduced divisional planes that render a rock fissile; and from lamination, in which the planes of separation in a rock are the result of deposition in successive layers. The folia of a schistose rock may be composed of only one mineral, but most commonly they consist of two or more; they are conspicuously lenticular, thickening and thinning out, and reappearing after an interval on the same or a different plane. These alternately lenticular folia are usually more or less closely welded or felted into each other, so that they are not readily separable; and they frequently present the appearance of being puckered or crumpled. The crystalline texture and the foliated character of the schists distinguish them at once from any ordinary bedded 'fragmental rock.'

Foligno, a town of Central Italy, on the Topino, 25 miles SE. of Perugia. The town has a modern appearance, and possesses a cathedral and several churches. Tanning, paper-making, the manufacture of sugar confectionery, and the cultivation of the vine and of silk are carried on. The town was destroyed by the people of Perugia in 1281, and in 1833 it suffered severely from an earthquake. In 1439 it became subject to the pope. Pop. 30,000.

Folkes, MARTIN, English antiquary, born in London on 29th October 1690, died on 28th June 1754, is known by two books on English coins—*A Table of English Gold Coins* (1736), and *A Table of English Silver Coins* (1745). He was a member of the Royal Society (president in 1741), of the Society of Antiquaries (president in 1750), and of the Paris Academy of Sciences.

Folkestone, a municipal borough, seaport, and bathing-place of England, on the coast of Kent, 7 miles WSW. of Dover, stands on uneven ground at the foot of a range of hills and on their slopes, the oldest part lying in a narrow valley, crossed by a fine railway viaduct. The town has rapidly extended and improved since the opening of the South-Eastern Railway, and of a daily service of steam-packets to Boulogne. Pop. (1881) 18,816; (1921) 37,571. Folkestone is included in the parliamentary borough of Hythe. The harbour is much used by boats employed in the herring and mackerel fisheries. In the vicinity are extensive Roman remains. Here Harvey, the discoverer of the circulation of the blood, was born in 1578.

Folkland. See FOLCLAND.

Folklore, a term first suggested by W. J. Thoms in 1846 (*Athenæum*, August 22, under his well-known signature 'Ambrose Merton') to designate what was then for the first time becoming a subject of wide popular interest, considered as a department of the study of antiquities or archæology, and embracing everything that related to ancient observances and customs, to the notions, beliefs, traditions, superstitions, and prejudices of the common people. Folklore, as understood by Thoms, had indeed been observed and noted by countless writers from the Father of History downwards; the *Gentleman's Magazine* in the 18th century, and, in the 19th, his own well-known journal *Notes and Queries* (instituted 1851) being invaluable repositories of such observed facts; but it was not till after the beginning of the 19th century that the value of folklore for the elucidation of the social history of mankind had become apparent to thinkers, and its systematic study been seriously begun. Nor had there been wanting special collections of detached facts, very varied in quality but all of precious value now, by curious antiquaries, as John Aubrey in his *Miscellanies* (1696), or by speculative original thinkers, as Sir Thomas Browne in his *Pseudodoxia Epidemica* (1646). The former discussed in a gossiping manner such matters as omens, dreams, corpse candles, and

second-sight; and another work by the same credulous author, *Remaines of Gentilisme and Judaisme* (ed. by James Britten, 1881), 'did not disdain to quote' a multitude of ancient customs which would otherwise have been forgotten, and which have proved to be a precious mine for later and more scientific students. The Rev. Henry Bourne published at Newcastle in 1725 his *Antiquitates Vulgares, or the Antiquities of the Common People*, valuable chiefly for its record of old popular customs connected with the feasts of the church; and at the same city John Brand published in 1777 the first edition of his famous *Observations on the Popular Antiquities of Great Britain*. This work, as subsequently enlarged by himself, partly from the stores of miscellaneous facts of folklore collected in Sinclair's *Statistical Account of Scotland* (1791–95), and thoroughly revised by Sir Henry Ellis in 1813, ill arranged as it is, remains the richest of such storehouses of folklore as formerly—of materials for folklore as now—understood. Of other books containing similar records more or less valuable of detached facts, it may be enough here to name Strutt's *Sports and Pastimes of the People of England* (1801); Hone's *Every Day Book* (1826–27), *Table Book* (1827–28), and *Year Book* (1829); and Chambers's *Book of Days* (1863).

Meantime the reawakening to natural poetry, and to the beauty of free emotional expression in literature, which lay at the foundation of what it is usual to call Romanticism, had already begun even in the 18th century, and the publication of Percy's *Reliques of Ancient English Poetry* (1765) had given a powerful impulse to Scott and others in England, to Herder, and to Arnim and Brentano in Germany, who found lying to hand a rich wealth of traditional poetry, the poetic value of which they fortunately had the eyes to see. But the study of folk-songs really began with Scott's *Minstrelsy of the Scottish Border* (1802–3). It was perhaps an advantage rather than a disadvantage that the first worker in this new field was but the folklorist unawares and mere great poet and romancer of genius that he was; for our folk-poetry would never have enriched and permanently influenced all later English literature but for its own intrinsic and genuine poetic quality, any more than our detached folklore facts would ever have risen above the dignity of the whimsical pastime of an idle hour but for their inherent though unsuspected faculty for throwing light backwards upon the history of human civilisation. And it is fortunate for us that we have had before us a succession of antiquarian students with curiosity enough to note and preserve things strange for their own sakes—facts merely half-understood or entirely misunderstood, but yet to be co-ordinated and systematised by later ages after a really scientific spirit had been born. The spread of book-learning and the inevitable diffusion of rationalistic ideas, the levelling of the ancient social distinctions, and the creation of totally new industrial conditions transplanting the people from the customs and ancient habitations of their fathers have stopped short the current of popular belief which has flowed traditionally down in undisturbed but ever-widening stream from the mists of obscure antiquity, and turned its waters, rich with the fertilising faculty of imagination, to overflow new fields within the vast vistas of science. Popular traditions began to be valued duly just as they began to decline and disappear; but fortunately a plentiful crop had been gathered and put into writing beyond the risk of oblivion before the growing disfavour for everything supernatural but religion itself, and the impatience of anything beyond the range of the practical and the profitable, had stripped our people of everything they had received from their fathers.

Yet the task of the folklore-collector even in England is not at an end, though the conditions under which he has to work are materially altered; for countless ancient notions still survive, although in strangely altered form, and although our citizens fondly imagine in all the pride natural to a little learning that all old things have been put away, and that all things have become new. The most consciously rational mind is ever unconsciously swayed by impulses and habitudes, the origins of which are so obscure as to be entirely unknown and even unsuspected, but which weigh irresistibly though imperceptibly upon it. The scientific student of folklore co-ordinates the results of observation and experience, and builds them into a unity. But he must not forget that to his generation belongs mainly the task of accumulating these materials, and that the building itself must be left to the larger generalisations of future ages. Meantime such works as Sir E. B. Tylor's *Primitive Culture* (1871), from a wide comparison of the essential identities and analogies between European and savage customs and superstitions, and Sir G. L. Gomme's *Folklore Relics of Early Village Life* (1883), from a close observation of the affinities of our own village and homestead customs with those of other lands, have shown us what large and significant constructive results may already be attained with the evidence we possess. It was the peculiar merit of Sir E. B. Tylor to have demonstrated the evidential value of such *survivals* of more or less savage earlier states of society as still exist among us to reflect light upon the past. 'Survival in culture, placing all along the course of advancing civilisation waymarks full of meaning to those who can decipher their signs, even now sets up in our midst primeval monuments of barbaric thought and life. Its investigation tells strongly in favour of the view that the European may find among the Greenlanders or Maoris many a trait for reconstructing the picture of his own primitive ancestors.' Sir J. G. Frazer's encyclopædic *Golden Bough* is formally a working-out of the relations of one such survival among the Romans.

Just as the science of archæology has been laboriously built up out of the relics of old peoples that have been brought to light, so the task of the folklorist is to construct the philosophy of primitive man from its still-surviving or recorded relics. These linger longest among the least progressive peoples, and it is in their superstitions and stories, whether in their native irrationality or as rationalised by a shallow philosophy, that the student will find the richest and most plentiful materials. He must not confine his pursuit of analogies to the experiences of merely Aryan or yet Old-World peoples, for in the survivals to be seen in the religious rituals and ceremonial traditions of the most civilised peoples he will find things absolutely identical with the beliefs and customs of present-day savages in Africa or the South Sea Islands. Neither identity of race, nor community of origin, nor conscious borrowing need be postulated if we accept the theory that the minds of men at parallel levels of culture are everywhere substantially the same, and develop naturally along the same lines in that gradual progress upwards, which is ever in movement, though ever differing in degree. The fundamental bases of popular beliefs then are everywhere the same: what is due to the particular race is the particular development of the belief. Gods, who are mere magnified men, capable like them of being influenced by magical powers, and not more superior than men themselves to trans-

formation into human and bestial forms; spiritual existences which pervade all nature, animate and inanimate alike, adding the human attribute of personality to all visible objects; ghost-souls surviving in shadowy form beyond the grave—these are the fundamental assumptions of all mythologies, and the essential foundations of the religion of all men. What race adds is the particular poetical form and colour with which the human imagination clothes its shadows. Andrew Lang, by his felicitous wealth of illustration, made this explanation the accepted working hypothesis of most mythologists of his time, who are often grouped together as forming the anthropological school. Since his death much ground has been gained by other theories. The Freudians have explained myths very much as they have Dreams (q.v.). The 'historical school' has been traced back to Friedrich Ratzel in the eighties of the 19th century, and to Drs Ankermann and Graebner in the 20th. In England it arose independently. Dr W. H. R. Rivers in his *History of Melanesian Society* (1914), a model of scientific method, showed that certain elements in the culture of the islanders are linked together in a way that enables the student to divide the whole into strata. These strata he believed to have been superposed one upon another by a succession of migrations. The interactions and adjustments of different cultures thus brought together are also important. 'The widespread similarities of culture are, it is held, due in the main, if not wholly, to the spread of customs and institutions from some centre in which local conditions favoured their development.' Such a centre Professor Elliot Smith finds in Egypt, whence Professor Perry and others seek to trace the world-wide diffusion of culture. It is not contended that the Egyptians colonised America, for instance; but that the building up of civilisation in response to local conditions can be traced in the history of Egypt, that Egypt passed on much to Crete and Babylonia, Babylonia to India, and so on, until not only in these regions, but even in the Pacific islands and America, we find the decayed remains of a culture that had no firm root in the people's own past. Much importance is attached to the search for gold and pearls, the setting up of megalithic monuments, irrigation, mummification, and a complex of customs and beliefs associated with these.

The first two generations of folklorists made a vast contribution to the science from the evidence offered within the Indo-European family; the third extended its borders to embrace the native Australians, the Zulus, Hottentots, Maoris, South Sea Islanders, Red Indians, and Eskimo; and extended the library of folklore and folk-tales to thousands of volumes.

First in importance of these is still the earliest, the *Kinder- und Haus-Märchen* (1812–14) of the brothers Grimm. The stories in the first two volumes of this wonderful work were collected during thirteen years from the lips of people living in Hesse and Hanau, many from a cowherd's wife with a special gift of story-telling. Wilhelm Grimm, writing in 1850, says: 'How unique was our collection when it first appeared, and what a rich harvest has sprung up since! At that time people smiled indulgently when we asserted that thoughts and intuitions were preserved in these stories, the origin of which was to be sought for in the darkness of antiquity. Now this is hardly ever denied. Stories of this kind are sought for with full recognition of their scientific value, and with a dread of altering any part of their contents, whereas formerly they were only regarded as worthless amusements of fancy which might be manipulated at will.' W. Grimm's *Deutsche Mythologie* (1835) is still unequalled in the range of its erudition and in the systematic thoroughness with which the mythology and superstitions of the ancient Teutons are traced back to the dawn of direct evidence and downwards in decay and diminution to the popular tales, traditions, and phrases in which they still unconsciously survive. These two works of Grimm created a school, whose abundant labours later folklorists have entered into, while they have enlarged the horizon of the science, because the stamp of soundness and sufficiency so far as it goes is impressed on all the work of Grimm and his successors, of whom, in Germany, the most eminent were Kuhn, Mannhardt, J. W. Wolf, and W. Schwartz.

Elsewhere, Castrén and Lönnrot devoted themselves to Finnish mythology; Asbjörnsen and Moe collected the Norse popular tales; Schiefner and Jülg, those of the Mongolians and Tatars; Hyltén-Cavallius and George Stephens, those of Sweden; Afanasief, those of Russia; Haltrich, of Transylvania; Kreuzwald, of Esthonia; Von Hahn and B. Schmidt, of Greece and Albania; Arnason, of Iceland; Rink, of the Eskimo; Bleek, of the Hottentots; Calloway, of the Zulus; J. F. Campbell, of the West Highlands of Scotland. The study of these tales involved the study of the customs imbedded in them, and ere long a plentiful crop of books appeared devoted to the preservation of popular proverbs, customs, rhymed riddles, and the like, among which a place of distinction is due to the *Fairy Legends and Traditions of the South of Ireland* (1825), by T. Crofton Croker; the *Popular Rhymes of Scotland* (1826) of Robert Chambers; *The Nursery Rhymes of England* (1842) and the *Popular Rhymes and Nursery Tales* (1849) of Halliwell(-Phillipps); and that not merely for the early date of their issue, but for their own intrinsic merits also. The great development of oriental studies that marked the 19th century opened up to the West through literary channels those vast treasuries of Eastern story from which many believe, as will be seen, that all our own traditional folk-tales were originally drawn in ancient ages. Max Müller's essays revealed to Englishmen a new world of undreamt-of affinities, and the combined charm of their literary grace, wide learning, and rare powers of exposition converted every reader to a theory which was only slowly displaced. Since then the study of folklore has become fashionable, indeed almost an article of patriotism, and societies have been formed in most countries to further its study. Of these the most important is still the Folklore Society of England, established in 1878, with a sufficiently wide programme, 'having for its object the preservation and publication of popular traditions, legendary ballads, local proverbial sayings, superstitions and old customs (British and foreign), and all subjects relating to them.' It numbers within its ranks most of the working folklorists of England, and has through its official organ, the *Folklore Record*, at first monthly, then quarterly as the *Folklore Journal*, later incorporated with *Folklore*, made numberless contributions of the first importance to the science; while it has also distributed valuable special treatises to its members.

The Folklore Society divides up the subject thus: I. *Beliefs and practices* relating to (1) the earth and the sky, (2) the vegetable world, (3) the animal world, (4) human beings, (5) things made by man, (6) the soul and another life, (7) superhuman beings—gods, godlings, and others, (8) omens and divination, (9) the magic art, (10) disease and leechcraft. II. *Customs:* (1) Social and political institutions, (2) rites of individual life, (3) occupations and industries, (4) calendar fasts and festivals, (5) games, sports, and pastimes. III. *Stories, songs, and sayings:* (1) Stories (*a*) told as true,

(*b*) told for amusement, (2) songs and ballads, (3) proverbs and riddles, (4) proverbial rhymes and local sayings.

Folksongs, Ballads, Counting-out Rhymes, &c.—The reader has already seen the important part that belongs to popular folksongs or Volkslieder in the scheme of folklore, and he will find this department already treated with some fullness in this Encyclopædia under the head of BALLADS. These belong also to literature proper, from their intrinsic poetic content, and from the important influence they have exerted upon more cultured poetry. The patriot whose survey ends with his own shores and the mere man-of-letters alike claim them as falling within their province, in so far as they are national history and literature as well as tradition. Yet these may be correlated with the traditional folk-poetry of other races no less than folk-tales, and we have a splendid example of this in Professor Child's treatment of our *English and Scottish Popular Ballads* (5 parts, 1882–88)—the best edition of a body of popular poetry available to the student.

Much attention has been paid to children's rhymes and formulas of play, which have been found to be handed down from immemorial antiquity, and to reflect with strange persistency the life and even the religion of long past times. The games and rhymes of American children of to-day agree not only with those of Old England, but with those of Germany, France, Italy, and Sweden. Those doggerel rhymes of unmeaning jingling words for 'counting out' live with startling persistence, and some idea of their venerable antiquity may be gathered from the history of the so-called 'Anglo-Cymric score,' a corrupted form of the Welsh numerals up to twenty, still used in Cumberland for counting sheep, but used by children in many parts of Great Britain, and more strangely still, even in America, where it has often been supposed to be of Indian origin. Of these jingles as many as 800 specimens were collected by a single editor (H. Carrington Bolton, 1888).

Folk-tales, their Content, Origin, and Diffusion.—These, the *Volksmärchen* of the Germans, the *Contes populaires* of the French, are properly popular tales handed down by oral tradition from remote antiquity. Besides this continuous life they have at various times been lifted into literature, and again reacted in new forms upon purely traditional lore, thereby complicating enormously the problems to be solved. Thus, in the *Odyssey* and *Rig-Veda* we find distinct traces of veiled and degraded folk-tales; while in the *Panchatantra*, *Hitopadesa*, *Kalilah wa Dimnah*, and Somadeva's *Kathá Sarit Ságara*, the *Thousand and One Nights*, the *Gesta Romanorum*, the *Disciplina Clericalis*, the *Tredeci piacevoli notti* (1550) of Straparola, Basile's *Pentamerone* (1637), the old French fabliaux, the *Decameron* of Boccaccio, and Chaucer's *Canterbury Tales*, we find many actual folk-tales, more or less disguised by artistic processes of elaboration and refinement. These stories, from whatever sources originally derived, exercised a profound influence upon both Eastern and Western literature. In 1697 Perrault published his famous *Histoires ou Contes du Temps Passé*, seven stories undoubtedly written down substantially in their traditional shape. They created a fashion, and in imitation of them literary fairy tales were steadily produced throughout the 18th century, as may be seen in the voluminous *Cabinet de Fées*. But the beginning of real science was, as has been seen, the *Kinder- und Haus-Märchen* of the brothers Grimm. Since their time thousands of stories have been printed from all quarters of the globe.

The Grimms early found a startling similarity in the substance of these stories, and it only remained for later workers to discover the same identities when the comparison was extended far beyond the range of Aryan affinities. It was found that certain incidents, plots, and characteristics occurred everywhere—as the ill-treatment of the youngest son or daughter, who is eventually successful, and is often the heir; the substitution of a false bride for the true; the abduction of a bride by a youthful hero, and the pursuit by her giant (or supernatural) father, who is outwitted by cunning; a supernatural husband or wife, who is for some cause obliged to abandon a human mate; forbidden chambers, and the disasters that follow from their being opened; descents into the world of gloom, and the danger of eating there; husband and wife forbidden to see each other or name each other's names; the souls of the dead entering animal forms; and the interchange of kindly offices, as if on equal terms, between men and beasts. Again, the incidents are usually unnatural and irrational, completely traversing ordinary human experiences: thus, magical transformations, cannibalism, incest, beasts and men intermarrying, women bringing forth beasts and *vice versâ*, and inanimate things obeying incantations and speaking like men are perfectly familiar occurrences. An attempt was made by Von Hahn, in the introduction to his *Griechische und Albanesische Märchen* (1864), to construct a scheme for classifying folk-tales so as to facilitate comparison, and this idea was developed by Baring-Gould, Alfred Nutt, and other folklorists, until at length it was adopted by the Folklore Society (Fourth Report, June 1882). A series of schedules was prepared for systematic tabulation, the following points being especially observed: (1) The fixing of a generic title for each story, and the abolition of the variant titles of the same story which now obtain in different collections; (2) the determination of a common terminology for the study of stories and for each description of story; (3) the determination of a common terminology for each story-incident; (4) the compilation of an index of story-incidents; (5) the tabulation of all stories in printed collections upon a common recognised plan. The Society also originated a similar analysis of customs.

The time is not yet ripe for any satisfactory answer to the sphinx-like riddle of the origin and manner of diffusion of folk-tales; here it must suffice to state briefly the chief attempts at an answer hitherto offered. The first theory, sanctioned by the august authority of the Grimms, and maintained by Max Müller, Von Hahn, Dasent, and, with more zeal than discretion, by Cox and De Gubernatis, is that popular tales form a part of the mythology of the Aryan peoples, and were carried by them westwards at the primeval dispersion. Some consider them the *detritus* of the saga and the epic, others again as the original elements by a reconstruction and artistic elaboration of which the epics and sagas were formed. The next contribution of first importance was made by Benfey, in the masterly introduction to his translation of the *Panchatantra* (1859). His contention was that the popular tales were carried to Europe from India within historical times, and diffused chiefly through literary channels, such as translations of Eastern story-books and the like. A few special sources were the fables connected with the names of Æsop or of Bidpai; the *Panchatantra*, especially the parent of tales; and *Syntipas*—in other versions called the *Book of the Seven Wise Masters*—more closely connected with novel literature. Among the more important media of communication may be named the wandering and trading Jews, the Moors in Spain, and the Crusaders in their intercourse with the Moslems in the East and with the orientalised Greeks of Byzantium. Dr Gaster (*Ilchester Lectures*, 1887)

made the old Slavonian religious literature the parent of the mediæval and imaginative apocryphal literature, the romances and epics, and the didactic fables; and argued that oral folklore arose out of this written literature, the traces of which may be found in saga and romance, in religious and epic poems, in riddles and tales, and even in popular beliefs, customs, and habits. The ultimate common origin of all these was the East, of which not only the religion but the profane literature reached the Slavonic peoples through the medium of Byzantium —the open gateway of the East. He postulated a previous literary period, and affirmed that not the legends alone, as now known to us, but also the fairy-tales, and even amulets and spells, were almost unknown in Europe before the 10th century. Mr Clouston and M. Cosquin follow Benfey with greater or less modifications; and Mr F. Hindes Groome made the striking suggestion (*The National Review*, July 1888) that one main channel of communication may well have been that ubiquitous, wandering, and specially gifted oriental race, the Gypsies. M. Cosquin argues that if the Aryan race before its dispersion preserved the myths only in their earliest germinal form, after the separate branches had lost touch of one another it would have been impossible for the final forms of the myths—the household tales as we have them now—to resemble each other so closely as they do. While admitting that the same ideas and situations are afloat wherever men exist at the same stage of culture, he refuses to allow that independent parallel or identical combinations are possible without conscious borrowing. What makes a story, properly speaking, is not the ideas which enter into it, such as speaking beasts, transformations, objects of magic, and the like, but rather the combination of the same, which is usually a thing entirely arbitrary; and it is impossible to believe, according to M. Cosquin, that identical successions and combinations of incidents can occur without transmission by some means or other. He argues that the combinations in European folk-tales are Indian, nay, Buddhistic; consequently they must have been transmitted within the historical period from India.

Some attribute the origin of all human culture to Egypt, but of course it might be said that ideas and combinations of ideas may have been carried from Egypt to India, which there ripened into fruit, and were scores of generations afterwards carried back again to the West.

The theory of Lang and the anthropological school has already been stated substantially in the foregoing pages. It makes the spontaneous generation of similar ideas, incidents, and arrangements of these, under the same physical conditions, and at parallel levels in culture, the most important element in the manufacture of folk-tales. Popular tales are thus 'kaleidoscopic arrangements of comparatively few situations and incidents, which again are naturally devised by the early fancy.' At the same time it admits that the process of borrowing has also gone on, and that stories once invented may have been carried from people to people by daring merchants, captured alien wives, and slaves bought or carried off by violence.

As in other departments of folklore, the pendulum has swung again from 'spontaneous and independent generation' to 'diffusion from one centre.' Thus Professor W. R. Halliday (*Folklore*, xxxiv. No. 2, 1923) gives (undogmatically) an explanation of European folk-tales not very different from Cosquin's. While pointing to signs of a certain current from west to east as well as from east to west, and suggesting various hypothetical centres of distribution—Celtic, Teutonic, Slavonic, Arabo-Persian, Indian—he tends to the opinion that these tales took their present form between the 9th and 13th centuries, when by way of Turkey and North Africa a victorious invasion of oriental stories took place. To the diffusion of Beast-fables (q.v.), however, a much earlier date is assigned. They probably came to Greece in classical times from the East.

See the articles on ANIMISM, BALLADS, BEAST-FABLES, CHAP-BOOKS, DEMONOLOGY, DIVINATION, FABLES, FABLIAUX, FAMILY, KIN, MAGIC, MYTHOLOGY, NURSERY RHYMES, TOTEMISM, WITCHCRAFT, and on the more important writers. Some of the more important books have been already mentioned; among general books may be named Bastian, *Der Mensch in der Geschichte* (1860); W. K. Kelly, *Curiosities of Indo-European Tradition and Folklore* (1863), antiquated, but still suggestive; Liebrecht, *Zur Volkskunde* (1879); Lang, *Custom and Myth* (1884), his preface to Mrs Hunt's trans. of Grimm (1884) and to his edition of Perrault (1888); W. A. Clouston, *Popular Tales and Fictions* (1887); Gustav Meyer's *Essays und Studien* (1885); Puymaigre, *Folklore* (1885); Steel and Temple, *Wideawake Stories* (1884); Hartland, *Science of Fairy Tales* (1891), and *Legend of Perseus* (1894–96); Lady Gomme, *Traditional Games* (1894–98); Sir John Rhys, *Celtic Folklore* (1901); Sir L. Gomme, *Folklore as an Historical Science* (1908); Sir J. G. Frazer, *The Golden Bough*, and *Folklore in the Old Testament* (1918); the Folklore Society's *Handbook* (ed. Gomme, 1890; ed. Miss Burne, 1914); Rivers, *History of Melanesian Society* (1914); Elliot Smith, *Migrations of Early Culture* (1915); W. J. Perry, *Children of the Sun* (1923), *Origin of Magic and Religion* (1923).

Folkmoot ('folk-meeting;' O.E. *mót*, *gemót*, 'assembly') was the old name in England for the public assembly of the nation for political and judicial purposes, or for collective deliberation. The old Germans had similar assemblies, as also the Scandinavians (the latter being called *Ting*, *Althing*). There were numerous local moots, such as the *shiremoot*, or county court. It cannot be said that there was in the old days a national folkmoot for all England, to which every freeman had a right to come; even the *Witenagemót* (q.v.) was not fully representative, but was rather a royal council of magnates. The *Moot-hall* was the hall of meeting; the *moot-hill*, the eminence or mound on which the open-air assemblies used to be held. The *mote* or *motte* (Old French), again, was the early Norman wooden castle on its mote-hill or artificial mound raised for the purpose—sometimes, no doubt, a moot-hill or older sepulchral mound utilised in this way (see CASTLE). See VILLAGE COMMUNITIES; Gomme, *Primitive Folkmoots* (1880).

Folksong, in music, has been defined as 'song and melody born of the people, and used by the people as an expression of their emotions and (as in the case of historical ballads) for lyrical narration.' It is passed on by tradition, often much changed in the course of transmission, till it is noted down by a collector. The folksongs of various peoples have sometimes exercised an invigorating influence on the works of composers; and, on the other hand, folksong is itself liable to be affected by the music of the conscious artist.

Folk melodies are very often constructed in one of the so-called ecclesiastical modes—Dorian, Mixolydian, Æolian, sometimes Phrygian; others again, including many Scots tunes, in the pentatonic scale. The Rev. John Broadwood in 1843 published a collection of *Old English Songs as now sung by the Peasantry of the Weald of Surrey and Sussex.* He was followed by Thomas Chappell, John Stokoe, Collingwood Bruce, Sabine Baring-Gould, Frank Kidston, W. A. Barrett, and Cecil Sharp. The Folksong Society was founded in 1898.

See Carl Engel, *Study of National Music* (1866); Kidston and Neale, *English Folksong and Dance* (1915); Cecil Sharp, *English Folksong* (1907); and the *Journal of the Folksong Society.* For the folksong as literature, see FOLKLORE, BALLAD.

Follicle. See Hair, Skin.

Fonblanque, Albany William, English journalist, was born in London in 1793, and when only nineteen exchanged the law for journalism. As editor of the *Examiner*, a leading Liberal weekly journal, he exhibited a singular keenness both of wit and intellect, and exercised no inconsiderable influence on public opinion between the years 1830 and 1836. The characteristics of his political writings may be gathered from his *England under Seven Administrations* (1837), a reprint of articles published in the *Examiner* from the period of the Canning and Goderich ministries to the return of the Melbourne ministry. Fonblanque's services to the Whigs were rewarded by his appointment to the uncongenial office of secretary to the Statistical Department of the Board of Trade in 1847. He died on 14th October 1872. A further collection of his writings from 1837 to 1860 was published by his nephew, together with a biographical memoir, in 1874.

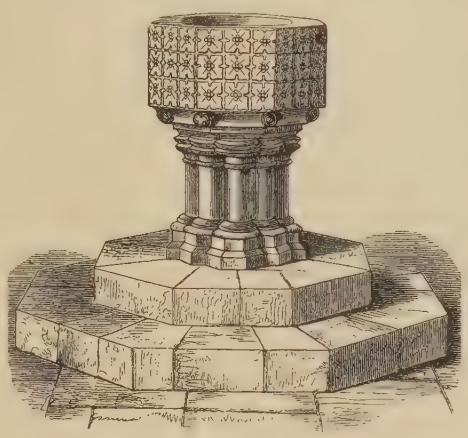
Fond du Lac (Fr., 'end of the lake'), the capital of a county of the same name in Wisconsin, stands at the southern end of Lake Winnebago, 63 miles NNW. of Milwaukee by rail. It is connected by steamers with Lake Michigan, through Winnebago and the Fox River, and carries on a large trade in lumber. It has many manufactures. The city is supplied with water by nearly a thousand artesian wells. Population, 20,000.

Fondi, a town of Italy, situated in the province of Caserta, NW. of Gaeta, and 6 miles from the sea, in a fertile but unhealthy plain, where grew the Cæcuban wine of classic times. The town, through which passed the Appian Way, is still partly surrounded by its ancient walls, and contains an old castle and a cathedral. Pop. 10,000.

Fonse'ca, a bay on the Pacific coast of Central America, discovered in 1522 by Gil Gonzalez de Avila.

Fonseca, Eleonora Pimentel, Marquesa di, was born in Naples in 1758, and was lady-in-waiting to Queen Maria Carolina until she forfeited her mistress's favour by remarking on her intimacy with Acton (q.v.). In 1798 she was an active partisan of the French; but on the fall of the Parthenopean republic in 1799 she was sent to the gallows at the instigation of the queen.

Font (*fons baptismalis*), the vessel used in churches as the repository of the baptismal water. In the early period, while immersion continued to be the ordinary rite in the administration of the sacrament of baptism, the Baptistery (q.v.) was furnished with a basin in the floor sufficiently capacious to admit of the immersion of a certain number of converts at one time. When infant baptism became general, fonts of an oblong form were employed, of suitable size for the immersion of a child. When it became customary to baptise by affusion—i.e. by pouring the water on the head of the person to be baptised—the size of the basin was naturally diminished, and eventually it assumed the dimensions and the form which are now familiar to us in most of the medieval churches in Great Britain and upon the Continent. The baptismal font, in its normal form, consists of a basin or cup, more or less capacious, but usually about 2 feet 6 inches in diameter, hollowed out of a solid block, and supported upon a stem or pedestal. It is ordinarily of stone, but some ancient examples of leaden fonts also occur, and a few of copper or of bronze. In general it may be said that the font, in its external design and character, followed the prevailing style of ecclesiastical architecture and ornamentation. There is some doubt as to whether any existing specimen in England really belongs to the Saxon period; but examples are found of all the later styles, from the Early Norman down to the latest revival of Gothic architecture in our own day; the Early English; the Decorated, of which a beautiful example exists in the church of All Saints, Norwich; and the Perpendicular, which is seen in its highest perfection at East Dereham in the same county of Norfolk. The annexed illustration exhibits a highly characteristic specimen of the fonts of the beginning of the 14th century, which stands in the church of Swaton, Lincolnshire, erected about 1310.



Font.

The external figure of the basin was often octagonal, sometimes circular, sometimes square, more rarely hexagonal. Ancient sarcophagi were sometimes employed. The basin was commonly supported on a single pillar or stem. Many cases, however, occur in which it rests on three, four, or five pillars, or, as in the engraving, on a group of pillars or pilasters united into a solid stem. In the square font the central basin rested on a solid central stem, and four shafts supported the four corners. The angles of the frame were used for carrying the salt, the oil, and the candles employed (see V. le Duc, *Dictionnaire*, vol. v. p. 539, for illustration). The exterior, as well of the basin as of the pedestal, was often highly decorated, ordinarily with sculpture, but occasionally also in gold and colours; the designs on the basin commonly representing subjects connected with baptism, or its types and symbols. We frequently meet around the pedestal figures of the apostles, sometimes only eleven in number, Judas being omitted.

In the Catholic Church the 'chrism,' or consecrated oil blessed by the bishop, and also the so-called 'oil of catechumens' are mingled with the baptismal water, which is reserved for subsequent use. With a view to the preservation of the water thus reserved, the font, especially when it is of porous stone, is sometimes lined with lead; and from an early date it has been furnished with a lid, which is secured by a lock. The lid was originally a flat wooden cover, but in later times it is carried up like a spiral canopy, and is often of a highly ornamental character.

The ordinary place of the font is at the western end of the nave, near the entrance of the church; but in some cases, especially on the Continent, it stands in a separate chapel or baptistery, or at least in a compartment screened off for the purpose. Even when it stands in the open nave, it is properly enclosed by a rail.

Fontainebleau, a town in France, in the department of Seine-et-Marne, is beautifully situ-

ated in the midst of a forest, near the left bank of the Seine, 37 miles SE. of Paris, with which it is connected both by steamers on the Seine and by railway. It furnishes a great deal of wine and fruit for the capital, and has manufactures of porcelain, and a sandstone quarry. Pop. 16,000.

Fontainebleau is chiefly famous for its château, or pleasure-palace of the kings of France, and the forest that surrounds it. The forest covers an extent of 65 sq. miles, and presents much fine scenery. The château is said to have been originally founded by Robert the Good toward the end of the 10th century. It was rebuilt in 1169 by Louis VII., of whom and of Philip Augustus it was a favourite residence, and was enlarged by Louis XI. and his successors. After being allowed to fall into decay, it was repaired and embellished by Francis I., by Henry IV., and by Napoleon I. Almost every king has added something in the way of enlargement or embellishment, so that it bears the character and style of almost every century. Louis-Philippe had all the paintings renovated, and the apartments restored in the taste of the 16th century. It was the residence of Christina of Sweden after her abdication, and here in 1657 she caused her secretary Monaldeschi to be executed. Under Louis XIV. it was occupied by Madame de Montespan, and under Louis XV. by Madame du Barry. Here Charles V. was entertained in 1539; here the decree for the revocation of the Edict of Nantes was signed in 1685; and here in the following year Condé died. In the château, too, Pope Pius VII. was detained a prisoner for nearly two years by Napoleon, and here this emperor signed the act of his abdication in 1814. In the forest Millet and other artists have lived and found their subjects.

Fontaines, MADAME DE, a French novelist, the date of whose birth is unknown. Her maiden name was Marie Louise Charlotte de Givri. She was a friend of Voltaire's in his youth, and died in 1730. She wrote *Aménophis* (a short story), and *La Comtesse de Savoie*, a tale of the 11th century.

Fontana, DOMENICO, an eminent engineer and architect, born in 1543 at Mili, on the Lake of Como. He became the papal architect in Rome, and was employed on many important public works, including the Lateran Palace and the Vatican Library. After the death of Sixtus V. he was royal architect and engineer in Naples, where he died in 1607.

Fontane, THEODOR (1819–98), German poet, essayist, and novelist, born at Neuruppin, had been a chemist until, in 1849, he took to literature in Berlin. See his Autobiography (2d ed. 1898), his *Briefe* (2d ed. 1905–10), and a Study by Hayens (1920).

Fontanes, LOUIS, MARQUIS DE, was born 6th March 1757, at Niort, in Poitou. After the completion of his studies he went in 1777 to Paris, where he acquired a reputation by his poems, *Le Cri de mon Cœur* (1778), *Le Verger* (1788), *L'Essai sur l'Astronomie* (1789), and *L'Épître sur l'Édit en Faveur des Non-Catholiques* (1789). He also wrote a metrical translation of Pope's *Essay on Man* (1783), with an elegant introduction, and an imitation of Gray's *Elegy*. In 1802 he was made a member, and in 1804 president, of the legislative body. His admiration of Napoleon was great; and his oratorical talents were often employed in eulogising the emperor's acts. In 1810 he entered the senate, and, passing on the fall of Napoleon into the service of the Bourbons, was raised to the peerage by Louis XVIII. He died at Paris, 17th March 1821. His writings, prose and poetic, which are regarded as models of elegance and correctness, were edited by Sainte-Beuve in 2 vols. in 1837, with a critical and biographical memoir.

Fontarabia, or FUENTERRABÍA, a picturesque old frontier town of Spain, at the mouth of the river Bidassoa, opposite to the French town of Hendaye, below the west extremity of the Pyrenees. It was long an important fortress, and the frequent object of contention between French and Spaniards, especially in 1638, when Condé was defeated, and in 1794, when its fortifications were demolished by the French. Battles were fought near by between Wellington and Soult in 1813, and during the Carlist war in 1837. Pop. 5600.

Fontenay-le-Comte, or FONTENAY-VENDÉE, a town of France, in the department of Vendée, is situated at the head of navigation on the river Vendée, 27 miles NE. of La Rochelle. Its most remarkable buildings are the beautiful Romanesque church of Notre Dame, with a Gothic spire 311 feet high, and the fountain from which the town is said to have derived its name. Pop. 9000.

Fontenelle, BERNARD LE BOVIER DE, was born at Rouen, February 11, 1657. His mother was a sister of Corneille. He was educated by the Jesuits and studied for the bar, but entered early in life upon a purely literary career in Paris. In the great quarrel of Moderns *versus* Ancients, which was then raging in France, he took part with La Motte and the other champions of the Moderns, assailing the Greek writers and their French imitators, and receiving in return the satiric shafts of Boileau, Racine, J. B. Rousseau, and La Bruyère. La Bruyère ridiculed him pitilessly in the *Caractères*, where he figures as Cydias, the pedant who ranks himself above Plato and Theocritus, and confidently awaits the hour when men will recognise his superiority to Homer. After the failure on the stage of his *Aspar*—a play to which Racine ascribed the origin of the practice of hissing in theatres—Fontenelle produced an imitation of Lucian, entitled *Dialogues des Morts*, and the *Lettres du Chevalier d'Her...*, a work of fiction written in the 'precious' style afterwards adopted by Marivaux. Thenceforth he devoted himself mainly to literary criticism and to the task of popularising science. His prose works brought him a remarkable reputation, which was to some extent merited by the elegance of the style and the perspicuity of the exposition. In 1697 he was made secretary to the Académie des Sciences, of which he afterwards became president. His *Éloges des Académiciens* added greatly to his fame, and after the death of Boileau in 1711 he enjoyed a well-nigh absolute rule in the Academy. He died in his hundredth year at Paris, on January 9, 1757, and is thus a link between the age of Molière and Boileau and the age of Diderot and Voltaire. He was a man of remarkable vigour and versatility of intellect. The best writers of his day endeavoured in vain to crush him. Had he not possessed rare strength of character he must have succumbed to the attacks of the brilliant men whose enmity he incurred. He attempted well-nigh every form of literature, he wrote idyls, and satires, and dialogues, and critical essays, histories, and verses of society, tragedies (*Aspar* and *Idalie*), scientific treatises, and operas (*Endymion*, *Thétis et Pélée*, &c.). He has left no book of outstanding merit; he was not a strong original thinker, and he seems to have cared less for truth than for paradoxes and piquant phrases. But his learning was far from contemptible, his style was graceful, and his wit was keen. His best works, the *Entretiens sur la Pluralité des Mondes*, and the *Histoire des Oracles*, the latter based on the treatise of the Dutchman, Van Dale, are still worth reading for the felicity of the expression and the frequent acuteness and ingenuity of the thought. Andrew Lang discovered the germ of his explanation of myths in Fontenelle's dissertation on Fables.

Fontenoy, a village of Belgium, 5 miles SE. of Tournay, was the scene of a battle (11th May 1745) in the war of the Austrian Succession, between the French, 60,000 strong, under Marshal Saxe, and the allies (English, Dutch, and Austrians), in nearly equal force, under the Duke of Cumberland. After a hard-fought fight the allies were forced to retreat, the loss on each side being about 7000 men. The victory was in great measure due to the courage of the 'Irish Brigade' in the French army, much besung by Irish poets. See F. H. Skrine's *Fontenoy* (1906).

Fontevrault (*Fons Ebraldi*), a town in Maine-et-Loire, 8 miles SE. of Saumur (pop. 2000), which owes its origin to a celebrated abbey founded by Robert d'Arbrissel, a Breton monk, in 1099, as the residence of a monastic society composed of both nuns and monks. The society followed the rule of Benedict, but was governed by an abbess, not by an abbot. The order of Fontevrault, which received the papal sanction in 1106 and 1113, soon spread through France and into Spain, and acquired great riches. The abbesses belonged for the most part to illustrious families, and were subject only to the pope. At the outbreak of the French Revolution there were fifty-seven priories of the order in France, which, however, were then abolished. The 12th-century church contains sepulchral monuments to several English sovereigns and princes, including Henry II., his queen, Eleanor of Guienne, Richard Cœur-de-Lion, and Isabella, the queen of John. Since 1804 the old monastic buildings and courtyards have been used as one of the central prisons of France, accommodating about 2000 convicts. See *Fontevrault et ses Monuments*, by Edouard (2 vols. Marseilles, 1874).

Greater Water-Moss (*Fontinalis antipyretica*): *a*, spore-case or capsule, divested of calyptra and lid, showing the peristome; *b*, spore-case, with its involucre of leaf-like scales.

Fonthill Abbey. See BECKFORD.

Fontinalis, a genus of Mosses, allied to Hypnum, but having the capsule in the bosom of the leaves, almost without stalk. Several species are British; one of which, the Greater Water-moss (*F. antipyretica*), growing upon rocks and roots of trees in brooks and ponds, is remarkable for the difficulty with which it burns, even when completely dried; on which account it is used in some parts of the north of Europe for lining chimneys to protect the adjacent woodwork from fire. Its shoots are a foot or more in length, and branched; they float in the water. The fruit is on the sides of the stems.

Foochow (*Fû-Châu*), capital of the Chinese province of Fû-chien, with suburbs extending to the river Min, 25 miles above its mouth. The town proper is surrounded with walls nearly 30 feet high, and 10 feet wide at the top. The river is thronged with floating houses, and is crossed by a great bridge, 329 yards long, built of huge slabs of stone, some of them 42 feet in length, resting on forty piers. The Min provides an easy communication with the interior, with which a large trade is carried on in timber, paper, and cotton and woollen goods; and the port, opened to foreign commerce in 1842, is one of the principal tea-markets and mission stations in China. The trade has declined owing to the competition of Indian teas; but the annual export is still extensive. There is also trade in salt, iron, fruits, and fish. The imports are chiefly cotton goods, sugar, rice, and beans. There are manufactories of silk and cotton fabrics and paper, and some shipyards; and on an island some three miles down the stream there is a large government arsenal. Pop. about 320,000.

Food is generally taken to indicate those solid matters which are consumed for the nourishment of the body, yet it is convenient to use the term with a much wider significance. Under the term food we are forced to speak of all matters ingested for nutritive purposes, irrespective of their physical conditions, and to include beverages of various kinds, and even the air we breathe. There is the following very simple reason for this somewhat extended definition of the word. Water is the basis of all beverages, and no ordinary solid food is without some water, while on the other hand most beverages, wine, beer, tea, &c., contain solid matter dissolved in water. Air, as every one knows, is a vital and ever-pressing necessity, and its action within the body is eminently nutritive. The tissues of the body consume its oxygen as well as the nutritive parts of beef and mutton; and air we must therefore include within our extended definition.

The classification of food into solid food, beverages, and air would, however, be an unsatisfactory one. The chemist has been able to divide the food-stuffs, as we may call them, into classes, by sorting into groups substances which have similar chemical and physical properties. This arrangement has the advantage that members of the same class have nearly always similar properties as regards their nutritive functions.

THE VARIOUS KINDS OF FOOD-STUFFS.

NITROGENOUS	Proteins.
	Nitrogenous extractives.
NON-NITROGENOUS	Carbohydrates.
	Fats.
	Vegetable acids.
	Inorganic salts.
	Water.
	Air (oxygen).

The Nitrogenous Foods.—These all contain nitrogen, and, inasmuch as during life nitrogen is invariably, and under all circumstances, excreted by the body, it must be replenished by nitrogenous food-stuffs. The proteins (albuminoid substances) are found both in the animal and vegetable world. Among animal proteins are the white of egg, the vitellin of the yolk, myosin from muscle (flesh of meat), fibrin and albumen from blood, and gelatin from bones. In the vegetable world vegetable albumens and globulins are present, and in the grains and seeds of plants they are found in quantity. Nitrogenous extractives are found in the muscles (flesh) of animals, and are probably of great value, chiefly as stimulants. Beef-tea is an extract of these from the muscle of the ox, and they are found in rich animal soups.

The Carbohydrates.—These are food-stuffs containing carbon, oxygen, and hydrogen, but no nitrogen. Moreover, the oxygen and hydrogen are present in the proportions which form water. The vegetable world furnishes us with the most important carbohydrates. These are the various starches and dextrines. Then we have the sugars—cane-sugar, grape-sugar, sugar of milk or lactose, &c. The flesh and other eatable parts of animals are poor in carbohydrates; nevertheless the latter are

found there. Glycogen (q.v.) or animal starch is widely distributed, although, except in the Liver (q.v.), it is present in small quantity.

Fats and Oils.—These substances, of a very high nutritive value, are found in both the animal and vegetable world. In vegetables they are especially abundant in seeds and fruits. In the animal world we find them in the tissues under the skin, and in many animals, such as whales, seals, &c., the blubber, as it is called, is present in enormous amount. The liver is generally found to contain a great deal of fat, as is also the tissue round the kidneys, and round other abdominal organs. The chief fatty matters present are olein, stearin, and palmitin.

Vegetable Acids.—The action of these substances as food-stuffs, though important, is not altogether understood; but their withdrawal from the food may lead to serious inconvenience. The most important vegetable acids are tartaric, oxalic, citric, acetic, and malic.

Inorganic Salts.—Of these the most important is common salt, or sodium chloride. It is present in small quantities in all foods, but in addition man requires as a rule a larger quantity. It greatly assists digestion, and probably is necessary for the formation of the gastric juice. Whereas it can pass through the system if taken in large quantities, yet a certain amount is required by the body to establish within it those conditions under which alone life is possible. Thus, many of the proteins would suffer complete alteration were it possible to abstract all the salt from the body, and the blood would become at once a turbid fluid which would rapidly cease to flow. In addition to sodium chloride there are many other salts required, such as potassium chloride and the phosphates of calcium and magnesium, the latter for the formation of bone. Iron salts are required for the formation of the colouring matter of the Blood (q.v.).

Water.—This all-important substance is taken in its natural form as spring, river, well, or rain water. In all cases certain inorganic salts are held in solution, which vary in their nature and quantity with the soil with which the water has come in contact. Organic (both animal and vegetable) matter may be present, especially in river and shallow well water. In addition, water is present in almost every kind of solid food, as well as in liquid foods and beverages. Bread, meat, cheese, potatoes, all contain a large quantity of water, and such substances as flour and biscuits are rarely free from a trace of it. Its importance for the needs of the economy are at once apparent when we recollect the large amount daily excreted by the lungs, the kidneys, and the skin, all of which require replenishing.

Air.—From the atmosphere we breathe oxygen is obtained, without which the other classes of food-stuffs would avail us little. Their destination is, in fact, to meet with this oxygen, and suffer changes called 'oxidation changes' within the tissues of the body.

Sources of the Food-stuffs.—*The Carcasses of Animals.*—From the carcasses of animals we obtain meat and bones and fat, all of which have an important nutritive value. Cartilage, gristle, and yellow elastic tissue (pax-wax) are of almost no utility. Meat consists of from 70 to 80 per cent. of water, and the rest of proteins, extractives, fats, salts, and indigestible substances. The proteins of meat form about 20 per cent. of the whole; they are easily digestible, more so perhaps than are the vegetable proteins. Amongst the protein fibres of the meat a certain amount of fat is generally lodged, and here and there it is collected in larger masses. The percentage quantity varies immensely, but even in lean meat there is on an average 2 per cent. of fat present. The extractives of meat are valuable stimulants of digestion, and the salts, chiefly chlorides and phosphates, are very abundant. The flesh of domesticated mammals, such as oxen, sheep, and pigs, is especially rich in fat. The same may be said of fowls, ducks, and geese. The flesh of wild mammals and birds contains less fat, and very little is ever present in the flesh of fish. The flesh of animals is almost invariably eaten after cooking. In this case the proteins are coagulated, the fibrous tissue of the meat is softened and rendered more digestible, and the savoury qualities of the meat are developed.

Meat may be cooked directly after killing, and in this case it is tender and very palatable. If the animal be kept for even a few hours the meat becomes hard owing to death coagulation; cooked at this stage it is tough and indigestible; it requires to be kept until it softens again. If kept for some time meat putrefies and becomes high. Game is generally eaten in this condition, and it is readily digested, and admirable in flavour. It is, however, apt to disagree with many people, and even fatal consequences may follow its consumption. High meat is putrid meat; the proteins have in part decomposed, but the remainder is partly in the very digestible form of a peptone protein. The meat contains microscopic organisms termed Bacteria (q.v.), and is full of their excretions (see Ptomaines). Mussels, oysters, and other shell-fish sometimes produce bad dyspepsia, nettle-rash, and even graver symptoms, although they are eaten perfectly fresh. Many fish, especially during the breeding season, are quite unpalatable or even poisonous, apart from putrefactive changes. These fish are for the most part inhabitants of the tropical seas. Idiosyncrasy plays a very important part in our selection of animal foods. Diseased meat is always to be avoided. No one questions the fact that the flesh of the pig affected with *Trichina spiralis* must be avoided. The parasites are not at all readily killed by cooking, and very dangerous febrile symptoms are produced by the action of the young trichinæ which wander into the tissues. Tapeworm is also produced by the consumption of the flesh of the pig and ox, although if the flesh be thoroughly cooked the danger is greatly diminished.

Bones of animals are very important articles of food. In the interior of the shafts one finds the yellow marrow, consisting of fat of a very savoury taste. At the ends of the bones is situated the red marrow, which is practically devoid of fat, but is rich in nitrogenous extractives. The whole bone, too, is porous, and boiling is able to extract from its interior a rich supply of nitrogenous extractives. Hence bones are useful for making soups, which we may look upon as hot decoctions of salts and extractives, having a useful stimulating action, but not of any great nutritive value, unless thickened by the addition of pieces of meat or vegetables, which should be served up with the soup. The bone itself consists of a gelatin-yielding substance termed *collagen*, which is chemically united with earthy inorganic salts. This gelatin may be removed by prolonged boiling, and is used for making jellies, and for various other purposes.

Cereal Grains.—These are very important articles of food, and are largely used by mankind in nearly all parts of the globe. The most important cereal grains are those of wheat, oats, rye, barley, rice, and maize. They form very condensed articles of food, containing little water, and consisting of highly nutritive solid matter. They all contain an abundance of starch, together with smaller quantities of dextrine and sugar. Protein matters are also present in no inconsiderable amount, consisting chiefly of insoluble substances, such as gluten-casein, gluten-fibrin, gliadin, together with

some soluble albumen. The cereals are as a rule deficient in fat and salts.

Wheat-flour and Bread.—Wheat is rich in albuminous matter, containing about 12 per cent. It contains about 70 per cent. of starch, and very little fat. The grain is crushed and separated into flour and bran. With the loss of the bran the flour loses some fat, salts, and nitrogenous matter; on the other hand, bran is irritating to the digestive mucous membrane. Whole-meal bread is therefore more nourishing, but is apt to disagree.

If flour be mixed with water it forms a sticky dough or paste. This consists of gluten, a nitrogenous substance of a sticky nature, by which the granules of starch are held together. On heating this dough, with or without admixture of eggs, milk, &c., pastry, biscuits, &c., are made. Macaroni is made by forcing dough through small apertures during the application of heat. Bread (q.v.) is dough inflated with carbon dioxide, which gas may be generated in the dough itself, or may be driven into it by pressure. When flour is converted into bread much of the starch is converted into the more easily digested dextrine, and the albumens are coagulated and otherwise changed. It is rendered soft and open, readily permeable by the digestive juices. One hundred pounds of flour yield about 135 lb. of bread. See BISCUITS.

Oats and Oatmeal.—Oats have this advantage over wheat, that they contain more fat and more saline matter. They may be looked upon on this account as more valuable food, when the diet is limited to a few articles only. They are ground into oatmeal, from which porridge may be made. Oatmeal boiled with a large quantity of water, so as to form a drink, has been highly spoken of. It is capable of forming a much more sustaining drink than perhaps any other, and is much advocated for the use of labourers, especially for those engaged in harvesting or in other labour where great exertion has to be made in a short space of time.

Barley, Maize, and Rye.—These are very nutritious, the maize containing about 6 per cent. of fat, in addition to albuminous and starchy matter. Rye and barley are apt to produce intestinal irritation.

Rice.—This grain is poor in nitrogen, and contains little fatty matter; so that those who subsist almost entirely upon it are obliged to supplement its deficiencies by admixture with fat, and with protein matter either in the form of milk or legumes. It should not be cooked by any boiling process, inasmuch as during the process it loses much of its nutritive value, the albumens being in part dissolved away. It should be steamed in preference.

The Legumes or Pulses.—These include the peas, beans, and lentils. They are distinguished by containing large quantities of nitrogenous matter, and accordingly their chief utility is to supplement the deficiencies of starchy and fatty food. They are eaten with rice in India, and in England they form a favourite dish—'beans and bacon'—equivalent to the 'baked beans' of New England. The Mexicans, however, are the greatest consumers of beans (*frijoles*) in the world, although this vegetable is nearly equally popular throughout Central America; and the *garbanzo*, or chick-pea, fills the place of the potato in Spain. Lentil soup is a valuable food. The pulses are not readily boiled, and are not digested very easily.

Vegetable Roots, &c.—Vegetable roots and tubers yield abundant food to man, of a highly nutritive quality, and containing as a rule a large quantity of starchy matter. The potato is one of the most important tubers. As it contains little nitrogenous and fatty matters, these must be added when the diet consists largely of potatoes. This tuber should be steamed rather than boiled: it is very digestible, especially when not too young. Since 1845, the year of the great potato disease, the plant has deteriorated, and, some maintain, is a less nutritive food than it had previously been. Arrow-root, which consists almost entirely of starch, and is largely adulterated with other forms of starch, cannot be considered in any other light than that of a single food-stuff, and in consequence it must always be used as an addition to other foods. The same remark applies to Tapioca (q.v.), and to sago, although this latter is obtained not from a root, but is cut away from the centre of the stems of several kinds of palm-trees. Other roots are the Jerusalem artichoke, containing sugar and nitrogenous matter, and turnips, carrots, and parsnips, containing starch, sugar, and a small quantity of nitrogenous matter. Beet-roots, mangold-wurzels, and radishes are all succulent roots, containing both starch and sugar.

Vegetables.—The most important vegetables are members of the cabbage tribe, amongst which may be mentioned the common cabbage, the red cabbage, cauliflower, Brussels sprouts, various kales, and broccolis. These have not a very high nutritive value, but they supply the economy with useful salts, and are in consequence very highly antiscorbutic. Much the same may be said for the lettuce, onion, mustard, cress, endive, &c.

Fruits.—These are of value chiefly on account of the sugar and vegetable acids they contain. The sugar is in a form which is readily absorbed; and, on account of the large quantity of vegetable acids, they have a very important antiscorbutic action.

Nuts, such as coconuts, walnuts, Brazil-nuts, are rich in oily and nitrogenous matter. They are not easily digested, however.

Beverages.—Water is the main constituent of every beverage. Most beverages contain solid matter, either in solution or in a state of suspension. We may divide beverages into nutritive and stimulating, the most useful ones combining both these properties. Perhaps the most important nutritive beverage is milk. It contains all the necessary food-stuffs, as is shown by the fact that the newly-born child can thrive on it alone. Its percentage composition is nitrogenous matter, 4 per cent.; fat, 4; milk-sugar, 5·2; salts, 8; water, 86 per cent. The composition varies in different breeds of cows. The Alderney cow yields a milk that is very rich in fat, while the milk of the long-horned cow is rich in casein. It varies too with the pasturage, and may even acquire poisonous properties. The peculiar taste of the milk from cows fed on turnips is well known to every one. The milk of the ass may frequently be taken by persons who are unable to digest cow's milk. Cream consists of the fat of milk, and is obtained by allowing freshly drawn milk to stand for some hours. The lighter cream floats to the surface, and may be removed. The name 'skimmed milk' is applied to the residue after removal of the cream. Buttermilk contains less fat than does skimmed milk. It is, however, of important nutritive value, as it contains much nitrogenous matter, salts, and sugar.

Tea, Coffee, and Cocoa are restorative beverages having a stimulating action. They have little nutritive value unless taken with milk and sugar. Tea contains an astringent substance—tannin, which causes the rough taste experienced when it is drunk without milk. The addition of a few drops of the latter substance prevents its astringency, by precipitating the tannin as an insoluble albuminous tannate. It should be made by pouring boiling water over the leaves; if the leaves are boiled in water they lose their aroma, and much astringency is developed. On account of its astringency tea

slightly impedes digestion and lessens the action of the bowels. Theine is the active principle. Coffee has, roughly speaking, the same composition as tea. Its active principle is *caffeine*, and it contains a tannic compound and a characteristic volatile oil. As a beverage it is stimulating; but it retards digestion and the action of the bowels. Like tea, it is said to prevent tissue waste, and it increases the action of the skin. Cocoa is much more nutritive than either tea or coffee, as it contains starch and a large quantity of fat and protein matter. Chocolate is prepared by adding sugar and flavouring matter to the cocoa. See also KOLA.

Alcoholic Beverages.—Alcohol is an article of food of some nutritive value, though perfect health is compatible with total abstinence (see ALCOHOL). Alcohol is undoubtedly oxidised within the body, although if taken in any quantity the excess is eliminated. Taken in reasonable quantity it stimulates the action of the heart, and probably raises slightly the temperature of the body; but it retards to some slight extent the action of the gastric juice. It is also a mental stimulant, producing exhilaration. In many alcoholic beverages a large quantity of saccharine matter is present, and these may in consequence hold a place as possessing high nutritive qualities. Such are beer and porter. Bitter principles, when present, as in beer, are gastric stimulants, and probably assist digestion by increasing the secretion of the gastric juice.

The Economics of Food.—In temperate climates when a pastoral people turn their attention to agriculture they become to a great extent vegetable feeders. Their diet no longer consists chiefly of the flesh and milk of animals, but in addition includes the use of a large proportion of grains, pulses, and other vegetable food-stuffs. The agricultural race in time displaces the pastoral one, for several reasons. In the first place, the very fact that the art of agriculture has been acquired commonly indicates a greater mental development, certain to exercise its full weight in the struggle for existence. In addition, however, there is another and an equally potent reason. Vegetable matter is, and must always be, more economical as a food-stuff than animal matter. A given area of soil must always yield food-stuffs of a more nutritive value if that soil has been used to cultivate vegetables such as corn, oats, &c., to be eaten directly by man, than if it be used for the maintenance of any animal kept for the subsequent nutrition of man. The reason is very simple. A vegetable has a certain nutritive value—i.e. it will yield when eaten so much muscular energy, &c. If eaten by man it will directly administer to the energy of his body, and his muscles and brain will be nourished by it. If it be given to an ox part will no doubt go to the nourishment of the ox, and then, if the ox be eaten, to the nourishment of the man. The greater part, however, will be consumed by the ox to obtain materials for *its own energy*. Every step it takes, the perpetual movement of its jaws in chewing, the whisking of its tail to chase away a fly, these are all deductions to be made out of the nutritive value of its food, and the residuum alone, and that a comparatively small one, is what is obtained when the ox is consumed. So truly is this understood by practical men that they try to lessen these deductions to the greatest possible extent. They prevent as much movement as possible on the part of the animals to be used as food, penning up the poultry, and placing the pig, naturally an active and intelligent animal, within the confines of a sty. In order that the animal may be compelled by a process of exclusion to devote itself entirely to feeding and to furthering the development of fat, it is rendered asexual by an operation which is in a high degree painful. Nevertheless, these deductions are only lessened in some degree, and it will ever be impossible to get rid of them altogether. It follows, therefore, from what we have said that, at any rate in a thickly populated country, it is an economy to go straight to the vegetable world for food rather than to consume the flesh of animals. The high price of meat is an indication of what has just been alluded to. There is a loss in converting vegetable into animal produce, and the value of the latter rises in proportion to that loss. Life may be very cheaply sustained on vegetable produce, such as bread, oatmeal, peasemeal, &c. The cost of animal food is two or three times as great in the case of milk, cheese, and butter, and about twelve times as much in the case of beef, veal, ham, &c. According to Frankland, if an average man were to confine himself to one article of diet he would require, to support life from day to day, 5·068 lb. of potatoes; 1·156 lb. of Cheshire cheese; 1·335 lb. of peasemeal; 1·341 lb. of ground rice; 2·345 lb. of bread; 3·532 lb. of lean beef; 4·300 lb. of lean veal; 6·369 lb. of whiting; 8·745 lb. of white of egg; 2·209 lb. of hard-boiled egg; 9·865 lb. of carrots; 12·020 lb. of cabbage; ·693 lb. of butter; ·555 lb. of beef fat; 6¾ bottles of stout. It is not, of course, supposed that healthy existence can be maintained on one or two food-stuffs alone; the diet should be varied as well as plentiful, and in order to be economical it must be drawn largely from the vegetable world.

The various countries of the world differ very widely in regard to their power of producing within their own borders food and to spare for all their inhabitants. The United States is the most conspicuous example of a country which raises in superabundance the essential food-stuffs required by its own people, and has of many kinds a large surplus available for export. Few European countries save Russia are self-sufficing in this way. Great Britain is the most notable example of a country which is very largely dependent on foreign countries for the food of its people, and to an ever-increasing extent. The meat-supplies (including animals) come from the United States, Argentina, Denmark, New Zealand, and Canada; butter from Denmark, France, Russia, and Canada; sugar from Germany, France, and British West Indies; cheese from Canada, United States, and Holland; eggs from Russia, Denmark, and Germany.

However great be the advantage to Great Britain in having access thus freely to the best markets of the world, there is one aspect of the consequent dependence upon foreign countries which has caused misgivings. What could a country dependent for such a large proportion of its food-supplies on foreign countries do in time of a war with a great state, even if it were not one of those on which it was directly dependent? This problem was referred to a Royal Commission which was appointed in 1903 and reported in 1905. The Great War of 1914–18 led to a practical working out of part of the question, notwithstanding the failure of the submarine to stop importation. Within the country, government control of distribution was resorted to, while the food-hoarder and the profiteer sprang to notoriety.

By botanists the word food is commonly applied not to the substances taken into the plant-body, but to those which the plant itself elaborates from them. A green plant obtains water and dissolved salts from the soil, and carbon dioxide from the air. From these it forms carbohydrates, proteins, &c., on which it feeds. Parasites and saprophytes, of course, get their food ready-made.

See ADULTERATION, DIET, DIGESTION, COOKERY, INFANTS (FEEDING OF), PARASITIC ANIMALS, VEGETARIANISM, and the books there cited; also ALCOHOL,

BEER, BREAD, CHOCOLATE, COCOA, COFFEE, PRESERVED PROVISIONS, VITAMINS, WINE, &c. For plants, see PHYSIOLOGY (VEGETABLE), CHLOROPHYLL, ROOT, SAPROPHYTIC PLANTS, PARASITIC PLANTS, FUNGI, BACTERIA, SYMBIOSIS, NITRIFICATION, NITROGEN-FIXATION, &c.

Fools, or JESTERS, persons who were kept in the households of princes and lesser dignitaries to furnish amusement by their real or affected folly. Wace has left a curious account of the preservation of William the Conqueror's life by his fool Goles. Other fools whose names have descended are the Hitard of Edmund Ironside, the Will Somers of Henry VIII., Archie Armstrong, who lost his office for jests which the petty-minded Laud could not endure; and in France Caillet and Triboulet in the time of Francis I., and Chicot in the reign of Henry III. Triboulet figures in Rabelais, and is the hero of Hugo's *Le roi s'amuse* and of Verdi's *Rigoletto*. The last private person to keep a fool in England was Lord Suffolk, whose jester, Dicky Pierce, was buried at Berkeley in 1728. Jamie Fleeman (1713–78), the Laird of Udny's fool, is yet remembered in Buchan.

In the East the office of jester existed in the 8th century, and probably much earlier in India. The famous Khalif Haroun al-Raschid had a jester named Bahalúl, some of whose sayings and doings have been preserved by Arabian writers. He appears to have possessed vivacity, wit, and observation, which were, however, often concealed under a mask of simplicity, and he was permitted to take great liberties with the khalif's courtiers. 'I wish,' said Haroun to him one day, 'I wish you would procure me a list of all the fools in Bagdad.' 'That would be difficult, O Commander of the Faithful,' replied the jester; 'but if you desire to know the wise men, the catalogue may soon be completed.' This found its way—*mutatis mutandis*—into English jest-books in the 16th century. One day Bahalúl was discovered seated on the khalif's throne, for which Haroun awarded him a whipping; then said the jester, 'O Commander of the Faithful, I sat in this seat only half-an-hour and have been whipped for doing so; what do *you* deserve who sit in it every day?'

A collection of Ramakistnan's jests in the Tamil language was translated into English and Telugu by Narrain Sawmy, and published at Madras in 1839, and not a few of them are almost identical with tales ascribed to European court jesters, such as our English Scogin and the Italian Gonella. This almost unknown little book explains how he was endowed with so much wit that he became the greatest jester in the world, and by the exercise of this wit at the court of a raja, was able to maintain himself and family. Like the European court jesters, Ramakistnan's too ready wit frequently roused his royal master's wrath; but though sometimes condemned to death he always evaded it, and was again and again received with favour through his irresistible drollery. His jests, however, have none of the coarseness which is the chief characteristic of his western brethren; for example, in his counterpart to the well-known jest of Scogin, when the king commanded him never to show his face in the royal presence again, he saves propriety and carries out his jest by entering with a large pot over his head and down to his shoulders. The Shakespearian stage fool has been traced to the Vice of the mystery and morality plays. See Douce, *Illustrations of Shakespeare* (1807); Dr Doran, *History of Court Fools* (1858); Lionel Johnson in *Noctes Shakesperianæ* (1887); H. Bradley in *A Book of Homage to Shakespeare* (1916); O. M. Busby, *Studies in the Development of the Fool in Elizabethan Drama* (1923). For APRIL FOOLS, see APRIL.

Fools, FEAST OF. The Romans kept the festival of Saturn, in December, as a time of general license and revelry. During the brief season of the Saturnalia (q.v.) the slave reclined on his master's seat at table, the master waited upon his slave, and society for the moment seemed to be turned upside down. The grotesque masquerade survived the pagan creed which gave it birth, and not only kept its place among the Christians, but, in the face of solemn anathemas from fathers and councils, found its way into the ceremonial of the Christian church. It was called, at different times and places, by many different names, but latterly came to be best known as the Feast of Fools (*Festum Fatuorum, Festum Stultorum*). The rites practised varied greatly, but were everywhere marked by the same spirit of broad, boisterous drollery, and coarse but not ill-natured caricature. The donkey played such a frequent part in it that the pageant was often called the Feast of Asses (*Festum Asinorum*). In some places the ass of Balaam was figured; in others, the ass which stood beside the manger in which the infant Saviour was laid; elsewhere, the ass on which the Virgin and Child fled to Egypt, or the ass on which Jesus rode into Jerusalem. In every instance there was more or less attempt at dramatic representation, the theatre being generally the chief church of the place, and the words and action of the drama being often ordered by its book of ceremonies. Several rituals of this sort are still preserved: that which was in use at Beauvais, in France, has a rubric ordering the priest when he dismisses the congregation to bray three times, and ordering the people to bray three times in answer. As the ass was led towards the altar he was greeted with a hymn. Where the ass did not come upon the stage the chief point of the farce lay in the election of a mock pope, patriarch, cardinal, archbishop, bishop, or abbot. These mimic dignitaries took such titles as 'Pope of Fools,' 'Archbishop of Dolts,' 'Cardinal of Numskulls,' 'Boy Bishop' (q.v.), 'Patriarch of Sots,' 'Abbot of Unreason,' and the like. On the day of their election they often took possession of the churches, and even occasionally travestied the performance of the church's highest office, the mass, in the church's holiest place, the altar. In some convents the nuns disguised themselves in men's clothes, chanted mock services, and elected a 'little abbess,' who for that day took the place of the real abbess.

The Feast of Fools maintained itself in many places till the Reformation in the 16th century. At Antibes, in the south of France, it survived till the year 1644, when we have it described by an eye-witness in a letter to the philosopher Gassendi. The scene was, as usual, a church; and the actors, dressing themselves in priests' robes turned inside out, read prayers from books turned upside down, through spectacles of orange-peel, using coal or flour for incense, amid a babblement of confused cries, and the mimic bellowings of cattle, and grunting of pigs. See Tilliot, *Mémoires pour servir à l'Histoire de la Fête des Fous* (Lausanne, 1741), and Schneegans in Müller's *Zeitschrift für Deutsche Kulturgeschichte* (1858).

Fool's Parsley (*Æthusa Cynapium*), an umbelliferous plant, common as a weed in gardens and fields in Britain, and in most parts of Europe, somewhat resembling parsley in its foliage and general appearance, so that serious accidents have occurred from its being mistaken for that herb; for it is a poisonous plant, somewhat resembling hemlock in its properties. With the curled variety of parsley it cannot easily be confounded; the leaves are smaller and glossy, and have a disagreeable garlic-like odour when rubbed. The growth is annual, but at first more rapid than that of true

parsley. When in flower it is readily known from every other plant in British gardens by its umbels wanting general involucres, but having upon the secondary umbels partial involucels of three slender leaves hanging down on one side.

Fool's Parsley (*Æthusa Cynapium*): *a*, umbel.

Foot. In man the bones of the foot are twenty-six in number, and are arranged in three natural groups—viz. the tarsal bones, which are the hindermost; the metatarsal bones, which occupy the middle portion; and the phalanges of the toes anteriorly. The tarsal bones, seven in number, are short and somewhat cubical, and form the heel and the hinder part of the instep. The uppermost (see fig. 1) is called the *astragalus*, from its supposed resemblance to the dice used by the Romans. Above, it articulates with the two bones of the leg, the *tibia* and *fibula*, and through these bones the whole weight of the body is thrown upon the two *astragali*. Below, it is connected with and rests upon the *os calcis*, or heel-bone, which is the largest bone of the foot. Immediately in front of the astragalus, and supporting it in this direction, is the *scaphoid* or boat-like bone.

Fig. 1.—Bones of the Foot and Ankle:
a, tibia; *b*, fibula; *c*, astragalus; *d*, os calcis, or heel-bone; *e*, scaphoid bone; *f*, *g*, *h*, the internal, middle, and external cuneiform bones; *i*, cuboid bone.

In front of the scaphoid bone are the three *cuneiform* or wedge-shaped bones; and on the outer side of the cuneiform bones, and in front of the os calcis, is the *cuboid* bone. We see from fig. 1 that the front row of tarsal bones is composed of the three cuneiform bones on the inner side of the foot, and of the cuboid bone externally. There are five metatarsal bones passing forward, one for each toe. Each cuneiform bone is connected with one, and the cuboid bone with two, of these metatarsal bones. Behind, they are close together, but as they run forward they diverge slightly from one another, and their anterior ends rest upon the ground and form the *balls* of the toes. They constitute the forepart of the instep. The remaining bones are those of the toes, and are named the *phalanges*, each toe having three of these bones, excepting the great toe, which has only two. (A similar law holds for the bones of the hand, each finger having three phalanges, but the thumb only two.)

The instep is composed of the seven tarsal and the five metatarsal bones, which are so arranged and connected (see fig. 2) as to form the *plantar* arch from the extremity of the heel-bone to the balls of the toes. The astragalus forms the summit or keystone of this arch, and transmits the weight which it receives back to the heel, and forward to the balls of the toes.

The bones where they articulate with one another are covered with a tolerably thick layer of smooth cartilage, and by this means, together with the very slight movements of which each bone is

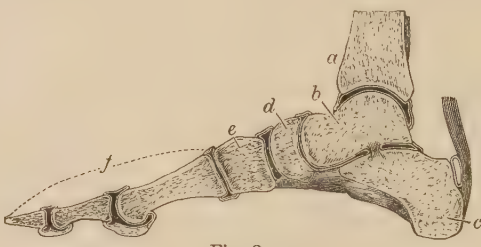


Fig. 2.
Section through the lower end of the tibia *a*, and through the astragalus *b*, the heel-bone *c*, the scaphoid bone *d*, the internal cuneiform bone *e*, and the bones of the great toe *f*.

capable, a degree of elasticity is given to the foot, and consequently to the step, which would be altogether wanting if the plantar arch were composed of one single mass of bone. This elasticity is far greater in the anterior pillar of the arch, which is composed of five comparatively long bones sloping gradually to the ground, than in the posterior pillar, which is short, narrow, and composed of a single bone, which descends almost vertically from the ankle to the ground. Hence, in jumping from a height, we always endeavour to alight upon the balls of the toes, and thus break the shock which we should feel if by accident we descended upon the heels.

The bones of the foot are held together by short ligamentous bands of great strength. These are attached to the non-articular surfaces of the bones, and are arranged mostly on their *plantar* and *dorsal*—i.e. upper—surfaces, while others are situated between bones, and are hence named *interosseous*. So resistant are these ligaments that it is almost impossible to dislocate the bones which they hold together.

The spot over which the inferior calcaneo-scaphoid ligament extends is the weakest in the foot, the astragalus being there unsupported by any bones; additional support is, however, afforded where it is more required by the tendon of a strong muscle, the *posterior tibial* (fig. 3, B), which passes from the back of the tibia (the chief bone of the leg) round the inner ankle, to be inserted into the lower part of the inner surface of the scaphoid bone. It not unfrequently happens that the astragalus, being either insufficiently supported, or from

its being overweighted, descends slightly below its proper level, causing a lowering of the arch and a flattening of the sole of the foot. The defect when slight is known as 'weak ankle;' when more decided it is termed 'flat-foot;' and in extreme cases the bone may descend to such an extent as even to render the inner side of the foot convex when it naturally should be concave.

In the movements of the foot upon the leg we see a striking combination of variety of movement with general security. This combination is effected by the harmonious action of three joints, each of which acts in a direction different from the others. The first of these joints is the ankle-joint, which is formed by the bones of the leg—the tibia and fibula—above, and the astragalus below. At this joint the movements of *flexion*—i.e. approximation of the toes to the knee, and *extension*—i.e. pointing the toes to the ground, take place. The second joint is between the astragalus and the heel-bone, and it permits the foot to be rolled inwards or outwards; while the third joint is between the first and second row of tarsal bones—viz. between the astragalus and os calcis behind, and the scaphoid and cuboid bones in front—and allows the degree of curvature of the plantar arch to be increased or diminished within certain limits. The following is the order in which the movements of these three joints occur: the raising of the *heel* (by the first joint) is accompanied by a rolling of the foot *in*wards (by the second joint), and by an increased *flexure* of the plantar arch (by the third joint); and the raising of the *toes* is accompanied by a rolling of the foot *out*wards, and a *straightening* of the sole.

The joints, however, merely allow of movements; they do not effect them: this is the special function of the muscles; and each of the three movements we have indicated is effected by special groups of muscles. The principal of these muscles are shown diagramatically in figs. 3 and 4, representing the inner and outer sides respectively. The first series of movements is mainly effected by three muscles: viz. (1) *muscles of the calf* (fig. 3, A), attached above to the bones of the thigh and leg, and below by the *Tendo Achillis* to the heel-bone; (2) the *posterior tibial* (fig. 3, B), attached above to the tibia, and below by its tendon to the scaphoid bone; and (3) the *short fibular* (fig. 4, C), attached above to the fibula, and below by its tendon to the outer metatarsal bone. The calf-muscles, whose tendon is inserted into the heel-bone, are large and very powerful, for in raising the heel they have to raise the weight of the body. The other two muscles, the posterior tibial and the short fibular, turn round the inner and the outer ankle respectively, and are inserted into the inner and the outer edges of the instep; the former being attached to the scaphoid, and the latter to the outer metatarsal bone. They not only assist in raising the ankle, but support it laterally. The muscle whose tendon is on the inner side of the foot (the posterior tibial) effects the two movements which are associated with the raising of the heel-bone—viz. the turning of the foot inwards and the increased flexure of the arch.

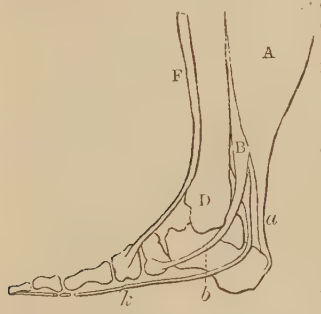


Fig. 3.

A, the gastrocnemius and soleus muscles, forming the muscles of the calf; *a*, the Tendo Achillis; B, the posterior tibial muscle; *b*, its tendon; D, the inner ankle; F, the anterior tibial muscle, attached above to the front of the tibia, below to the internal cuneiform bone; *k*, the flexor tendon of the great toe.

The second series of movements—the raising of the toes, the turning of the foot outwards, and the straightening of the sole—are effected by two muscles, the *anterior tibial* (fig. 3, F) and the *third fibular* (fig. 4, G), whose tendons pass, one in front of the inner ankle, and the other in front of the outer ankle, to the corresponding edges of the instep, and are inserted into the internal cuneiform and the outer metatarsal bones. These muscles are direct flexors of the tarsus upon the leg; the former raising the inner, and the latter the outer border of the foot.

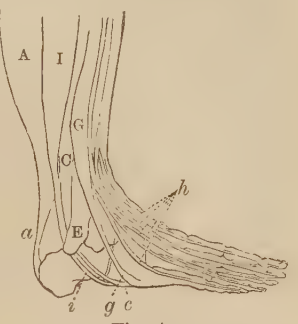


Fig. 4.

E, lower end of fibula, forming the outer ankle; C, the short fibular muscle, attached above to the fibula, and below by its tendon, *c*, to the outer metatarsal bone; I, the long fibular muscle, its tendon, *i*, running behind the outer ankle and under the instep to the metatarsal bone of the great toe; G, the anterior or third fibular muscle, attached above to the fibula and below by its tendon, *g*, to the outer metatarsal bone; *h*, the extensor tendons of the toes.

Another point in the anatomy of the foot that requires notice is the mode of union of the metatarsal with the tarsal bones. In these joints in the fourth and fifth toes a slight revolving motion can take place, which probably enables the outer metatarsals to adapt themselves to inequalities of the ground, and to equalise the distribution of the weight which is thrown upon the foot; while, in the corresponding joints of the three inner toes, scarcely any motion can occur—a provision by which additional strength is given to the inner side of the foot, upon which the weight of the body most directly falls.

The skin of the sole is very tough and strong; and intervening between it and the bones and the strong fascia of the sole of the foot is a thick pad of fat, which acts the part of an air or water cushion in defending the adjacent parts from injurious pressure, and in deadening the jars and shocks that would otherwise be felt in leaping, &c.

Fig. 5.

Fig. 6.

A few remarks on the subject of shoes may here be added. The shape of the sole of the natural foot is shown in fig. 5, while the shape after the prolonged use of a badly-made shoe is given in fig. 6. In the foot in its normal state the great toe is seen to be free from the others, and the line of its axis prolonged backwards passes through the centre of the heel; while in the foot distorted by the use of the shoe the line of the great toe is quite altered, and the toes generally—not being able to find room side by side—overlap each other

and lose their separate and individual actions; corns, bunions, and ingrowing toe-nails being the natural consequence of this maltreatment. Meyer of Zurich drew attention to the bad treatment which the foot receives from ordinary shoemakers, and pointed out that the great toe should be allowed to have its normal position, and this can be done by making the inner edge of the sole incline *in*wards, instead of *out*wards, from the balls of the toes. The accompanying figure (7) gives the outline of a shoe designed under Meyer's superintendence, and shows the difference between it and the usual shape; the latter being indicated by the dotted outline. High heel-pieces tend to make the step less steady and secure, to break down the arch of the foot, to shorten it, and to impair the action of the calf-muscles. A high heel-piece, moreover, places the forepart of the foot at a lower level than the heel; the weight is thus thrown too much in the direction of the toes, and they are thrust forward and cramped against the upper leather of the shoe.

Fig. 7. Shoe designed by Dr Meyer, the dotted outline being the usual shape.

If we compare the human foot with the feet of other mammals we find that it presents certain peculiarities, all of which have reference to man's erect posture. The chief peculiarities are (1) the greater relative size of the tarsal bones as compared with the other bones of the foot, and the more perfect formation of the plantar arch, which is higher and stronger than in any of the lower animals. Strength and elasticity are thus combined in the human foot in the highest degree. (2) The great toe is remarkable in man for its size and strength, and for the firm manner in which its metatarsal bone is joined to the other bones so as to render it the main support to the foot. (3) If we compare the human foot with that of the gorilla (fig. 8) or any other Anthropoid Ape (q.v.) we see that the toes are short and small in man in relation to the other parts of the foot, while in the gorilla the toes form the greater part of the foot. Indeed, a reference to fig. 8 shows that the organ in question is rather a *hand* than a *foot*, and hence the term *quadrumanous* as applied to this class of animals. There is scarcely any plantar arch, and the weight of the body bears chiefly on the outer edge of the foot; the digits are long and strong, and the inner one diverges so as to form a thumb rather than a great toe.

Fig. 8. Foot of Gorilla.

It remains to notice some of the most marked varieties of form which the bones of the foot present in mammals. In the following group of figures the same letters are attached to the same bones. Thus, *a* marks the astragalus; *cl*, the calcaneum or heel-bone (the posterior projection of which forms the hock of the horse); *s*, the scaphoid; *b*, the cuboid; *ce*, the ecto- or outer, *cm*, the meso- or middle, *ci*, the ento- or internal cuneiform. Now, as a general rule in all mammalia, the ecto-cuneiform supports the third or middle of the five toes when they are all present, the meso-cuneiform the second, and the cuboid the fourth and fifth. Bearing in mind this law, we see that the large bone in the horse, known as the cannon-bone, which is articulated to the ecto-cuneiform, *ce*, is the metatarsal of the third toe, to which are articulated the three phalanges of that toe, the last phalanx, 3, being expanded to form the hoof. The small bone popularly known as the splint-bone (not shown in the figure), and articulated to the meso-cuneiform, is the rudimentary or stunted metatarsal of the second toe, 2; and the outer splint-bone, articulated to the cuboid, is the rudimentary metatarsal of the fourth toe, 4; so that in the horse we have only one toe, the third, sufficiently developed to reach the ground, with mere traces of a second and fourth toe on either side. In the foot of the ox the cuboid, *b*, is relatively larger than in the horse, and is equal in size to the ecto-cuneiform, *ce*. The cannon-bone articulates with both these tarsal bones, and hence answers to the metatarsal bones of both the *third* and *fourth* digits; it is accordingly found to consist of two distinct bones in the fœtus; and in the adult it is divided internally into two cavities, and its original separation is marked out by an external elongated ridge.

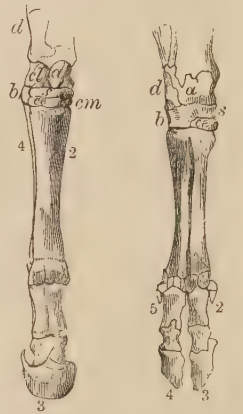


Fig. 9.—Horse. Fig. 10.—Ox.

Fig. 11. Rhinoceros.

Fig. 12. Hippopotamus.

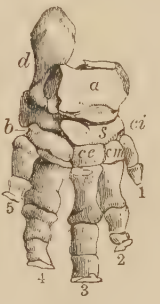


Fig. 13. Elephant.

At the lower end are two distinct joints for the phalanges of the third and fourth toes. While in the horse we had the rudiments of the *upper* parts of two toes (the second and fourth), in the ox we have the rudiments of the *lower* parts or phalanges of two toes (the second and fifth), forming the 'spurious hoofs,' and marked 2 and 5 in the figure. In the rhinoceros there is one principal toe (the third), as in the horse, with the second and fourth toes in a less developed state; while in the hippopotamus there are two principal toes (the third and fourth), as in the ox, with the second and fifth toes not fully developed. In the elephant there is a fifth digit added, answering to our great toe, and articulating with an ento-cuneiform bone, so that in the foot of this animal we have all the bones occurring in the human foot. Owen concludes from these and similar observations that the course of the simplification of the five-toed foot is, first, a diminution and removal of the innermost toe; next, of the outermost; then, of the

second; and lastly, of the fourth; the third or middle toe being the most constant and (in the lower animals) the most important of the five.

Foot, the most common unit of lineal measure all over the world, was taken originally from the length of the human foot. The three foot-measures that occur most frequently are the Paris foot or *pied de roi*, the (German) Rhenish foot, and the English. Compared with the French *mètre* (= 3·28090 English feet) they stand thus:

		Mètre.			English Inches.
English foot	=	0·30479	Paris foot	=	12·78912
Paris ,,	=	0·32484	Rhenish ,,	=	12·35652
Rhenish ,,	=	0·31385			

In round numbers, 46 Paris feet = 49 English feet, 34 Rhen. or Ger. feet = 35 English, and 57 Paris feet = 59 Rhenish. The Russian foot is almost exactly equal to the English. Many local feet are only about 10 inches. The foot has almost uniformly been divided into 12 inches, and the inch into 12 lines (often, however, into tenths). The French *pied usuel* is the third part of the metre (see YARD, METRE). In Music a foot is the short figure with one accent, and in Metre a grouping of syllables long and short, stressed and unstressed (dactyl, iambus, &c.).

Foot-and-Mouth Disease. See MURRAIN.

Football. Probably no game has ever been able to count upon so much popularity and so many opponents at one and the same time as the great English winter pastime of football. When it was first played it is impossible to say, but in one form or another the game has existed for very many centuries, in spite of an amount of opposition that would have completely extinguished a less attractive form of exercise. As in the case of cricket, and indeed many other ball games, opinions are divided as to whether football sprung up on English soil or was an importation. The Greeks had a game to a certain extent resembling football, which was played with the kind of ball known as *harpaston*, and one set of players had to force the ball into that portion of the ground guarded by a rival team in any way they chose. Amongst the Romans, too, there was a game played with a large inflated ball, the *follis;* and, though it is evident this was only struck with the hand, yet the ball used was undoubtedly similar to the football of later years. No trace of the game as at present understood has, however, been discovered beyond the limits of Britain, where it has flourished for centuries. That football in its early days was played with a boisterous vigour which very closely approached brutality, and often led to breaches of the peace, ample proof is adduced by the numerous attempts made to prohibit it. As early as 1314 a proclamation was issued by Edward II. forbidding the hustling over large balls (*ragaries de groses pelotes*), which it is to be presumed had reference to football. In 1349 the game, designated in the statute by its present name, was objected to by Edward III.; and similar measures were adopted with a view to its suppression by Henry IV. (1401) and Henry VIII.; while during the reign of Elizabeth the game was forbidden upon pain of imprisonment. Despite these prohibitive measures and much hostile criticism, football continued to be regularly pursued by the people at large until the middle of the 17th century, when it began to decline in popularity, the change being due possibly to the influence of Puritanism. It was not, however, allowed to die out altogether, and after being kept alive by the younger generation it ultimately became a regular item in the public school curriculum. This flame was fanned by the athletic revival of the 19th century, and before the century ended it was an open question whether the votaries of football did not outnumber those of cricket.

The description of game played in the early ages was like that of the present day in that it consisted in forcing the ball through goals which were then defined by objects dependent upon the spot where the game was decided. The ball at the start was placed as now midway between the two goals, and each side, consisting of any number of players, endeavoured to gain the upper hand by any device or strategy. The game was played either in the street, on a field, or 'across country,' when in some instances the goals were several miles apart. Shrove Tuesday was the great football day. Until 1540 a game took place annually on this day on the Roodee, at Chester, and in some parts of England a game similar in character is still indulged in. The ball was kicked or thrown at the discretion of the player, and in the struggle to gain or retain possession of the ball there was some exceedingly rough work. A description of such a contest played as recently as 1888 was given in *The Field* of March 3 of that year. Joseph Strutt, writing in 1801, describes the game of that time, and by its close affinity it is evident that this was the prototype of the old hacking and tripping game, an early development of Rugby Union football.

Football at the public schools was and is still of very varied character, the rules of the game having, as an admirable authority has suggested, been probably drawn up to suit the capacity of the playground. Where the ground, as at Rugby School, took the form of a large meadow, there running with the ball, the consequent tackling or collaring, and the rough tactics adopted in the primitive game could be indulged in without fear of serious danger; but not so in the circumscribed and more general kind of playground, with, in many cases, its flagged pavement. Here it was necessary that the rougher element should be eliminated; and hence arose the game in which kicking the ball was alone permissible, to be subsequently known by the name of Association football.

About the middle of the 19th century clubs began to be formed by old public school boys. The Sheffield and Hallam clubs, playing the 'dribbling' or non-handling game, were started in 1857; a year later the celebrated Blackheath Club was formed for the purpose of promoting the 'carrying' game; and in 1858 came the institution of the famous Richmond Club. Others of course followed, and in 1863 a praiseworthy attempt was made to determine upon one code of rules to govern all players. This attempt failed, but a body, to be ever afterwards known as the Football Association, was in the same year formed by the 'dribbling' clubs, who were numerically stronger than the followers of Rugby. The latter section was content to remain without organisation until 1871, when the Rugby Football Union sprang into existence. Under the management of the societies named, the game has improved and grown in marvellous manner, until it stands unrivalled in Great Britain as a winter pastime. International and all other kinds of matches are played, and so extraordinary is the popularity of football that on several occasions over 100,000 people have been known to attend a single match, while some of the many clubs organised as limited liability companies have declared fair dividends. These companies run teams of paid players, who throughout the season take part in Football League (formed in 1888) and Rugby League (formed in 1901) competitions respectively, the first-mentioned playing according to Association rules, and the latter under the code adopted by the Northern Rugby Football Union (started in 1895). Other matches are, of

course, played by these professional teams, including international games, except those arranged by the Rugby Union and by the Football Association for amateurs.

The diagram will give some idea of the field of play.

In Rugby Union football the area for play is usually 110 yards by 75 yards; each goal is composed of two upright posts exceeding 11 feet in height from the ground, and placed 18 feet 6 inches apart, with a cross-bar 10 feet from the ground. For a match the opposing sides number fifteen each, and are generally disposed as follows: one full back, four three-quarter backs, two half-backs, and eight forwards. The arrangement of the side is, however, entirely in the hands of the captain, who may deem it expedient to draw from the forwards for additional strength behind the scrummage. The dimensions of the ball are: length, 11 to 11¼ inches; length circumference, 30 to 31 inches; width circumference, 25½ to 26 inches. From these it will be gathered that the ball, weighing from 13 to 14½ oz., is oval in shape. It must be hand-sewn, with not less than eight stitches to the inch. It is the object of each side to obtain as many tries or goals as possible. At the present time matches under the Rugby Union code are decided by points: a try equals three points; a goal from a try (in which case the try does not count), five points; a dropped goal (except from a mark or a penalty kick), four points; a goal from a mark or penalty kick, three points. A try is gained when a player touches the ball down in his opponents' in-goal. This is accomplished by a player, when not offside, dodging his opponents and crossing the goal-line at any spot. A player is put offside if he enters a scrummage from his opponents' side, or, being in a scrummage, gets in front of the ball, or when the ball has been kicked, touched, or is being run with by any of his own side behind him—i.e. between himself and his own goal-line. A side having so touched the ball down, one of the players of the same side must bring it up to the goal-line in a straight line from the spot where it was touched down, and thence walk out with it in a line parallel to the touch-lines such distance as is thought proper, and there place it for another of the side to kick. Should the ball be kicked directly over the cross-bar (not over either post) it is a goal. A goal may, however, be obtained by a drop-kick (made by letting the ball fall from the hands and kicking it the very instant it rises) at any time during the game; or from a place-kick (made by kicking the ball after it has been placed in a nick made in the ground for the purpose of keeping it at rest) or a drop taken as a free kick for a fair catch (a catch made direct from a kick, throw forward, or a knock on by one of the opposite side), or as an award for a penalty.

AA, goal-posts; BB, goal-lines; CC, touch-lines.

In the Rugby Union game the four corners outside the lines marking the field of play are known as touch in goal.

For Association football the most popular dimensions of ground are 120 yards by 80, and for cup-tie matches, which are exceedingly numerous, the field of play must not be less than 110 yards by 70. The goal-posts are placed eight yards apart, with a bar across eight feet from the ground. In this game only goals count, and to obtain a goal the ball (27 to 28 inches in circumference, and weighing 13 to 15 oz.) must be passed between the goal-posts under the bar. No player is permitted to carry, knock on (strike or propel the ball with hand or arm), or handle (play the ball with hand or arm) the ball under any pretence whatever, except in the case of the goal-keeper, who, within his own penalty area, may use his hands in defence of his goal, either by knocking on or throwing, but not 'carrying,' the ball. A goal may be scored from a free kick awarded as a penalty for tripping, kicking, striking, or jumping at a player, handling the ball, holding or pushing an opponent, or charging from behind, but not from any other free kick. Matches are played between sides numbering eleven each, the players being generally disposed as follows: a goal-keeper, two backs, three half-backs, and five forwards. As at Rugby Union, the greatest factor towards success is the working together of the whole team.

In many parts of the world besides Great Britain football has of recent years spread in a remarkable way. In both France and Germany it has grown rapidly in popularity, but it has perhaps taken the strongest hold in Australia, New Zealand, South Africa, and Canada. Two games are played in Australasia, the one being strictly according to the English Rugby Union code, the other a combination of the two styles so well known in Great Britain. In the so-called 'Australian' game, which is played throughout Victoria, and to a small extent in some other states, the ball has to be bounded by the player while running, and in this particular the game differs from both Rugby Union and Association. New South Wales, Queensland, and New Zealand favour the Rugby Union game, into which they have of late years introduced minor modifications; but both games are exceedingly popular with the public, who muster in their thousands at the more important matches. Comparatively little Rugby Union is played either in Canada or the United States, but in both countries the Association game flourishes. Until the last quarter of the 19th century football was less known in the United States; but, under the New York and Paterson clubs, the game grew rapidly, and in April 1884 was formed the American Football Association. The game is very popular in the colleges and schools, where an elaborated form of the English Rugby is played; the ball is advanced by carrying, passing, or kicking, and the playing of the 'team' is regulated by secret signals. A variety of football is very popular with some Indian tribes, as the Washoes of Nevada. Visits to Great Britain have been paid by teams representing France, Germany, Australia, New Zealand, South Africa, Canada, and the United States, and in most cases return visits have been made.

Foote, Andrew Hull, American naval officer, was born in New Haven, Connecticut, in 1806, entered the navy in 1822, and after some service against the pirates of the West Indies was appointed captain in 1849. In 1856 he gallantly carried by storm four Chinese forts at Canton, from which he had been fired on while protecting American property. On the outbreak of the civil war he equipped and organised the western flotilla, and in February 1862, with his gunboats, he stormed Fort Henry. At Fort Donelson, in the same month, he received a wound which soon afterwards compelled him to resign his command; but his services obtained for him the rank of rear-admiral and a vote of thanks from congress. He died in New York city, 26th June 1863, while on his way to take over the command of the fleet off Charleston.

Foote, SAMUEL, English actor and writer of comedy, was born at Truro, in Cornwall, in January 1720. His father at one time sat in parliament for Tiverton, and was mayor of Truro; his mother inherited a considerable fortune from her brother, Sir John Goodere, Bart., who was murdered by another brother. Foote left Worcester College, Oxford, without a degree, and about 1740 entered the Temple; but after wasting his fortune in a career of pleasure he turned to the stage as a means of support, and in 1744 made an unsuccessful début as 'a gentleman' in 'Othello.' In 1747 he opened the Haymarket Theatre—where he was at once director, actor, and dramatic author—with *Diversions of the Morning.* In this and other pieces he introduced well-known living characters, and by his admirable powers of mimicry succeeded in drawing large audiences; the theatre was closed by order of the magistrates, but Foote hit on the device of inviting his friends to 'a cup of tea,' for which tickets were to be obtained at the coffee-houses. He appeared in a great number of parts in London, Edinburgh, and Dublin, but would seem to have achieved success almost solely in his own plays. In 1766 he broke his leg by a fall from his horse, and amputation was found necessary. This, however, did not interrupt his career; he even turned the incident to account on the stage, by composing parts expressly adapted to his own state. He died at Dover on 21st October 1777. Of his plays the best are *An Auction of Pictures, The Minor, The Liar,* and *The Mayor of Garratt,* which have been frequently published. Many anecdotes of him, though not infrequently borrowed from earlier sources, are given in Cooke's *Memoirs of Samuel Foote* (1805); see also Forster's *Biographical Essays* (3d ed. 1860), Joseph Knight in the *Dict. of Nat. Biog.*, vol. xix. (1889), and a Life by P. H. Fitzgerald (1910).

Foot-guards, the flower of British infantry, ordinarily the garrison of the metropolis, comprise the Grenadiers, Coldstream, Scots, Irish (1902), and Welsh (1915) Guards. See GUARDS.

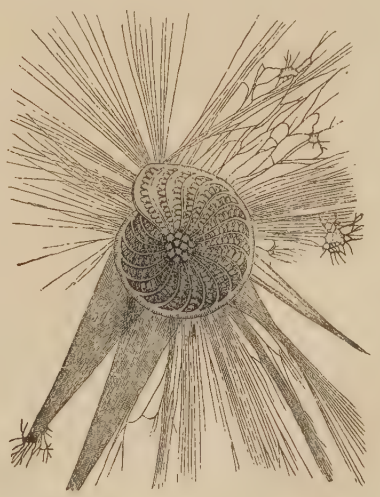
Foot-pound is the unit used to express the *work done* by any form of force. Thus, taking 1 lb. and 1 foot as the units of weight and distance, if 1 lb. be raised through 1 foot, the *work done* is equivalent to 1 foot-pound; and generally, if W represent the *work done,* P the *weight in pounds,* and *h* the *height in feet,* then W (in foot-pounds) = P*h*.

Footprints. See FOSSIL.

Foot-rot amongst sheep is of two varieties, the commoner and less troublesome often accompanied by an inordinate growth of hoof, which towards the heel becomes turned in, and at the toe or round the margin cracked or torn, and thus affords lodgment for sand and dirt. Insufficient wearing of the hoof is the obvious cause, and hence the prevalence of foot-rot in soft rich pastures, and especially amongst sheep previously accustomed to bare, rough, or upland walks, where the hoof is naturally worn down by the greater amount of walking necessary to procure sustenance. Taken in time, when lameness is first apparent, and before the hoof is cracked and the foot inflamed, a cure rapidly follows the careful paring of the superfluous and diseased hoof; indeed, further treatment is scarcely necessary unless any of the vascular parts have been laid bare, when a little tar may be applied as a mild astringent and protection from flies. When from inattention or neglect the hoof is separated from the sensitive parts beneath, when ulcers appear on the sole, or proud-flesh springs up, active astringents or mild caustics are necessary. The shepherd's old favourite butter of antimony, diluted with an equal quantity of tincture of myrrh, is a good remedy when cautiously and temperately used. A convenient paste, which in inexperienced hands is safer than a fluid caustic, may be made with equal weights of flowers of sulphur and finely-powdered sulphate of copper, rubbed up to the needful consistency with lard or vaseline. Many have great faith in a mixture of the salt of copper with gunpowder and lard.

The second variety is allied to *foul* in the foot, and is contagious. The foot is hot, tender, and swollen around and immediately above the coronet. Ulcerations may arise in the interdigital space, and the swelling and subsequently the proud-flesh cause a spreading of the toes. In the milder cases and earlier stages the parts should be well washed with a solution of chloride of zinc, and in all cases the loose and semi-detached horn carefully removed, the parts thoroughly cleansed before applying the dressing, and in bad cases protected by a bandage. When ulcers appear they must be touched with lunar caustic or dressed with the paste already recommended. Or a foot-bath, 16 feet long and 8 inches wide at the bottom, with spreading sides to allow the sheep to walk through, is used with a 10 per cent. solution of sulphate of copper, or 1 part of sulphuric acid to 10 parts of water; a dry day should be chosen, and the sheep put on a bare road or causeway until their feet are dry. It should be used once a week if necessary.

Foraminifera, a class of unicellular animals or Protozoa, almost always marine in distribution, most characteristically provided with limy shells, which have formed the chalk of the past and are now forming similar deposits in the deep sea. A living Foraminifer, often about the size of a pin's



A living Foraminifer (*Polystomella strigillata*).

head, consists of a central nucleated mass of protoplasm, of a shell surrounding this, and of long, branched, and interlacing threads of living matter streaming outwards, with food-absorbing and locomotor functions.

Description.—The shell, which is much better known than its tenant, is characteristically calcareous, chambered, and covered with minute holes. But it is occasionally chitinous, and often arenaceous—i.e. composed of cemented particles of sand. At first a simple enough insheathing test, and so remaining in many forms, the shell is very generally added to, so as to cover successive overflowings of growth. The ways in which fresh chambers are formed—in linear series, in spirals, and the like—produce types of architecture of great beauty and variety, as to the building of

which we can only conceal our ignorance by calling them organic crystallisations. The spirals often look like miniature sketches of the shells of Nautili, snails, and other molluscs. When partitions are formed between successive chambers they leave apertures through which bridges of protoplasm preserve the vital continuity. On the

Shells of various Foraminifera.

outer surface the outflowing protoplasm may reserve for itself one relatively large aperture, or a couple, or a few, but most characteristically there are numerous minute holes left all over the shell.

The internal protoplasm, so far as observed, is homogeneous, except for granules, frequent pigment, and the essential nucleus or nuclei. On the outflowing processes, which are more irregular and interlaced than is usual in Radiolarians, granules stream outwards and inwards in active currents. The pseudopodia effect locomotion, but are also very important in entangling the diatoms, infusorians, and the like which Foraminifera use as food. In the pelagic Foraminifera, such as the Globigerinids, the peripheral part of the protoplasm is abundantly vacuolated, and probably contains a fluid lighter than sea-water. In *Hastigerina*, one of the Globigerinids, there is a zone of much vacuolated protoplasm outside the shell. On the whole, however, the living part of Foraminifera seems to have a very uniform structure. Foraminifera multiply by fission or by spore-formation, and in some cases—e.g. *Patellina* and *Discorbina*—several individuals may unite closely before forming spores. Many—e.g. *Polystomella*—show a remarkable dimorphism, occurring in two distinct forms which differ notably in the size of the first chamber of the shell and as regards their nuclei. In these dimorphic species a complicated alternation of generations occurs. In a few cases—e.g. *Microgromia socialis*—a number of individuals are united to form a loose colony, a primitive kind of association exhibited by not a few Protozoa. Most modern forms are small, below half an inch in diameter, and many very much less, down to microscopic dimensions. The largest living species (*Cyclocypeus carpenteri*) measures slightly over 2 inches across the shell, and recalls the extinct giant Nummulites, many of which were as large as half-crowns.

Distribution.—The Foraminifera are mostly marine, and occur at all depths; a few (Globigerinids), like the Radiolarians, are pelagic; most live on submerged objects or at the bottom. A few from brackish and even fresh water are known, and one species (*Gromia terricola*) has gone ashore. The pelagic forms as they die sink gently to the bottom, and are there forming, especially at depths between 1000 and 2000 fathoms, great beds of Globigerina ooze or modern chalk. In other regions sandy-shelled forms predominate at the bottom.

In marine geological strata from the Silurian onwards Foraminifera abound. Chalk consists almost wholly of fossil Globigerinids, and the Nummulites have contributed largely to the great Eocene limestones. The animal nature of Eozoon (q.v.) from the pre-Cambrian strata is now generally denied, and is at least very doubtful.

Position and Classification.—The Foraminifera were so named by D'Orbigny in 1826, and placed beside the Cephalopods, to the shells of some of which the tests present a mimetic or prophetic resemblance. The title referred not, as might be supposed, to the superficial apertures on the shell, but to the communications between successive chambers. Hertwig would call them Thalamophora, in allusion to the typical chambered shell; while Carpenter emphasised the living network of processes in the title Reticularia. Accenting as they do the amœboid phase of cell-life, the Foraminifera have their place beside Amœbæ, Radiolarians, and Sun-animalcules in the Rhizopod division of Protozoa (q.v.). They were formerly classified as Perforate and Imperforate according to the presence or absence of numerous apertures on the test, but as this distinction separates apparently adjacent forms it is no longer generally adopted. By Brady, who has described the *Challenger* collection in a monumental monograph, they are classified in ten families, of which Gromia, Miliolina, Astrorhiza, Lituolina, Textularia, Chilostomella, Lagena, Globigerina, Rotalia, and Nummulites are the name-giving types. In Gromia the shell is chitinoid, flexible, and with a single aperture; in the related Shepheardella there is an aperture at each end of an elongated test. The test of Miliolina is normally of lime, but in brackish water tends to become chitinoid, and at great depths a siliceous film. Irregular sand particles form the primitive test of Astrorhiza, and the use of detached sponge spicules led to the related Haliphysema being mistaken for a very simple sponge. Among Lituolidæ, Parkeria and Loftusia are relatively large forms—about two inches in diameter and length respectively. A peculiarly interesting *Challenger* form among the pelagic Globigerinids—*Hastigerina murrayi*—has the shell surrounded by a zone of bubbly protoplasm, and in its vacuoles and internal shell suggests Radiolarian characteristics. The species of Foraminifera are legion, probably above two thousand. They are interesting, as illustrating complexity and beauty of architecture at the very threshold of life, and important both in the making of the earth and in the present-day economy of submarine life.

See Eozoon, Nummulites, Ooze, Protozoa, Radiolaria; Brady, *Challenger Report*, 1884; Bütschli, *Protozoa* (Bronn's *Thierreich*); Carpenter, Parker, and Jones, *Introd. to Study of Foraminifera* (1862); Schultze, *Organismus der Polythalamien* (1854); Sherborn, *Bibliography* (1888); Chapman, *Foraminifera* (1902); Lister in Lankester's *Treatise on Zoology*, Part i. (1903).

Forbach, a manufacturing town of 8000 inhabitants, in Lorraine, 6 miles SW. of Saarbruck. Here on 6th August 1870 the French had to retreat.

Forbes, Alexander Penrose, bishop, was born in Edinburgh, the second son of Lord Medwyn, a judge of session, 6th June 1817, and spent the years 1837–40 in the East India Company's service, until ill-health compelled his retirement. He graduated at Oxford in 1844, was ordained in the same year, and in 1847, at the early age of thirty, was consecrated Bishop of Brechin, in Scotland, receiving the honorary degree of D.C.L. in 1848. A warm friend of Pusey, he delivered a charge in

1857 which was practically a manifesto on the manner of the Eucharistic Presence and on the nature of the Eucharistic Sacrifice; its publication raised a storm which culminated in its author's trial before the other bishops of the Scottish Episcopal Church in 1860, resulting in a 'declaration of censure and admonition.' Forbes died on 8th October 1875, more widely mourned than any Scottish bishop since the Reformation. He edited, with his brother, the *Arbuthnot Missal* (1864), published with an elaborate preface *Kalendars of Scottish Saints* (1872), and was the author of valuable expositions of the Articles (2d ed. 1871) and Nicene Creed (2d ed. 1866), and of numerous other works, chiefly devotional. See Memoirs by Miss Skene (1876) and Canon Mackey (1888).

Forbes, ARCHIBALD, special correspondent of the *Daily News*, a son of the minister of Boharm, near Keith, was born in 1838. He was educated at Aberdeen University, and served for some years in the Royal Dragoons. But in 1870–71 he went through the Franco-German war as war-correspondent; and thenceforward, whether in Spain with the Carlists, in Cyprus, in the Russo-Turkish campaign, or in the Zulu war of 1879, he accustomed the British public to expect feats of unexampled audacity, swiftness, tact, and pluck in securing and transmitting his vivid first-hand notes of events at the front to his newspaper. A memorable exploit was his famous ride of 110 miles in 15 hours, in order to report at once the victory of Ulundi (1879). He had lectured in Great Britain, America, and Australia, and wrote a novel, *Drawn from Life* (1870), *Glimpses through the Cannon Smoke* (1880), *Chinese Gordon* (1884), and *Memories of War and Peace* (1895). He died 30th March 1900.

Forbes, DUNCAN, of Culloden, Lord President of the Court of Session, was born either at Culloden or at Bunchrew—for the family possessed both estates—in the neighbourhood of Inverness, on the 10th November 1685. In 1704 he commenced his legal studies in Edinburgh, and completed them at Leyden. On his return from Leyden he was called to the bar, and almost immediately after appointed Sheriff of Midlothian. He rose rapidly into practice and into political influence through his connection with the great Duke of Argyll. During both of the rebellions he acted a prominent part on the side of the Hanoverian government. In 1715 he was in the north actively engaged in opposing the rebels along with his elder brother John. After the suppression of the rebellion he was opposed to the project of carrying the prisoners out of Scotland to be tried by English juries; and he was opposed to the forfeitures also on grounds of policy as well as of humanity. The only effect of his moderation was to bring suspicion on his own loyalty. In 1725 he became Lord Advocate. He was not distinguished as a debater, but he was much employed at this period of his career in appeal cases. In 1734 his brother John died, and he succeeded to the estates of the family. During many subsequent years he largely ruled the destinies of Scotland and contributed to her dawning prosperity by fostering and developing her internal resources. His policy, even before 1745, was to extinguish the rebellious temper by gaining over the Jacobites to the government, and by forming Highland regiments under loyal colonels. Forbes was appointed President of the Court of Session in 1737; but he still continued his interest in the general improvement of the country. Though he was aware of the character and, in general, of the designs of the Jacobites, the rebellion of 1745 took him by surprise. But he was no sooner aware of the danger than he hastened to the north, as he had done on the occasion of the former outbreak; and by his presence and the influence which he possessed in his own district, he did much to counteract the proceedings of the rebels. Lovat's clansmen attacked Culloden House, but were beaten off with great spirit by the president and his people. When the rebellion spread he was compelled to take refuge in Skye; and on his return after Culloden, instead of reaping the fruits of his services, he was regarded with jealousy and aversion by the government. Even the large sums of money he had advanced were never repaid him. The ingratitude of the government and the disasters brought on the country by the rebellion shortened his days; but he discharged his judicial duties till within a month of his death, 10th December 1747. See Hill Burton's *Lives of Lord Lovat and Duncan Forbes of Culloden* (1847).

Forbes, EDWARD, naturalist, was the son of a banker, and was born at Douglas, Isle of Man, February 12, 1815. He received a desultory and imperfect education in early life in consequence of ill-health. In 1831 he went to London with the intention of becoming a student at the Royal Academy, but later in the same year entered the university of Edinburgh as a student of medicine; and in 1836 he finally relinquished his medical studies to devote himself exclusively to the natural sciences. In 1836–37 he studied at Paris under Geoffroy St-Hilaire, Jussieu, and De Blainville. From the first year of his college life Forbes had spent his summer vacations in rambles over various parts of Great Britain or in excursions on the Continent, publishing the results of the observations which he made either as separate works or in the pages of scientific journals. In 1841 he joined the surveying ship *Beacon* as naturalist, and accompanied that vessel during the survey of a part of Asia Minor. On his return to England in 1843 he became professor of Botany in King's College, London, and curator of the Geological Society. In 1844 he was appointed palæontologist to the Museum of Geology in connection with the Ordnance Geological Survey; in 1851 professor of Natural History in the School of Mines; in 1852 president of the Geological Society; and in 1853, on the death of Professor Jameson, he was elected to the vacant chair of Natural History in the university of Edinburgh. In the summer of 1854 he delivered a short course of lectures—the only one he was destined to give—for at the commencement of the winter session he was seized with a severe illness, which speedily proved fatal; and he died on the 18th November 1854, in the thirty-ninth year of his age, and in the very zenith of his fame. Forbes had been a voluminous writer and a diligent observer of nature from his earliest youth, and had collected an immense mass of materials, many of which were, however, left at his death in a state of disorder. He did much to advance and systematise special departments of natural history, both by his own labours and by the stimulus which he imparted to his associates and pupils. His classification of the British star-fishes opened a new era in that branch of zoology; and his discovery that air-breathing molluscs lived at the period of the Purbeck beds rectified many erroneous hypotheses. From an early period he had directed his attention to the distribution of animal and vegetable life in different zones of the sea and land, and his observations in this path of inquiry have opened many new fields of research. Of his separate works, papers, and monographs upwards of two hundred were published, many of them copiously illustrated by his own beautiful drawings. Among them may be instanced the following: *On the Distrib. of Pulmonif. Mollusca in Europe* (1838), *Malacol. Monensis* (1838), *Star-fishes* (1841), *The Radiata and Mollusca of the Ægean* (1843), *Travels*

in Lycia (in conjunction with Spratt, 1846), *Naked-eyed Medusæ* (1847), *British Mollusca* (conjointly with Hanley, 4 vols. 8vo, 1853), and *Collection of Literary Papers by E. Forbes* (1855). See the Memoir by G. Wilson and A. Geikie (1861).—His brother DAVID (1828–76) was distinguished as a geologist.

Forbes, JAMES DAVID, physicist, was the son of Sir William Forbes of Pitsligo, and grandson of the Sir William given below. Born at Edinburgh, April 20, 1809, he studied in the university there from 1825 until 1830, when he was called to the Scottish bar. But the physical sciences were from an early age serious rivals to the law in his affections. From 1833 he held the chair of Natural Philosophy in Edinburgh University, exchanging it in 1859 for the principalship of the United College in the university of St Andrews. Among his contributions to science are his investigations on the polarisation of radiant heat by the tourmaline, and also by reflection, and its circular polarisation (1834)—discoveries forming some of the strongest proofs of the identity of calorific and luminous rays; the unequal polarisation of heat from different sources (1844); the conductivity of heat by iron; the refrangibility of heat; the depolarisation of heat; underground temperatures, &c. He is, however, best known by his researches on the motion of glaciers, in connection with which subject he wrote *Travels through the Alps* (1843), *Norway and its Glaciers* (1853), *Tour of Mont Blanc and Monte Rosa* (1855), and *Occasional Papers on the Theory of Glaciers* (1859). He was the first to establish the great fact that glacier ice moves in its channel like a viscous fluid, the middle moving faster than the sides, and the upper portions faster than the lower. In meteorology Forbes, among other things, improved Wollaston's application of the thermometer to the determination of heights, and verified Fourier's theoretical results concerning the temperature of the ground at different depths and in different kinds of soil and rock. He also contributed numerous papers on astronomy and other subjects to the *Transactions* of the Royal Societies of London and Edinburgh, to the *Edinburgh Philosophical Journal*, and similar periodicals. He died December 31, 1868. See his *Life and Letters*, edited by Shairp, Tait, and Adams Reilly (1873).

Forbes, SIR JOHN, physician, was born about the close of 1787, at Cuttlebrae, Banffshire. After studying at Aberdeen and Edinburgh he entered the navy in 1807 as assistant-surgeon; in 1817 he took the degree of M.D. at Edinburgh; and after practising as a physician at Penzance and at Chichester he went in 1840 to London, where he speedily made a large practice. He was knighted in 1853 by the Queen, to whose household he held the appointment of physician in ordinary. He was F.R.S. and D.C.L. of Oxford, as well as member of numerous foreign societies. Conjointly with Drs Tweedie and Conolly he was the editor of the *Cyclopædia of Practical Medicine* (4 vols. 1832–35). In 1836 he founded the *British and Foreign Medical Review*, which he carried on for twelve years. To him in a great measure belongs the merit of having introduced the use of the stethoscope in England, and of having successfully directed the attention of British practitioners to the art and practice of physical diagnosis. He died 13th November 1861.

Forbes, SIR WILLIAM, of Pitsligo, an eminent Scottish banker, son of Sir William Forbes, Bart., advocate, was born in Edinburgh, April 5, 1739. In his fifteenth year he entered the bank at Edinburgh of Messrs John Coutts & Co., and in 1761 was admitted a partner; and in 1763 a new company was formed of which Sir William Forbes ultimately became the head. In 1781 he purchased the estate of Pitsligo, Aberdeenshire, which had been forfeited by Lord Forbes of Pitsligo for taking part in the rebellion of 1745. He published a Life of his friend Beattie, the poet, in 1805; also *Memoirs of a Banking House*, being the history of his own (1803; ed. by Robert Chambers, 1860). He died November 12, 1806. His bank became in 1830 the Union Bank of Scotland. One of his sons was John Hay Forbes, Lord Medwyn.

Forbes-Mackenzie, WILLIAM (1801–62), M.P. for Peeblesshire, whose name is known in connection with an Act introduced by him and passed in 1853 'for the better regulation of public-houses in Scotland,' prohibiting provision-merchants from selling excisable liquors 'to be drunk on the premises,' permitting public-houses to be open on week-days only between 8 A.M. and 11 P.M., and forbidding the sale of liquor in hotels throughout the Sundays save to lodgers and *bonâ-fide* travellers. See LICENSING LAWS.

Forbidden Fruit, or ADAM'S APPLE, a name fancifully given to the fruit of different species of Citrus, especially to *C. Medica*, var. *paradisi*, which has indentations in its rind suggesting tooth-marks. In Ceylon the same name is applied to the fruit of *Tabernæmontana dichotoma* (Apocynaceæ). The shape of the fruit suggests the idea of a piece having been bitten off, and the legend runs that it was good before Eve ate of it, although it has been poisonous ever since. See SHADDOCK.

Force. As employed in physical science, the term force means any cause which changes the direction or speed of the motion of a portion of matter. It is therefore correctly applied to a push or pull, to the weight of a body, the attraction exerted by a magnet on a piece of iron or by an electrified body on a pith-ball, &c. This is expressly laid down in the first of Newton's Laws of Motion—to wit:

Every body perseveres in its state of rest, or of uniform motion in a straight line, except in so far as it is compelled by forces to change that state.

Now, we find that we can, by conscious muscular exertion, set a piece of matter in motion, and also change its motion both in speed and in direction. Hence we figure to ourselves that we are exerting force upon it. But here great caution is requisite, as the direct impressions of sense are, in many cases, notoriously misleading. Until we know what Matter (q.v.) is, it is practically useless to speculate as to the precise nature of force, if indeed there be such a *thing* at all. Even Newton's language has an anthropomorphic character which it would be difficult to avoid without coining words for the purpose. Of course in Newton's system the force is assigned in direction and magnitude by the change of motion (i.e. of Momentum) said to be produced by it in a given time. This is the essence of the second law of motion.

And the third law greatly extends our view of the subject, for it points out that force is always dual:

To every action there is always an equal and contrary reaction, or the mutual actions between two bodies are always equal and oppositely directed.

But, as the results of the action and reaction alike are mere changes of momentum, and as neither can present itself without the other, all that we are logically entitled to say is that no change of motion takes place unaccompanied by an equal and opposite change. The introduction of the action and reaction may thus be merely an attempt to explain this observed interchange of momentum by the help of the sense-suggested notion of force.

There is no doubt that the introduction of the idea of force has been very useful, if only in

enabling us to express the fundamental laws of dynamics in a particularly concise and easily intelligible form. But there is equally little doubt that everything yet known on the subject can be perfectly well expressed without the use of the term force, or of the idea which it embodies.

The dynamical expression for which the term force has been introduced as a substitute presents itself in two forms, different in name and conception, but intrinsically the same—viz. the time-rate at which momentum (see DYNAMICS) changes, or the space-rate at which Energy (q.v.) is transformed or transferred. Thus, when a stone is let fall, the momentum which it acquires is proportional to the time of falling, so that after t seconds its amount is, say, At; and in falling through a space of h feet it loses in potential energy, while it gains in kinetic energy, an amount proportional to the height fallen through, say, Bh. Experimental measurement shows us that A and B are one and the same quantity, and we say it represents the weight of the stone—i.e. the force under which we figure to ourselves that the fall takes place. It is very convenient to do so. But, except the indications of our muscular sense, we have no proof whatever that there is any reason for the fall of the stone other than the observed fact that energy has the property of preferring the kinetic to the potential form. And the statement that a stone of given mass has potential energy to a given amount, depending directly on its elevation above the earth, is sufficient (without even *mention* of weight, or of force in any form) to enable us to calculate all the circumstances of its fall. Though we have confined ourselves to an exceedingly simple example, a similar but of course more general statement as to energy enables us to make the calculation requisite for determining the motion in all cases, however complex.

Newton's definition of force has sometimes been amended (?) into 'Any cause which changes, *or tends to change*, the motion of a body.' But this is entirely foreign to his system. For his second law expressly says, '*Change of momentum is proportional to force, and takes place in the direction of the force.*' Hence, from Newton's point of view, there is no balancing of forces, though there may be balancing of the effects of forces.

The *Resultant* of two forces which act on the same particle of matter is defined as the single force which could produce in that particle the same change of momentum as would the two given forces if they acted jointly on it for the same period of time. As it follows at once from Newton's second law that different forces, acting for equal times on the same particle, produce velocities in their own directions *and proportional to their magnitudes*, the question of compounding these forces is the same as that of compounding the corresponding velocities. Hence we have at once the only correct basis for the proof of that *Parallelogram of Forces*, or *Triangle of Forces*, on which (from the so-called *statical* point of view) as much absolutely useless thought has been expended as upon Euclid's celebrated twelfth axiom and its consequences.

The true measure of a force is, of course, the amount of momentum which it produces in a given time. Hence, if our fundamental units of mass, length, and time be the pound, foot, and second, unit force is that which gives in one second a speed of one foot per second to a mass of one pound. This is the British absolute unit of force. As gravity produces a speed of about 32 feet per second during each second of the motion of a falling body, the unit force is (speaking very roughly) about $\frac{1}{32}$d part of the weight of a pound—i.e. about the weight of half an ounce. If we adopt the so-called C.G.S. system, in which the units are the centimetre, gramme, and second, the unit force (called a *dyne*) is that which in one second produces a speed of one centimetre per second in a mass of one gramme. Compared with the British absolute unit, the dyne is very small, being little more than $\frac{1}{14000}$th part of it.

But the most startling of all the reflections on force and its ultimate nature which have perhaps ever been made are those of Faraday. Without calling in question in ordinary cases the truth of the conservation of energy, he endeavoured, by experiment (the only genuine test in a question so novel and so profound), to prove what may be called the Conservation of Force. Here we understand *force itself*, and *not energy*. He argues thus: Two masses, according to the undisputed law of gravitation, attract with four times their mutual force if their distance be diminished to half, and with only one-fourth of the same if their distance be doubled. He asks *whence comes* the additional force in the former, and *what becomes of* the lost force in the latter case?

Now, it is evident that this is a new question, totally distinct from any we have yet considered. To answer it, we must know *what* force is. Would gravitation have any existence if there were but one particle of matter in the universe, or does it suddenly come into existence when a second particle appears? Is it an attribute of matter, or is it due to something between the particles of matter? Faraday tried several experiments of an exceedingly delicate kind, in order to get at some answer to his question. A slight sketch of one of them must suffice. A pound-weight is not so heavy at the ceiling of a room as it is when on the floor; for, in the former case, it is more distant from the mass of the earth than in the latter. The difference for a height of 30 feet is (roughly) about $\frac{1}{350000}$th of its weight. Now, if a mass of metal be dropped through such a space, an additional force, $\frac{1}{350000}$th of its weight, is called into play; and the object of the experiment was to detect whether electrical effects accompanied this apparent *creation* of force. The mass, therefore, was a long copper wire, whose coils were insulated (see ELECTRICITY) from each other, and whose extremities were connected with those of the coil of a delicate Galvanometer (see GALVANI). Had any trace of an electric current been produced, the needle of the galvanometer would have been deflected; but, when all disturbing causes were avoided, no such deflection was detected. Other experiments with a view to the detection of other physical energies were also tried, but, like the first, with negative results only.

From what has been said above it is clear that we must not hastily conclude that there is such a *thing* as force, though we are in the constant habit of speaking about it. Our sensations are all more or less misleading until we can interpret them. The pain produced by a blow is quite a different thing from the energy of motion of a cudgel; and, when our muscular sense impresses on us the idea that we are exerting force, we must be cautious in our conclusions. For it is certain that force is *merely the rate per unit of length* at which energy is transferred or transformed.

Force and **Fear** are used as technical terms in the law of Scotland to denote that amount of constraint or compulsion which is enough to annul an engagement or obligation entered into under its influence. As consent is the essence of contracts, contracts entered into under compulsion are, in law, either (as some authorities say) void or (at lowest) voidable. But it is not every degree of constraint which will have this effect in law. As Bell states it (*Principles*, 12), the force and fear must be 'not vain or foolish fear, but such as to overpower a mind of ordinary firmness, or such as,

applied to a person of weaker age, sex, or condition, will produce the effect of overpowering violence on a firmer mind. Among the instruments of force and fear which have been held to annul engagement are threats and terror of death; pain to one's self, or one's parent or child; infamy and disgrace; imprisonment, when employed to obtain an advantage beyond the lawful object of it; and even loss of property.' On proof of force and fear the law restores the parties to the contract to the position in which they were before it was entered into, and will find the party employing it liable in damages as reparation for any injury done to the party constrained. The corresponding term in English law is Duress (q.v.). This consists in imprisonment or actual or threatened violence to the party himself, his wife, his parent or his child. An old distinction was drawn in criminal law as to *mayhem*—i.e. deprivation of a member proper for defence, as an arm, a finger, an eye, or a fore-tooth (but not a jaw-tooth, or an ear, or a nose, because these are supposed to be of no use in fighting). The distinction, however, is practically obsolete, and in any case has no application in civil matters. Duress renders a contract voidable, not void.

Forcellini, EGIDIO, Italian lexicographer. See FACCIOLATI.

Forceps (Lat., 'a pair of tongs or pincers'), the name given by surgeons to an instrument of great antiquity, used as a substitute for the fingers, and consisting of two levers of metal jointed together crosswise, nearer to one end than the other. The hand grasping the longer ends of the levers or handles closes the shorter ends, which are shaped so as to seize firmly the intended object. There is scarcely a surgical operation in which some form of forceps is not applied; and very numerous different shapes and sizes are made for different purposes. In addition to the forms used for the extraction of teeth (see DENTISTRY) there are, e.g., the *dissecting* forceps, which have roughened points, to lay hold of small portions of tissue which are to be divided by the knife; the *lithotomy* forceps, which have blades concave like spoons; and *fenestrated* forceps, which have apertures in the blades, and, as the soft tissues project into these, obtain a firm hold with less risk of tearing the parts. By means of Liston's *cutting* forceps a powerful hand can divide a great thickness of bone. But the most important of all are the *midwifery* forceps, an invaluable invention in cases of difficult delivery, which daily rescues from suffering and danger numerous mothers and infants. It was invented in the 16th or 17th century, probably by Peter Chamberlen, who, however, with his son and grandson, kept their method of facilitating delivery as a profitable family secret; and it did not become generally known to the medical profession till the first half of the 18th century. Numerous modifications of the instrument have since been introduced, but its main principle remains unchanged. It consists of two concave fenestrated blades, forming a cavity into which the head of the child fits. The blades are applied separately, one to each side of the head, and then locked together. Holding by the handles, the accoucheur aids the natural efforts of labour. The instrument does not necessarily or generally injure either mother or child.

Forcible Entry. According to English law any person who enters on property, in order to take possession of it, with violence or intimidation is guilty of a misdemeanour. It is immaterial whether the person so entering has a right to the property or not. If a person wrongfully in possession detains property by violence or threats he is guilty of the offence known as forcible detainer.

Forcing, in Gardening, is a term used to designate a process in which artificial heat is applied so that flowers, fruits, or other products of plants are obtained at a date or season other than that at which they may be had in the ordinary course of culture. The diminished light of the short days of the year is the gardener's chief obstacle. This in the case of forcing fruits taxes his skill to the utmost, because abundant light is essential both to the proper fertilising of the flowers and to the perfecting of the fruit. Some vegetables and salads and many flowers are, however, more successfully forced in the dark than in light. Rhubarb, sea-kale, mushrooms, lily of the valley, lilac, are all forced in greater or less darkness in order the better to develop their individual perfections. A purple lilac is preferred to a white one for forcing, because it not only comes out of the process a purer white, but with a greater substance than the latter. See GARDENING.

Ford, HENRY, American millionaire and pacificist, was born 30th July 1863 near Detroit, educated at a district school, and became a machinist. He early set himself the problem of producing cheap motor-cars, and in 1903 organised a company which ere long was producing, near Detroit and elsewhere, some 20,000 cars a week. A profit-sharing scheme was announced in 1914, with a minimum wage of five dollars a day, and provision was made for education, legal and medical advice, and other means of combining the men's welfare with efficiency. On the outbreak of the Great War he sent a peace ship on an unsuccessful mission to Europe, and strove hard against America's participation; but when his efforts failed, he threw his whole weight into the prosecution of the war. In 1918 he was Democratic candidate for the United States Senate in Washington, but was defeated. In 1919 he acquired the *Dearborn Independent*, a weekly with no advertisements. He came to be spoken of as a possible candidate for the presidency.

Ford, JOHN, dramatist, was the second son of Thomas Ford of Ilsington, Devonshire. He was baptised at Ilsington, 17th April 1586. After studying for a short time at Exeter College, Oxford, he became in November 1602 a member of the Middle Temple. His first work was an elegy on the death of the Earl of Devonshire, entitled *Fame's Memorial* (1606), with a dedicatory sonnet to Penelope, Countess of Devonshire (the 'Stella' of Sidney's sonnets); and in the same year he published *Honour Triumphant; or the Peers' Challenge . . . Also the Monarchs' Meeting; or the King of Denmark's Welcome into England.* He was writing for the stage as early as 1613, when his unpublished comedy, *An Ill Beginning has a Good End*, was acted at the Cockpit; but the first of his published plays is *The Lover's Melancholy*, produced 24th November 1628 and printed in 1629, a comedy of no particular merit. His most powerful tragedy, *'Tis pity She's a Whore*, acted at the Phœnix in Drury Lane, was published in 1633, with a dedicatory epistle to John, first Earl of Peterborough. To the same year belongs *The Broken Heart*, dedicated to Lord Craven. The closing scenes, deeply impressive but strangely fantastic, were passionately admired by Charles Lamb. *Love's Sacrifice* (1633), dedicated to the author's cousin, John Ford of Gray's Inn, is in parts excellent, but disappointing as a whole. Far more satisfactory is *The Chronicle History of Perkin Warbeck* (1634), dedicated to the Earl (afterwards Duke) of Newcastle. *The Fancies Chaste and Noble* (1638), dedicated to the Earl of Antrim, has an interesting but badly handled plot. *The Lady's Trial* (1638), had it been equal at all points, would have been a good play; it fails in the last act. *The Sun's Darling*, licensed for the stage in March 1623–24 and posthumously published in 1656, was

written in company with Dekker, who probably supplied the pleasing lyrical passages. Two other plays by Dekker and Ford, *The Fairy Knight* and *The Bristowe* (Bristol) *Merchant*, were produced in 1624, but were not published. *The Witch of Edmonton*, produced *circa* 1621 and published in 1658, was written with Dekker and William Rowley. Ford's share was probably confined to the scenes which relate to Frank Thorney. On one occasion Ford collaborated with Webster; but the tragedy, *A late Murder of the Son upon the Mother*, licensed for the stage in September 1624, was not given to the press. To Webster's *Duchess of Malfi* (1623) Ford prefixed a copy of commendatory verses. Among the plays unfortunately destroyed by Bishop Warburton's cook were four pieces by Ford, a tragedy, and three comedies. The tragedy, *Beauty in a Trance*, was entered in the Stationers' Register in 1653, and the three comedies, *The London Merchant*, *The Royal Combat*, and *An Ill Beginning has a Good End*, were entered in 1660; but all four remained unpublished.

After the publication (1639) of *The Lady's Trial* Ford passes from notice. There is a tradition that he secured a competence by his professional labours, and ended his days in Devonshire. It is certain that he was not dependent on the stage for his livelihood. In procuring practice he was doubtless aided by the influence of his maternal uncle, Lord Chief-justice Popham. Ford had little comic talent, but his place among the tragic poets is unassailable. There is often a want of spontaneity in his writings; he is too elaborate and too subtle; but his two great tragedies, *'Tis Pity* and *The Broken Heart*, are not far inferior to Webster's masterpieces. William Gifford edited Ford's works in 1827, Hartley Coleridge in 1840; in 1869 Alexander Dyce revised Gifford. An edition in Bang's *Materialien* was begun in 1908.

Ford, Richard, F.S.A., was born in 1796, graduated at Oxford in 1817, and was called to the bar, though he never practised. The years 1830–34 were spent in a series of long riding tours in Spain; and in 1845 appeared the first edition of his delightful *Handbook for Travellers in Spain*. His *Gatherings from Spain* (1846) is mainly made up of charming matter which want of space caused to be cut out of the second edition of the *Handbook*. For twenty years Ford was a contributor to the *Quarterly* and other reviews, and his papers on Spanish art especially are of great value. He died 1st Sept. 1858. See his Letters (ed. Prothero, 1905).

Fordun, John of. This early Scottish chronicler was a secular priest, perhaps connected with the cathedral of Aberdeen. It has been inferred from his name that he was born at Fordun, in Kincardineshire. Having proposed to himself the compilation of a chronicle of Scotland, he is said to have travelled on foot through Britain and Ireland in search of materials. He lived to write only five books of his *Scotichronicon*, bringing the history down to the death of King David I. in 1153. He left collections extending to the year 1384, about which time he is supposed to have died. The work which John of Fordun had left unfinished was resumed in 1441 by Walter Bower, abbot of the monastery of Austin Canons Regular, at Inchcolm, in the Firth of Forth. Making use of his collections so far as they went, Bower enlarged the five books which Fordun had completed, and wrote eleven new books, bringing the *Scotichronicon* down to the year 1437; but many of his alterations corrupted Fordun's narrative. The work is the chief authority for the history of Scotland prior to the 15th century; its value being greatest during the 14th, when it is contemporary. Of the *Scotichronicon* there exist upwards of twenty MSS., the purest as regards Fordun's text being that preserved in the Wolfenbüttel library. Four printed editions have been published. The latest edition of Fordun's own work is that chiefly from the Wolfenbüttel MS. edited by W. F. Skene (2 vols. Edin. 1871–72); one of the volumes being an English translation of the Latin text.

Forecasts. See Meteorology.

Foreclosure, in English law, the process by which a mortgagor failing to repay the money lent on the security of an estate is compelled to forfeit his right to redeem the estate. Every person having mortgaged his estate is entitled to an equity of redemption, which can only be cut off by a formal process. For this purpose the mortgagee files a bill of foreclosure, praying that an account may be taken of the principal and interest due under the mortgage, and that the mortgagor, on failing to pay, may forfeit his equity of redemption. If on the day fixed for payment the money be not forthcoming, the mortgagor will be declared to have forfeited his equity of redemption, and the mortgagee will be allowed to retain the estate. See Mortgage.

Foreign Enlistment Act. In the law of England there was a statutory prohibition of enlistment in the service of a foreign prince from the times of James I.; but the statute commonly known as the Foreign Enlistment Act is that of 1870. It provides that if any British subject shall agree to enter the service of any foreign state at war with any friendly state, either as a soldier or a sailor, without the license of the sovereign, or an order in council or royal proclamation, or if any person within the British dominions induces any other person to enlist in the service of a foreign state, such person shall be guilty of a misdemeanour. The officers of the customs, on information on oath, may detain any vessel having persons on board destined for unlicensed foreign service. Masters of vessels knowingly having such persons on board are punishable by fine or imprisonment or both. Persons building any vessel for foreign service without license are guilty of a high misdemeanour, and the ship and stores are forfeited. Even to assist a foreign state at war with a friendly state by supplying warlike stores without license is a misdemeanour punishable with fine and imprisonment. These penalties are irrespective of any consequences that may follow to the individual for having committed a breach of international law. See Mercenaries.

Foreigner. See Alien.

Foreign Law. The term foreign is applied by lawyers to places and matters outside the limits within which certain laws apply and courts have jurisdiction. Thus, to an English lawyer Scotland is a foreign country. Foreign law as such has, of course, no application to England; but the comity of nations requires that it should be recognised and acted upon in certain cases, as, for example, by the Extradition (q.v.) of offenders. The judgment of a foreign court, if in favour of the defendant, is an answer to an action brought on the same complaint in England; if in favour of the plaintiff, it is accepted as *primâ facie* evidence that his claim is well founded, and he may obtain satisfaction by suing on the judgment in England. Foreign law is proved in an English court as a matter of fact by the evidence of experts, or, if necessary, by taking the opinion of a foreign court. Government is empowered to make treaties for facilitating mutual ascertainment of laws. The courts will not act on a judgment which seems to have been improperly obtained, nor will they enforce a foreign law which is not in

accordance with natural justice as we understand it. The foregoing rules are not peculiar to England; they are followed by the courts of other countries; French courts give effect to English judgments. See also CAPITULATION, CONSUL.—For Foreign Attachment, see ATTACHMENT; for Foreign Money, in law, see TENDER.

Foreign Legion (*Légion Étrangère*), a body of foreigners of all nationalities, many of them ne'er-do-wells and 'men with a past,' or even unmitigated blackguards, was recruited for the French service, organised at Toulon in 1831, and sent to assist in the conquest of Algeria, where in 1834, spite of severe losses in the field, their numbers rose to 5600; four battalions being German, one Spanish, and one partly Polish and partly Italian, engaged for from three to five years. In the Crimea 900 (out of 3200) succumbed. They fought well in Mexico and the Franco-German war, and in 1884 were reorganised in two regiments. It is stationed as required, and is under French officers. The discipline is very severe, and in some respects cruel. See (as well as Ouida's *Under Two Flags*) J. P. Le Poer, *A Modern Legionary* (1904), M. M., *Memoirs of the Foreign Legion* (1924).—In the Spanish Foreign Legion serving in Morocco, peculiarly barbarous conditions were reported in 1921.

Foreign Office. See SECRETARY OF STATE.

Forel, FRANÇOIS ALPHONSE (1841–1912), was born and died at Morges, on the Lake of Geneva, of whose 'seiches,' geology, natural history, &c., he made a scientific study. He wrote *Le Léman* (1892–1902) and *Handbuch der Seenkunde* (1901).

Foreland, NORTH and SOUTH, two promontories of England, on the east coast of Kent, between which are the Downs and Goodwin Sands. North Foreland, the *Cantium* of Ptolemy, which forms the north-east angle of the county, consists of chalky cliffs, nearly 200 feet high. South Foreland, also composed of chalk-cliffs, is 16 miles S. of North Foreland. It was off this part of the coast that the four days' sea-fight between Monk and De Ruyter took place in 1666. Both Forelands have lighthouses.

Forensic Medicine. See MEDICAL JURISPRUDENCE.

Foreshore. See SEASHORE.

Foreshortening, a term in Painting or Drawing, applied to signify that a figure, or a portion of a figure, which is intended to be viewed by the spectator directly or nearly in front, is so represented as to convey the notion of its being projected forward; and, though by mere comparative measurement occupying a much smaller space on the surface, yet to give the same idea of length or size as if it had been projected laterally.

Forestalling. See ENGROSSING.

Forest-bed. See PLIOCENE.

Foresters. See FRIENDLY SOCIETIES.

Forest-fly, or HORSE-FLY (*Hippobosca equina*),

Forest-fly (*Hippobosca equina*), magnified: *a*, natural size; *b*, the pupa, as deposited by the mother.

a Dipterous insect, parasitic on horses, oxen, &c., frequent in forests, particularly in the New Forest, Hampshire. It is a small insect, about four lines long, of a shining brown colour, with some yellow. Living on the blood of its host, it especially infests the tail, belly, and flanks. The insect passes the larval stage and becomes a pupa within the mother. One only is produced at a time, enclosed in a relatively large, black, bead-like, tough cocoon, from which the insect finally emerges by bursting open a kind of lid.

Forest Laws. Forest is defined by Coke to be a safe preserve for wild animals (*ferœ*) of the chase. A forest, in the sense of the law of England, is a large tract of open ground, not necessarily covered with wood, but usually containing woodland interspersed with pasture, and forming part of the property of the monarch, and governed by a special code, called the forest law. This particular law not only had reference to matters connected with hunting and the like, but generally governed the persons living within the forest in all their relations. Though the privilege of forest belongs of right to the sovereign alone, it may be granted by him in favour of a subject, who becomes entitled to exercise the privileges of forest in the district assigned. This right was exercised by the Saxon kings. William the Conqueror greatly extended the royal forests, 'afforesting' and putting under forest laws vast districts in Hampshire and Yorkshire (but did not lay them waste or remove houses or churches); he also made several penalties for offences against the game.

The laws of the forest were first reduced to a code by the Forest Charter of 1217. Under William II., Henry I., and Stephen the cruel oppression increased for those whose lands were afforested; and Henry II. made extensive new afforestations, but was forced to relax the severity of the forest laws by passing a statute known as the Assize of Woodstock, 1184. This placed the forest law on a definite footing apart from the common law, and ordained that special forest courts should be held regularly for each forest—(1) the *Woodmote* or court of attachment, every forty days; (2) the *Swainmote* or court of freeholders, thrice a year, for inquiry; and (3) the *Justice-seat* or *Eyre of the Forest*, once every three years, a court of record and conviction, presided over by the chief-justice in eyre, acting as the king's commissioner. This was the highest forest official, though there were foresters and others attached to each royal forest; and no one could own a forest or appoint a forester except the king. In course of time irregularities and abuses crept in; and a detailed history of British forestry from about the end of the 11th to near the close of the 15th century would be a continuous record of attempted afforestations and reafforestations on the part of the kings, and of enforced perambulations of boundaries and disafforestation of usurped lands when the barons were strong enough to wring such concessions from the sovereign. Thus in 1215 Magna Carta modified the forest laws, and in Henry III.'s reign (1216–72) new charters were obtained; as also during the 14th and 15th centuries, when those holding land in or near a royal forest were subject to grievous oppression. The right of the sovereign to create a forest is by the common law confined to lands of his own demesne. Henry II. had arbitrarily exercised his power by afforesting the lands of his subjects; but by this charter of Henry III. it was provided that all forests so made should be disafforested. By the same charter the penalties for destroying game were greatly modified, it being provided that no man should lose life or limb for slaying deer, but that the punishment should be restricted to fine or imprisonment for a year and a day. Chap. 11 contains the following curious privilege: 'Whatsoever arch-

bishop, bishop, earl, or baron, coming to us at our commandment, passing by our forest, it shall be lawful for him to take and kill one or two of our deer by view of our forester if he be present; or else he shall cause one to blow an horn for him, that he seem not to steal our deer; and likewise they shall do returning from us.' Charles I.'s attempts to impose penalties and exact fines for alleged encroachments on the ancient boundaries of the forests, though the right to the lands thus taken was fortified by possession for several centuries, were among the first grievances with which the Long Parliament dealt. Since the passing of the act for the 'certainty of forests' (16 Car. I. chap. 16), the laws of the forest have practically ceased. The last Court of Justice-seat at which business was transacted was held in the reign of Charles I. before Lord Holland; the office of itinerant forest justices was not abolished until 1817, the criminal law of the forest having been almost wholly repealed half a century before.

In Coke's time there were sixty-nine royal forests; of these the principal were the New Forest, Sherwood, Dean, Windsor, Epping, Dartmoor, Wychwood in Oxfordshire; Salcey, Whittlebury, and Rockingham in Northamptonshire; Waltham in Lincolnshire; and Richmond in Yorkshire. Some of these were disafforested as recently as 1850, and now only four are preserved—Windsor and Wolmer as the exclusive property of the crown, New Forest and Dean with greatly circumscribed privileges, popular rights overshadowing crown rights. Scotland has many royal forests: in Perthshire, Athole, Glenartney, Glenfinlas, Glenalmond, &c.; in Aberdeenshire, the Stocket, Dyce, Kintore, Benachie, Drum, Birse, Braemar; in Forfarshire, Platan, Montrethmont, Kilgerry; in Kincardine, Cowie and Durris; in Banffshire, Boyne and Enzie; in Elgin, Darnaway, &c. South of the Forth were those of Torwood, Cadzow, Ettrick, Selkirk, Jedburgh, Traquair, the New Forest in Dumfriesshire, &c. The forest code of Scotland (*Leges Forestarum*), though neither so complete nor administered with the same rigour as that of England, was still generally complained of for its severe penalties and vexatious restraints. The grant of a right of forestry conferred the same privilege as if the ground over which it extended had been originally, and had continued to be, a king's forest. See DEER-FORESTS, FORESTRY, GAME LAWS, MAGNA CARTA, WOODS AND FORESTS; the articles on Dean, Epping, Sherwood, New Forest, &c.; Turner, *Select Pleas of the Forests* (1902); Cox, *Royal Forests* (1905).

Forest Marble, a member of the middle division of the Jurassic System (q.v.), of which the typical beds occur in Wychwood Forest, Oxfordshire. The principal bed is a fissile limestone, containing large numbers of dark-coloured shells, and capable of being polished and used as 'marble.'

Forestry is the science and art of forming and economically cultivating forests; practically the art of managing growing timber. It is accordingly rather *sylviculture* than *arboriculture*, but may be taken to include both branches.

The history of British forestry can best be understood from a brief survey of what took place in England. At one time the greater part of the British Isles was probably thickly covered with primeval woods, though most of our common timber-trees have been introduced; but even before the Roman period extensive clearances had already been made. In the Saxon and Danish periods the chief use of the woodlands was for hunting and for the pannage of great herds of swine, while wide tracts containing woods and other lands were here and there reserved as 'royal hunting-grounds.' William the Conqueror acquired many such tracts, and he extended their boundaries and gave them the name of *forestæ* or 'forests,' two of the largest being the New Forest in Hants and the Forest of Dean in Gloucestershire, both of which were formed before 1086. Lands thus reserved for the king's deer were said to be 'afforested;' and new 'forest laws' of a much more cruel and stringent character than had obtained before 1066 were applied to their administration. For the history of these forests, see FOREST LAWS. The office of chief-justice was not abolished by act of parliament till 1817, when his duties were entrusted to the First Commissioner of Woods and Forests. And now the existing remnants of these ancient royal forests are administered by the commissioners under an act of 1852. In Scotland forest laws framed on the English model, but nothing like so oppressive, were introduced at a comparatively late date, probably during the 15th century; while in Ireland, at a still later date, only arboricultural enactments seem to have had force, from 1634 onwards.

The planting of trees in Britain for utility or ornament certainly dates at least as far back as the Roman period, and most of our common woodland trees have been introduced, along with many others serving purely ornamental purposes, which grow well in our mild and equable climate, free from extremes of summer heat and winter cold. The indigenous kinds include common and sessile oak, ash, beech, hornbeam, Scots elm, white and goat willow, aspen, birch, alder, rowan, and cherry among broad-leaved trees, and Scots pine and yew among conifers; besides shrubs like field-maple, hawthorn, holly, juniper, &c. But to the Romans we owe the English elm, sweet chestnut, black and white poplar, lime, and service; while subsequent introductions date from much later periods—15th century, sycamore and crack willow; 16th, maple, plane, spruce, and maritime pine; 17th, silver fir, Canadian poplar, horse-chestnut, robinia, and larch (England); 18th, Weymouth and Corsican pine, and larch (Scotland); 19th, Austrian pine, Douglas fir, Menzies spruce, Monterey, Lawson's, and Nootka cypresses, giant arbor vitæ, and Japanese larch; while in the 20th century, as yet, the American larch may perhaps prove to be the most important new species, with the hybrid (European × Japanese) larch.

From this it would appear that from the 11th to the 15th century, while England was groaning under the worst tyranny of the oppressive forest laws, no important new kinds of timber-trees were introduced. But it is certain that arboriculture was habitually practised, and chiefly in the form of coppice with standards, long before the latter date. This seems clearly proved by the Statute of Enclosure passed in 1482, which applied only to the 'forests, chases, and purlieus' (or disafforested lands), and permitted landowners having woods within the same to fence their young coppices against deer and cattle for seven years after each fall, instead of only for three years, as had then apparently long been customary. But even at that early date there began to be great fear of a serious want of timber both for ship and house building and for fuel and firewood; and the great measure taken to obviate this danger was the passing of a Statute of Woods in 1543, of a compulsory and prohibitive nature, and applying to all the woods in the English realm. According to the rotation in which the coppice or underwood was worked (fourteen years or under, fourteen to twenty-four, and over twenty-four years), the falls were to be enclosed and fenced for four, six, or seven years; and on every acre of wood felled 'twelve standils or storers of oak' had to be left, or, failing oak, then of 'elm, ash, asp, or beech,' to make up the number

of twelve standards per acre 'likely to prove to be timber-trees.' These were then the five most highly prized kinds of timber, and especially the oak for shipbuilding. But those provisions soon seeming inadequate, the time of enclosure was in 1570 increased by two years in each case.

About this time, during the Elizabethan period, considerable advances in forestry appear to have been made. In Taverner's *Book of Survey* of the royal forests in 1565 the 'setting' or sowing of acorns and beech-mast is mentioned (as regards the regeneration of old woods, see OAK and BEECH), and one of the first instances of thus also raising oak-woods where they were not already growing is said to have been thirteen acres in a corner of Cranbourne Chase, in Windsor Forest, about 1588 or shortly after that. Down to the end of the 16th century all the 'plantations' made were probably sown, while planting with live plants was only introduced early in the 17th century owing to the acorns and other tree-seeds being eaten by mice and voles, birds, &c. Thus Arthur Standish, in his *New Directions for Increasing Timber and Firewood* (of which the 2nd edition was issued in 1615), urged that, to obviate destruction of seed by field-mice, 'the remedy for such as would raise plants is by nurseries, where the mice may be destroyed by traps.'

All through the 17th and 18th centuries growing anxiety about timber for shipbuilding and other purposes necessitated close attention to forestry in all parts of the United Kingdom, and many acts of parliament were passed relating to woods and plantations; while in royal forests, and in the Forest of Dean in particular, regular schemes of management were introduced. So great was the scarcity of oak-timber in 1660 that the Commissioners of the Navy asked the advice of the Royal Society, and the result was the reading of a paper by John Evelyn on October 15, 1662, which was expanded and published as *Sylva, or a Discourse of Forest Trees*, in 1664, and which, passing into the 4th edition before the author's death in 1706, gave a great stimulus to planting for profit and ornament throughout Britain. And its influence continued all through the 18th and down into the 19th century, as numerous subsequent editions appeared (6th to 11th, 1786–1825), edited and annotated by Dr A. Hunter of York. The only other authors whose influence on British arboriculture has been at all comparable with Evelyn's are Sir Walter Scott and Loudon, during the first half of the 19th century.

It is noteworthy that one effect of the Statute of Woods (1543) and of subsequent modifying acts was to enforce a particular method of treatment of woods—namely, coppice or underwood consisting of oak, ash, hazel, chestnut, birch, willow, dog-wood, &c., with standards of oak, ash, &c.—which thus compulsorily became the national form of British arboriculture. This secured for the standards of various ages in the copsewoods a free growing-space, enabling them to form large limbs and grow into crooked and curved timber suitable for shipbuilding. And so generation after generation of foresters and woodmen grew up in the firm belief that this was not only the best, but also the only suitable way of producing good timber of any kind whatever, with the result that in course of time, when highwoods also became a common method of timber-growing, there was a strong inclination to overthin greatly. This great and very usual fault of British arboriculture, down almost to the present day, was encouraged by the ruling idea that for the proper development of timber-trees the distance from stem to stem should equal one-third of their height—a generalisation which gives the same treatment to light-demanding trees like oak and larch, and to shade-enduring kinds like beech and spruce.

This specially arboricultural copsewood system continued to be practised with a considerable degree of regularity until well into the 19th century; and in its earlier years the English copses were among the most profitable portions of landed estates, as the underwoods also supplied hurdles, hop-poles, and small wood, everywhere in great demand and saleable at good prices. But as the market for oak-bark and small coppice-wood has changed completely, and is very poor now compared with what it used to be, many of the old coppices, with or without standards, have been converted into high-woods, in which the main object is to grow trees having large, long, clean stems.

The highwood method of timber-growing became considerably extended when large plantations of larch and other conifers were made in Britain about the middle of the 18th century, and in Ireland about the end of it. During the first half of the 19th century, however, the old national system of arboriculture began to decline, and became almost a lost art so far as regularity in storing and thinning out the different age-classes of standards was concerned. After Britain obtained command of the seas cheap foreign timber could be imported to any extent necessary, and less attention was paid to the woodlands. The decline was more rapid when steam communications improved by land and water. The growing neglect of the woodlands increased when the import-duty was taken off colonial timber in 1846, and became intensified when the import-duty was also removed from all foreign timber in 1866. Teak and iron were ousting oak for shipbuilding, cheap and good coniferous timber and sawn wood were apparently obtainable in inexhaustible abundance, and the value of home-grown woodland produce of all sorts fell so low that timber-growing, for centuries an important rural industry, became unprofitable, and many of the existing woods and plantations came to be practically treated as game-coverts and ornamental parts of the large landed estates.

Since 1866, however, the year in which what has proved a death-blow was given to the old system of British arboriculture, the great economic changes throughout the world have profoundly affected the question of Britain's timber-supplies. The vast increase in population and the enormous industrial development that have taken place in America since the reconstruction of the United States, and in Germany since the union of the empire in 1871, made these two formerly wood-exporting countries our keenest competitors for the surplus supplies of the great timber-producing tracts in Canada, Scandinavia, and Russia. But even in these still well-wooded countries there is less timber now available than formerly, and the cost of extraction is greater, so that prices have risen greatly and have constantly an upward tendency. Hence the importance of trying to improve British forestry and to adopt some well-considered national scheme of timber-planting throughout Britain, in order to increase work for our rural population, and to ensure the steady supply of our annual requirements in timber and other wood in years to come, has engaged the attention of government. Although the British Empire contains the largest and the most valuable forests in the world, Britain itself is one of the most poorly wooded countries. In 1915 its woodland area was about 3,098,000 acres, of which 1,730,000 acres were in England, 188,000 in Wales, 880,000 in Scotland, 300,000 in Ireland.

Much has recently been done for the improvement of British forestry and for the instruction of the public in matters relating thereto, and in urging government to deal with the timber question, by the Highland and Agricultural Society of Scotland,

the Royal Society of Arts, the Royal Scottish Arboricultural Society (1854), the Royal Arboricultural Society of England (1881), and the Irish Forestry Society (1901); and it was mainly to their efforts in these directions that a number of official inquiries and reports were made in 1885–1918. But so far as planting is concerned, only very little practical result followed. Small sums were granted and lent, chiefly for education, from the fund made available by the Development Act (1909). The Great War made foreign timber difficult to get, and British woods were felled so lavishly that the problem became acute. In 1919 a Forestry Act was passed, by which a Forestry Commission was set up, charged with the duty of promoting the interests of British forestry generally. The functions of the English and Scottish Boards of Agriculture and the Irish Department of Agriculture, so far as they related to forestry, were handed over to the commission, which is empowered to acquire land for afforestation; promote the sale, utilisation, and conversion of timber; make grants and loans to persons and local authorities for afforestation (including replanting); manage forests or advise on management; set up and carry on forest industries; collect statistics; establish and aid schools; promote research; prevent damage by rabbits, hares, and vermin. Greater facilities for instruction in modern forestry are required, especially in Scotland, where there is greatest scope for timber-growing. A course, for the most part in Continental forestry, was instituted in 1885 at Cooper's Hill, but transferred in 1905 to Oxford University, where probationers are trained for the Indian Forest Service and for forest appointments in the crown colonies. Other university centres at which lectures are given include Edinburgh (1889), Newcastle (1891), Bangor (1904), Cambridge (1907), and Dublin (1913), the most comprehensive courses being at Edinburgh and Cambridge; while somewhat similar instruction is provided at various agricultural colleges. In some cases degrees (B.Sc.) are granted, in other cases diplomas or certificates; and certificates in forestry are also given after special examinations by the Highland and Agricultural Society of Scotland and the Surveyors' Institution, London. For the training of young woodmen a forest school was opened for England and Wales in the Forest of Dean, Gloucestershire, by the Commissioners of Woods and Forests in 1904, and in 1905 a similar forest school for Ireland was organised at Avondale, Co. Wicklow, on an estate acquired along with adjoining woodlands for this purpose by the Department of Agriculture and Technical Instruction.

The probationers trained at Oxford, Cambridge, or Edinburgh for the Indian Forest Department go out as officers in the Imperial Forest Service, while officers of the Provincial Forest Services are trained at the Indian Forest College at Dehra Dún (United Provinces), and members of the subordinate staff (foresters, &c.) are taught at local forest schools organised in different provinces. Since the formation of the Indian Forest Department in 1863 great progress has been made in the administration and development of the vast forests yielding a large revenue. In most of the self-governing dominions, however, it is only of recent years that attention has been given to the conservation of timber-growing lands, and most of them have organised a forest service similar to that in India. Canada was the first dominion to establish a chair of forestry (at Toronto 1907). In several of the crown colonies and protectorates (Ceylon, Federated Malay States, Kenya, Nigeria, &c.) the forest administration follows the lines of the Indian model, though on a much smaller scale.

The modern forestry now taught at university and collegiate centres has been to a great extent adapted from the Continental systems, in so far as they apply to the very different economic conditions obtaining in Britain. Like every other art concerning the cultivation of the soil, the natural sciences form its foundations; and it is advisable that a student should have a fair knowledge of chemistry, physics, climatology, geology, elementary soil-science, botany, and zoology before commencing the study of forestry itself, in which these and other sciences come into play. This modern art of forestry is usually divided, for convenience in teaching or studying it, into four main branches, with an *Introduction:* (1) *Sylviculture*, (2) *Management*, (3) *Protection*, and (4) *Utilisation*.

The *Introduction* should make a brief survey of the history of arboriculture in the United Kingdom, then indicate the direct and indirect utility of extensive woodlands with regard to climate, atmospheric and soil moisture, water storage and purification, and also to the employment of rural labour.

The climatic and physical effects of large compact blocks of woodland consist in tending (1) to equalise the temperature both of the soil and of the atmosphere, and to diminish extreme differences in each of these during summer and winter; (2) to increase the relative humidity of the air, and also perhaps slightly increase the total amount of dew, mist, and rainfall; (3) to absorb and retain moisture in the soil, and especially in the upper layer of humus, thus helping to prevent floods, to maintain the perennial flow of springs and brooks, and to act as purifying filters in water-catchment areas; (4) to protect the surface-soil from erosion during heavy rainfall; and (5) to help to purify the air from excess of carbon dioxide. *Their economic uses* are (1) to provide work for part of the rural population, and especially during winter, when other work is scarce; (2) to provide part of the timber now imported in vast quantities for industrial purposes, and thus increase the sum-total of wages payable to workmen in our own country; (3) to give shelter to fields and farm live-stock; and (4) to add to the attractions of country life by increasing facilities for sport. On the average one permanent woodman is required for every hundred to one hundred and fifty acres of woodland; but this gives no indication of the total amount of employment of various kinds that large woodlands worked on business principles would ensure to the rural population in planting, tending, and felling timber-crops; in preparing, extracting, transporting, and converting the timber; and in distributing the converted timber and other woodland produce. Any great national scheme of planting would ultimately mean that many millions of pounds sterling would annually be circulated among our own rural population in place of being sent abroad as at present. Even 3,000,000 acres of well-managed coniferous timber-crops worked with a rotation of sixty years would give an annual mature fall of 50,000 acres, besides thinnings in younger woods, and would probably yield on the average a total crop of about 100 tons weight of timber per acre, or about 5,000,000 tons of raw material having to be cut, dressed, transported, converted, and distributed.

1. *Sylviculture* deals with the formation, tending, and reproduction or regeneration of woodland crops, whether coppices, simple or stored (*sylva cædua*; see COPSE), or highwoods (*saltus*) of any description, between which two different classes of woods and plantations there are important legal distinctions (especially with regard to entailed estates in England). Unless this main branch has been preceded by a course of forest botany, consideration has first to be given to the woodland trees and their sylvicultural characteristics; their relation to

soil, climate, aspect, and environment; their relative demand for light, or capacity for enduring shade; and their rate of growth and suitability for growing in pure and in mixed woods. Coppices worked with a rotation of twelve to twenty years or so can be naturally reproduced by felling close to the ground, and standards may be stored, or the whole may be interplanted for conversion into highwood; while mature highwoods can either be naturally regulated by seed shed from parent trees (as is customary with beech, and less frequently oak, ash, sycamore, and Scots pine), or else clear-felled and a new crop raised artificially by sowing or planting. Owing to the rank growth of weeds in our damp climate the Continental methods of sowing are generally quite unsuitable, and planting is therefore customary, the young plants required being raised in nurseries (see the article TRANSPLANTING). Woodland planting of any sort can only be successful when there is a favourable combination of the following five factors: (1) suitable soil and situation, with such drainage and other soil-preparation as may be necessary; (2) suitable kinds of trees for the given local conditions, and of a suitable size and quality; (3) a suitable method of planting and number of plants per acre; (4) adequate protection against human actions, weeds, live-stock, game, and vermin for some years till the young plantation has thoroughly established itself; and (5) immunity from serious damage by frost, wind, drought, fire, fungus disease, &c. With regard to their timber, woodland trees are classified as hardwoods (oak, ash, elm, &c.), softwoods (willow, poplar, alder, &c.), and conifers. Of these the conifers are usually the most suitable for planting for profit on poor land, because they are generally less exacting as to soil and climate, hardier and more capable of accommodating themselves to their environment, quicker in timber production, and on the whole more easily disposed of; whereas hardwoods usually need a fairly good class of soil, or at any rate one that has already been enriched with humus, for their profitable growth. And in any case wet land has to be thoroughly drained and prepared before planting (even if only by cutting small drains and inverting thick sods at the given planting-spots), as there is always great risk in altering the water-level in the soil carrying a timber-crop. But the future profit of any plantation is directly affected by the mode of planting, the size of the plants, and the distance at which they are set, as these mainly determine the initial cost, with beating-up until the plantation establishes itself. Two methods of planting have hitherto been customary in Britain, *notching or slit-planting* by making L or T shaped or other incisions in the sod, and then slipping in the plants—the cheapest method, but only suitable for a very light and friable soil; and *pitting* or opening out pockets of soil, and then replacing it carefully around the roots of the plant inserted. The cheapest way of opening pits is with a semicircular spade, of which several kinds are now in use. Whether naturally regenerated woods or artificial plantations should be pure or mixed depends on circumstances; but as a rule mixed woods are best, the mixture taking place in the natural method of groups of varying size specially suited to differences in soil, aspect, &c. Formerly planting was commonly done on a stencil-like 'planter's scheme'—e.g. hardwoods every eight or twelve feet—and filled up with larch, pine, &c. as 'nurses;' and often the nurses were left after they should have been thinned out, so that the ultimate wood was very different from what had been originally intended. With regard to tending woodlands, instruction is given as to weeding and cleaning of young crops, and the thinning of those that have arrived at or are getting beyond the polewood stage of growth. The natural tendency hitherto to overthin has already been alluded to, and the fact was also indicated that light-demanding trees like oak, ash, larch, or pine require somewhat heavier thinning than shade-enduring kinds like beech, Douglas fir, spruce, or silver fir; and, of course, the necessity for thinnings and the extent to which they are at any time desirable depend on local conditions. These also regulate the chance of profit in partially clearing and underplanting a maturing crop—a measure seldom likely to be profitable here.

2. *Management* deals with the best adjustment of the *capital*, represented by the land and the growing timber-crops of all ages, and the *income*, represented by the annual increment in wood accruing throughout all the woodlands on any estate, so as to be able to indicate the best and most profitable way of carrying out the proprietor's wishes, while at the same time safeguarding the capital and utilising the increment as fully as possible. This is rendered all the more difficult from the fact that part of the capital employed in production (the immature timber-crops) is of the same description as the wood produced for sale. This is also true of banking, and there would be hopeless confusion in a bank business without daily balancing of books and verification of balances. Something of the same kind has to take place if woodlands are to be managed on scientific principles. The proper amount of capital in growing timber for the given land forming any working-circle must be fixed, and the probable annual increment accruing thereon must be calculated to ascertain the proper annual fall. This can be roughly done by simple subdivision of the total area into equal or equally productive annual or periodic falls according to the number of years in the rotation; but where more scientific and systematic methods are adopted (after Continental models), a *working-plan* has to be compiled after making a register of all the crops, taking stock of their respective age, condition, cubic contents, and annual increment per acre, and arranging them into their proper age-classes, which can also be shown on a coloured 'stock map' (ordnance survey, 6 inches to the mile is best). A wooded estate would be in an ideal or 'normal' condition if it had a normal succession of crops of all ages, each having a normal density and a normal increment, and having the annual falls normally distributed over the whole area; for then there would be a normal growing-stock or capital in wood, and a normal annual increment proportionate to the quality of the land and giving an equal income from year to year. But this ideal condition can never be attained, nor could it be maintained; and the object of a working-plan is so to adjust the given conditions of soil, growing-stock, and annual increment as may best suit the objects aimed at by the proprietor; the specific recommendations as to felling, thinning, and planting being usually made for the next ten years or more, when a revision is advisable. In the *valuation* of woodlands for succession-duty, rates and taxes, &c., the various acts of parliament regulating these imposts prescribe the manner in which they are to be assessed; but for all ordinary purposes exact actuarial methods have to be followed, as in all other money calculations. And as the rate of interest affects these considerably, 3 per cent. ought to be usually adopted for forestry.

3. *Protection* is provided by means of special forest laws in all countries having extensive woodlands; and this was formerly the case in Britain to a far larger extent than now obtains, when theft of and injury to trees, woods, shrubs, &c. are dealt with under the Larceny and Malicious Injuries Act of 1861. Accidental damage from railway fires is provided for in the Railway Fires Act, 1905,

operating from 1908. But in addition to protection against human actions, woodlands need to be protected against game (red deer, roe-deer, hares and rabbits, blackcock, &c.), vermin (squirrels, mice and moles, and insects), weeds, epiphytes and parasitic fungus diseases, frost, wind, and various other injuries arising from inorganic causes; and this main branch of forestry teaches the best way of preventing these different kinds of danger (so far as possible), and how any damage done can best be remedied.

4. *Utilisation* deals with the technical properties, practical uses, and market value of the different kinds of timber, the best way of felling and preparing it for sale, of transporting it by land and water, and of preserving it by seasoning and antiseptic processes. And it also treats of special woodland industries, such as estate and other sawmills, the preparation of wood-pulp and cellulose, charcoal-burning, resin-tapping, and grazing in woodlands, about all of which—and especially about small sawmills—it is desirable that the forester should know something.

It is, however, very important that such a theoretical course of instruction should be supplemented by frequent excursions to, and also by residence in, woodland estates.

See the numerous articles on the several trees and their management — oak, ash, elm, beech, birch, fir, pine, chestnut, walnut, willow, plane, hornbeam, &c.; teak, ebony, mahogany, eucalyptus, palm, &c.; also WOOD and TIMBER, and the following books. Nisbet's *The Forester* (1905) and *The Elements of British Forestry* (1911), Forbes's *English Estate Forestry* (1907), and Maw's *The Practice of Forestry* (1909) are the chief books on British arboriculture; while Schlich's (and Fisher's) *A Manual of Forestry* (various editions) deals mainly with German conditions.

Forez, an old division of France, in the Lyonnais, now included in the department of Loire. The capital was Montbrison. The Forez mountains in the west, between the Loire and the Allier, reach 5381 feet in Pierre-sur-Haute. The east is a plain, through which flows the Loire.

Forfar, the county town of Forfarshire, 14 miles NNE. of Dundee, stands at the east end of Forfar Loch, on a rising ground in the fertile valley of Strathmore. It was a royal residence as early as the reign of Malcolm Canmore, whose son, David I. (1124–53), made it a royal burgh; but in 1308 Bruce captured and razed the castle —its site is marked now by the town cross of 1684. Forfar, says Boece, was brought in 1526 to little more than a country village; but since the middle of the 18th century it has risen again to a comfortable town, with several good public buildings, among them a striking Episcopal church (1881). The making of brogues by the 'Forfar souters' is a thing of the long past; and linen is now the leading manufacture. With Montrose and three other burghs it returns one member to parliament. Pop. 10,000. Glamis Castle, a stately château-like pile, the seat of the Earl of Strathmore, lies 5 miles WSW.

Forfarshire, or ANGUS, a maritime Scottish county, washed on the east by the North Sea, on the south by the Firth of Tay. It has an utmost length and breadth of 36 and 36½ miles, and an area of 870 sq. m. The surface is finely diversified, the rich plain of Strathmore—the Howe of Angus —dividing the Sidlaw Hills (1399 feet) from the Grampian Braes of Angus in the north-west, which culminate in Cairn na Glasha (3484 feet) on the Aberdeenshire boundary, and exceed 2000 feet in twenty-two other summits. The chief streams are the North and South Esks and the Isla; and Loch Lee (9 by 2 furlongs) is the largest of several small lakes. The rocks are Silurian in the north-west, and elsewhere Old Red Sandstone; the soils are very various. Somewhat less than half of the entire area is in cultivation, and more than one-nineteenth under wood. Agriculture is practised on the best methods, and much attention is paid to live-stock, though the celebrated 'polled Angus' belongs now specially to Aberdeenshire (see CATTLE). Linen and jute are the staple manufactures of the towns. These include Dundee, Montrose, Arbroath, Brechin, Forfar, Kirriemuir, and Carnoustie. The county returns one member to parliament. Pop. (1801) 99,053; (1881) 266,360; (1921) 270,950. Part of Southern Pictavia, then till 1242 the *mormaer*-ship or old Celtic earldom of Angus, Forfarshire is rich in antiquities—vitrified and other hill-forts, cairns and standing-stones, Roman camps, the sculptured stones of Meigle, Aberlemno, St Vigeans, Glamis, &c., the ruins of Restennoth priory and Arbroath abbey, the round tower and cathedral of Brechin, and the old castles of Glamis, Edzell, Finhaven, Airlie, &c. See A. Jervise's *Memorials of Angus and Mearns* (1861), and *Land of the Lindsays* (2d ed. 1882); and Warden's *Angus or Forfarshire* (4 vols. 1880–83).

Forfeiture is a legal term which includes the various cases in which a person is penally deprived of property. An offender who is fined forfeits a sum of money, which is recovered out of his general estate. The feudal law of England made forfeiture of land and goods part of the punishment of an offence involving disloyalty or breach of feudal duty; thus, the lord might claim lands in case of what was called 'escheat with attainder,' and there was forfeiture to the king in case of treason. An act of 1870 abolishes forfeiture in case of conviction for treason and felony; but the crown may appoint a person to administer the property of a convict; compensation to parties injured, and the costs of the prosecution, may be paid out of his estate. Civil forfeiture of land may still be incurred by unlawful alienation in Mortmain (q.v.), or by breach of the conditions on which the property has been acquired. A tenant, for example, may incur forfeiture by breach of his covenants, or by wrongful disclaimer—i.e. setting up a claim adverse to that of his landlord. Forfeiture for tortious alienation (i.e. for attempting to convey an estate greater than the grantor is entitled to) is now obsolete. The courts will always lean against a forfeiture, and the Conveyancing Act, 1881, protects a tenant against this extreme penalty where compensation in money meets the justice of the case.

In Scotland civil forfeiture may arise either from statutory enactment, at common law, or by agreement. By 1597, chap. 246, it is enacted that vassals failing to pay their feu-duties for two years shall forfeit their right. This forfeiture must be established by an action to recover the feu-duties in arrear, and may be avoided by payment at the bar. At common law a vassal forfeited his land by disclamation or purpresture. The former is analogous to the English disclaimer, and consists in the denial by a vassal of his lawful superior. Purpresture was incurred by the vassal's encroachment on the streets, highways, or commonties belonging to the crown or other superior. These forms of forfeiture are fallen into disuse. Forfeiture on special agreement depends wholly upon the terms of the condition inserted in the titles to the land. The condition must be fortified by irritant and resolutive clauses, and must enter the sasine, in order that it may be effectual against purchasers of the lands. Of this kind of forfeiture are breaches of Entails (q.v.). See ATTAINDER, TREASON.

Forgery (Fr. *forger*, 'to form metal into shape,' 'to fabricate')—the *crimen falsi* of Roman law, in

which it was punished with banishment or death, according to the enormity of the particular offence and the rank of the offender—is 'the making of a false document in order that it may be used as genuine;' and, in certain specified cases, 'the counterfeiting of a seal or die.'

The essential elements in the crime of forgery are (1) that there should be in the offender an intention to deceive, and (2) that the fabrication or alteration should be sufficiently skilful to render possible the deception of a person using ordinary observation. It is not necessary that the fraudulent imitation should be exact. The fraudulent application of a real signature to a false document, and of a false signature to a real one, are both forgeries.

The Forgery Act, 1913, now consolidates, simplifies, and amends, so far as England is concerned, the law relating to forgery and kindred offences. A document is 'false,' within the meaning of the act, if the whole or any material part of it purports to be made by or on behalf of a person who did not make it or authorise its making; or if, though made by or on behalf of such person, the time or place of making, where either is material, or, in the case of a document identified by number or mark, the number or any distinguishing mark is falsely stated. In particular, a document is 'false' (*a*) if any material alteration, whether by addition, insertion, obliteration, erasure, removal, or otherwise has been made in it; (*b*) if the whole or some material part of it purports to be made by or on behalf of a fictitious or deceased person; (*c*) if, though made in the name of an existing person, it is so made with the intention that it should pass as having been made by some other person, real or fictitious. For the purpose of the act (*a*) it is immaterial in what language a document is expressed, or in what place, within or without the king's dominions, it is to take effect; (*b*) the forgery may be complete even if the document, when forged, is incomplete, or is not or does not purport to be binding in law; (*c*) the crossing of any negotiable instrument is a material part of such instrument.

By the common law of England forgery was a mere misdemeanour, and punishable as such by fine, imprisonment, and the pillory; but capital punishment was the usual penalty (see, e.g., the cases of Dr Dodd in 1777 and Fauntleroy in 1824) for the more serious class of offences under this head. Capital punishment in cases of forgery was, however, restricted by acts passed between 1830 and 1832, and abolished in 1837 and 1861. Under the consolidating act of 1913 the punishment varies from penal servitude for life to not more than two years' imprisonment, with or without hard labour. A person injured by a forgery, whether by being deprived of a right, or by parting with property on the strength of it, is entitled to recover damages or the property parted with. People who pay on a forged document cannot, apart from statutory authority (see articles BANKING, BILL OF EXCHANGE), charge the person on whose account the payment is made with the amount paid. Their only remedy is against the recipient. The Forged Transfer Acts, 1891 and 1892, permit the making of compensation (by payments in cash instead of the issue of stock, &c.) for loss sustained through forged transfers of shares, stock, or securities.

Comparison of handwriting is primary evidence of forgery. The knowledge requisite for this purpose may have been acquired by the witness (i.) having seen the party write; (ii.) having received communications from him in the course of business; (iii.) being an expert in the comparison of handwriting, and having had the opportunity of comparing genuine specimens of the party's handwriting with the writing in dispute. The Forgery Act, 1913, does not apply to Scotland. Under Scots law forgery is a crime at common law, and punishable as such.

See also the articles COINING, FRAUD, and TRADE-MARKS.

In the United States, also, falsification of writing is not necessarily forgery in a legal sense; the writing of letters and signing them with the name of another, however injurious to the feelings and interests of that other, is not forgery in law unless pecuniary rights, obligations, or engagements are intended to be directly affected by the false writing. The definition in Bishop's *Criminal Law* is: 'Forgery is the false marking or materially altering, with intent to defraud, of any writing which, if genuine, might apparently be of legal efficacy in the foundation of a legal liability.'

LITERARY FORGERIES are to be distinguished from all use of pseudonyms, devised to conceal the identity of a writer; and from all writings in imitation of some author's style, and temporarily fathered upon him for mere literary purpose; as well as from so-called *pious* frauds, by which writings honestly intended for edification are connected with some more or less ancient name that commands respect. Such compositions as are deliberate attempts to pass for what they are not are literary forgeries, and are as unpardonable as forgeries of the signature of a London banker. The fictitious account of Formosa, with an alphabet and specimens of a language, published by George Psalmanazar in 1704, was such an imposture as could not long escape discovery. The most famous of such literary forgeries in English literature are connected with the name of Shakespeare—himself but a stalking-horse for another, according to thousands of half-educated people whom no evidence could satisfy. The famous Ireland forgeries began with an autograph of Shakespeare, fabricated by Samuel W. H. Ireland, to gratify his father, but soon grew into a heap of papers, and an entire play, entitled *Vortigern*, which was quickly damned at Drury Lane. The criticisms of Malone, and the alarm of young Ireland's father, necessitated a confession, published in 1796. Twenty years before, Chatterton's Rowley poems had opened up a bitter controversy about their authenticity, from which the boy-poet escaped by untimely suicide; and the Ossianic poems produced by MacPherson (1762–63) have been rank forgeries to a chain of scholars from Dr Johnson to J. F. Campbell, although as vigorously defended by many enthusiastic writers. The famous Perkins Folio of Shakespeare, said by J. P. Collier in 1852 to have been discovered, with an extensive series of contemporary marginal annotations, created a great commotion among Shakespeare scholars, but was at length unanimously condemned, and its annotations proved to be recent fabrications. In 1852 was published by Mr Moxon a series of letters by Shelley, which were discovered a few weeks later to be impudent forgeries, and were at once suppressed by the publisher. It was discovered that there was a brisk trade in the manufacture of letters, autographs, and marginal annotations upon books by Shelley, Byron, and others, and that many of these showed not only great technical skill in imitation, but no mean literary ability in their composition. It would be well for purchasers of letters and autographs of famous persons to make sure of their history, as there is still too good reason to believe that the supply of these is adapted to correspond with the demand. The most remarkable of all the dupes of literary forgers was Michel Chasles (q.v.), upon whom had been passed as many as 27,000 autographs, including those of Pascal, Shakespeare, Dante, and even Julius Cæsar. The fragment of a Moabite Deuteronomy, inscribed on fifteen pieces of sheepskin, brought to London in

1883 by Shapira, was a really skilful imitation, but failed to deceive Dr Ginsburg and Clermont-Ganneau. See books by E. K. Chambers (1891) and J. A. Farrer (1907).

Forget-me-not (the name is accounted for by various legends) is *Myosotis palustris;* but the term has spread to the larger-flowered species, and indeed to all the members of the genus—practically superseding the more prosaic title of Scorpion-grass, derived from the inflorescence so characteristic of the Boraginaceæ, and also that of Mouse-ear, from the hairy leaves. *M. silvatica*, the wood forget-me-not, the Alpine *M. alpestris*, and among exotic species *M. azorica*, are specially worthy of cultivation. *M. versicolor*, a common weed, is remarkable for the change of colour in its flowers, which not only show the change from red to blue in opening so common in the order, but begin with a distinct yellow. By the doctrine of Signatures (q.v.), Myosotis was like a scorpion's tail, and therefore good for scorpion bites. The newer name came from Germany, and was so little known in England in 1800 that to 'Hope's gentle gem, the sweet forget-me-not' Coleridge appended a note explaining what plant he meant.

Wood Forget-me-not (*Myosotis silvatica*): *a*, a flower.

Forisfamiliation (lit., 'the putting forth from or beyond the family') is the separation of a child from the family of his father, as by marriage, or by receiving from his father a separate stock, the profits of which are enjoyed by himself, or by renouncing *Legitim* (q.v.).

Fork. See CUTLERY.

Forli, capital of the province of the same name in Italy, situated at the foot of the Apennines, in a pleasant and fertile plain, 40 miles SE. of Bologna by rail, is a well-built and handsome city. Of the churches the cathedral, S. Girolamo, and S. Mercuriale are the most notable. In these and in the city gallery are some of the best pictures of Cignani, Guido, Melozzo, Guercino, and others. The citadel, founded in 1361, is now used as a prison. There are manufactures of silk, shoes, hats, and cloth. Forli (the ancient *Forum Livii*) is said to have been founded by Livius Salinator, after his victory over Hasdrubal, on the Metaurus, 207 B.C. In the middle ages it formed a republic, and during the subsequent struggles of the Guelphs and Ghibellines frequently changed its rulers. In 1860 Forli, which had been incorporated in the States of the Church since the time of Pope Julius II., became Italian. Pop. 52,000.

Forlorn-hope, the body of men selected to effect a lodgment on a breach, or to lead in scaling the wall of a fortress. The word is from the Dutch *de verloren hoop* (*hoop* pron. as English *hope*), 'the lost band or troop;' Fr. *enfants perdus.*

Form, in music, is the scheme of symmetry underlying the construction of a composition. Many pieces are built upon the plan of a Song (q.v.); the first movement of a Sonata (q.v.) or Symphony (q.v.) shows another fundamental form; and a third is the Rondo (q.v.). The Symphony as a whole developed out of the Suite, and has in turn given rise to the freer 'symphonic piece' or 'symphonic poem.' For form in philosophy, see ARISTOTLE.

Formalin, a powerful antiseptic and disinfectant, is a watery solution of formaldehyde (formic aldehyde; see ALDEHYDE). It is largely used on the Continent for preserving milk, and is not so innocuous as is sometimes represented.

Forma Pauperis. See IN FORMA PAUPERIS.

Formation has by English geologists been generally applied to a group of strata united by some character which they have in common, whether of age, origin, or composition, as the *Carboniferous Limestone formation*, which, together with the formations of the *Millstone Grit* and the *Coal-measures*, constitutes the Carboniferous System. The term is therefore of subordinate importance to *system*. Foreign geologists seldom use formation in this sense. With them the word is descriptive of the materials composing strata, as *chalk formation*, meaning thereby not the Cretaceous System, but beds composed of chalk; so *carboniferous formation* is a group of beds containing coal. To bring our nomenclature into uniformity with that of foreign geologists some purists propose dropping the term formation out of our systems of rock classification. But to do that would require despotic authority, and the term will probably survive in spite of its supposed inconvenience.

Formes, KARL, bass singer, was born in 1810 at Mülheim, on the Rhine, and was for some years a verger before he made his début on the stage at Cologne, in 1842, as Sarastro in the *Zauberflöte*. He was engaged for a time in Vienna, and sang in Italian opera at Covent Garden until 1857, when he visited America, and entered on a comparatively wandering life, in spite of the possession of a voice that for volume, compass, and quality was one of the most magnificent ever heard. He died at San Francisco, 15th December 1889.—His brother, THEODOR, born in 1826, appeared first at Ofen in 1846, and was long one of the most noted tenor singers in Germany. He died in 1874.

Formia, formerly Mola di Gaeta, a seaport of Italy, on the Gulf of Gaeta, with 12,000 inhabitants. The ancient *Formiæ*, it became a Roman town in 338 B.C., and was celebrated for its wine. Here are the ruins of Cicero's villa, Formianum.

Formic Acid, CH_2O_2 or HCOOH, derives its name from the circumstance of its having been first obtained from the red ant (*Formica rufa*). It occurs in ants, in the stings of bees, wasps, and nettles, in fir needles, and in various animal secretions. It may be obtained from any of these by distillation with water. Anhydrous formic acid is a mobile liquid of extremely penetrating odour, crystallising at 35° F., and boiling at 214° F., miscible in all proportions with water and alcohol. It produces a painful blister if dropped on the skin. The aqueous acid is prepared in the following manner: Half a pound of oxalic acid is mixed with one pound of glycerine, and the mixture heated in a retort to 275° F.; a little dilute formic acid distils; another quantity of oxalic acid is added, and the mixture again heated, and so on indefinitely, the glycerine remaining unchanged at the end of the operation. The decomposition is as follows:

Oxalic Acid.		Formic Acid.		Carbonic Acid.
$C_2H_2O_4$	=	CO_2H_2	+	CO_2.

Acid containing 56 per cent. of the pure substance

is obtained in this way. The anhydrous acid is procured by preparing the lead salt, and decomposing this with sulphuretted hydrogen. It may be formed synthetically in various ways: (1) By direct combination of carbonic oxide, CO, and caustic potash, KOH, forming KCO_2H, potassium formate; (2) by boiling aqueous prussic acid; (3) by heating chloroform with caustic potash. Formic acid and all its salts (called formates or formiates) are strong reducing agents, and precipitate metal from solutions of gold, silver, or mercury salts. Formic acid is obtained in small quantities by the oxidation of a great number of organic substances. Formates of silver and lead are sparingly soluble; all the others are freely so. By heat they are converted into oxalates yielding pure hydrogen.

Potassium Formate. Potassium Oxalate. Hydrogen.

$$2KCO_2H = K_2C_2O_4 + H_2.$$

Formosa, called by the Chinese and Japanese *Taiwan*, an island lying off the Chinese province of Fû-chien, from which it is separated by a strait from 90 to 220 miles wide. Formosa, which was ceded by China to Japan in 1895, is crossed by the meridian 121° E. and the Tropic of Cancer, and has a maximum length of 235 miles, whilst its breadth varies from 70 to 90 miles. Area, 14,000 sq. m. Forming one link in the volcanic chain that extends from the Aleutian Islands southwards to New Guinea, it constitutes the eastern escarpment of what was once the great Malayo-Chinese continent, and is connected by a submarine plateau with the Chinese mainland. The backbone of the island, extending north and south, is formed of a range of densely-wooded mountains, of which the highest peak, Mount Morrison (renamed Niitake-yama by the Japanese), is 14,270 feet high; Mount Sylvia, the second, is 12,480. Eastward of this range lies a narrow strip of mountainous country, presenting to the Pacific a precipitous cliff-wall with in many places a sheer descent of from 5000 to 7000 feet, whilst a very short distance farther east the floor of the ocean sinks to a great depth at an extremely steep gradient. The western side of the range consists of a single broad alluvial plain, stretching from north to south of the island, seamed by innumerable water channels, and terminating at the coast-line in mud flats and sand-banks. Yet on this side of the island the land is rapidly encroaching upon the sea, as the consequence of the gradual elevation of the western seaboard and the deposition in and around the embouchures of the rivers of the large amount of sediment brought down by them from the mountains. This latter process is primarily due to the heavy rainfall of the northern, central, and eastern portions of the island, where the rain-clouds of the north-east monsoon, after crossing the warm Kiosiwo or Japanese Gulf Stream, on coming in contact with the mountain barrier of the island become chilled and discharge their contents in rains of excessive violence. Apart from this heavy rainfall, the climate is not exceptional, the insular position ensuring a modification of the heat by sea-breezes. The mean of summer is 80° to 90° F.; of winter, 50° to 60°. Violent typhoons are very common at certain seasons.

The island is famous for the rich luxuriance of its vegetation, many of our hothouse plants growing wild on the mountain slopes and in the valleys, and there is a profusion of ferns, tree-ferns, camphor and teak trees, pines, firs, wild fig-trees, liquidambars, bananas, bamboos, and palms. 'Rice paper' is prepared from the pith of a tree peculiar to Formosa. Of animal life it is noticeable that there are a great number of species of birds peculiar to the island, that insects are scarce, and that noxious wild animals are few, but that fish are plentiful in the waters round the coast. The principal products of commercial importance are tea, sugar, coal, turmeric, rice, sweet potatoes, ground-nuts, bamboos and rattan, grasses, tobacco, timber, the fruit lung-ngan, sesamum-seed, and above all camphor, the specialty of the island. Coal is worked, and a little petroleum exported; gold is found in the river gravel, and is collected; sulphur is abundant, especially in the north; and iron and silver exist. The principal exports are camphor and tea; the imports, opium, cottons, and woollens. The Japanese sought to prohibit the importation of opium, but have been compelled to make the trade in it, like that of camphor and salt, a government monopoly. A very large proportion of the shipping trade is carried on by means of native junks, which ply to and from the mainland; the remainder mostly in British bottoms. The principal ports are Tamsui, Kilung, Takow, Taiwan, and Anping. Kilung has become an important bunkering port. Most of the trade is with Japan—China, Britain, and the United States sharing the rest. Taiwan was the seat of government till 1887, when it was transferred to Tai-pei or Taihoku (pop. 163,000). The Pescadores, or Hokoto Islands, also ceded to Japan in 1895, are a group of basaltic islands 20 to 25 miles west of Formosa, with an area of 50 sq. m. and a population believed to amount to some 55,000.

The inhabitants of Formosa, numbering in 1920 3,654,398 in all, consist of Chinese settlers, about 153,000 Japanese, and 104,000 aborigines, who seem to consist of several different tribes, mainly of Malayan and Negrito descent. Three divisions are recognised: Pepohwan, civilised and sinicised agriculturists; Sekhwan, other settled tribes; and Chinhwan, the untamed savages of the mountains, who waged fierce and unceasing warfare against the Chinese immigrants. Of the natives, whose language is Malayan, not very much is known. There seems to be evidence of matriarchate. Priestesses are prominent in their religion, and seek to influence the spirits by slashing at them with long knives in their wild dances. Head-hunting is going out of fashion. The civil government of Japan has entirely subdued the turbulent element, and made well-nigh incredible progress in equipping an administration of more than European modernity. Hygienic works, including sewage disposal, water-supply, and hospitals, have been carried out, and an efficient educational system established, with elementary and normal schools. Roads and railways have been made; the post and telegraph offices are complete. The island was known to the Chinese before the Christian era, but does not seem to have seriously attracted their attention until the year 605 or 606 A.D. In the 14th century they established several colonies in Formosa, which, however, were withdrawn in the middle of the 17th century. Although Portuguese and Spanish navigators began to visit the island a century earlier, the first European people to establish themselves on it were the Dutch, who in 1624 built Fort Zelandia, near the modern Taiwan. They were, however, expelled in 1661 by a Chinese adventurer, Koksinga, who retained possession of the island for twenty-two years. Some years later a regular Chinese colonisation of the western half of the island was carried through, the colonists coming principally from Fû-chien and Kwang-tung. Subsequently the island became notorious for the piracy of its inhabitants and the ill-treatment they inflicted upon navigators who chanced to be wrecked on their coasts. Accordingly in 1874 the Japanese invaded Formosa; but on the Chinese undertaking to check the evils complained of they withdrew. Ten years later the French, during their contest with China in Tongking, held for a time the coal districts of Kilung. The occupation by the

Japanese troops did not take place without opposition from the natives and Chinese 'Black flags.' But the Japanese were practically in full possession of the island before the end of 1895, and set themselves at once to the work of reorganisation.

See, besides the older authorities, Guillemard, *Cruise of the 'Marchesa'* (1886); Terrien de Lacouperie, in *Jour. Roy. Asiatic Soc.* for 1887; Girard de Rialle, in *Revue d'Anthropologie* for 1885; Imbault-Huard, *L'Île Formosa* (1893); W. Campbell, *Formosa under the Dutch* (1903); J. W. Davidson, *The Island of Formosa Past and Present* (1903); Y. Takekoshi, *Japanese Rule in Formosa* (1907); Mrs McGovern, *Among the Headhunters of Formosa* (1922); Owen Rutter, *Through Formosa* (1923); B. Hayata, *Icones Plantarum Formosarum.* The *Description of Formosa* (1704) by Psalmanazar (q.v.) was a tissue of inventions.

Formosa, a territory in the extreme north of Argentine Republic, formed in 1884, and bounded on three sides by the rivers Pilcomayo, Paraguay, and Bermejo. Estimated area, 41,400 sq. miles; pop. 20,000. The country is generally a vast plain, gently sinking to the south-east, covered with forests, and in large sections liable to frequent inundations, the summer rains lasting from October to May. The capital is Formosa, on the Paraguay, about 100 miles NNE. of Corrientes.

Forms of Address. See ADDRESS.

Formulæ. See CHEMISTRY.

Forres, a royal burgh of Elginshire, 5 miles S. of Findhorn village on the Moray Firth, and 25 ENE. of Inverness, with which and Nairn and Fortrose it returned a member to parliament until 1918. On its Castle Hill, a royal residence from 1189 to 1371, stands an obelisk (1857), 65 feet high, to the Crimean hero, Dr Thomson of Cromarty; whilst on the wooded Cluny Hill are a hydropathic establishment, and the Nelson tower (1806), 70 feet high. Sueno's Stone is a remarkable sculptured monolith, ascribed by Skene to the year 900; the Witch's Stone recalls Forres's old reputation for witchcraft, not in Macbeth's time alone. Public buildings are the town-house, Falconer museum, mechanics' institute, and Anderson's Institution. Pop. 4000.

Forrest, EDWIN, actor, was born in Philadelphia, 9th March 1806, his father being of Scotch descent, his mother a German, and made his first regular appearance on the stage there in 1820, as Douglas in Home's tragedy. At the age of twenty he appeared as Othello at the old Bowery Theatre in New York, where his immediate success was the foundation of a popularity that survived for many years. He played in London with great success in 1836–37, but at his appearance in 1845 his Macbeth was hissed by the audience; and an unworthy and spiteful resentment that prompted him, a few weeks later, to stand up in a private box in the Edinburgh Theatre and hiss Macready, utterly destroyed his reputation in England and Scotland. A more serious result of his jealous action was the Astor Place riot in New York in 1849, which ensued on the hissing of Macready's Macbeth by Forrest's sympathisers, and which ended in the death of twenty-two men. These events, and the public scandal attendant on a suit for divorce brought by his wife, lessened his fame and embittered his temper. He retired from the stage between 1853 and 1860, when he returned to fill at Niblo's Garden, New York, the most successful engagement of his life. Later tours proved failures, and, after a long struggle against weakness and disease, he made his last appearance as an actor in the part of Richelieu, at the Boston Globe Theatre in 1871. Even then a craving for the old-time applause led him to give readings from Shakespeare in several large towns; but these, too, proved unsuccessful, and he retired to his native city, where he died of paralysis, 12th December 1872. Forrest has been not unjustly called an essentially melodramatic actor; his robust physique and powerful voice made the assumption of sentimental parts almost impossible. But his powers as a tragedian were of a very high order; his Lear, Othello, Coriolanus, and several other parts were justly ranked in their own day as memorable performances. With him the line of great American actors begins. See lives by Alger (1877), Barrett (1881), and Harrison (1889).

Forrest, BARON (SIR JOHN FORREST; 1847–1918), Australian explorer and politician, was born at Bunbury, in Western Australia, and from 1864 onwards was connected with the survey department of the colony. In 1869 he commanded an expedition in search of Leichhardt; in 1870 he headed an exploring expedition from Perth to Adelaide; in 1874, with his brother Alexander (born 1849), one from Champion Bay through the heart of Australia to the Adelaide-Port Darwin telegraph line. He was first premier and treasurer of Western Australia under responsible government (1890–1901); and joining the Federal Cabinet in 1901, he held several offices under Sir E. Barton and Mr Deakin (1901–4), and was treasurer in Mr Deakin's two later administrations (1905–8 and 1909–10), Mr Cook's (1913–14), and Mr Hughes's (1917–18). He was made a peer of the United Kingdom in 1918. Among his publications are *Explorations in Australia* (1876) and *Notes on Western Australia* (1884–87).—His brother ALEXANDER, besides taking part in John's journeys, in 1879 started, along with Hill, to explore the north-western parts of the Australian continent; discovered the fertile region now called Kimberley District; and ascended the river Fitzroy for a distance of about 250 miles. This journey was described in *Journal of an Expedition from the De Grey to Port Darwin* (1880).

Forrest, NATHAN BEDFORD (1821–77), a distinguished Confederate cavalry commander during the Civil War, was born at Chapel Hill, Tennessee, and was at first a slave-trader.

Forst, an industrial town of Prussia, 80 miles SE. of Berlin by rail, has a population of about 32,000, mostly engaged in manufacturing buckskins, in cloth manufactories, and in tanneries. Forst has also a trade in cattle.

Förster, FRIEDRICH CHRISTOPH, poet and historian, born near Kamburg, in Saxe-Meiningen, on 24th September 1791, devoted himself at first to the study of archæology and the history of art, but on the outbreak of the war of liberation joined the Lützow sharpshooters along with young Theodor Körner, and, like him, wrote fiery war-songs, stirring up his countrymen against the French. After his return to Berlin he taught for a while in the school of artillery and engineering, but was dismissed for writing a work criticising the Prussian constitution. In 1829, however, he was appointed a custodian of the Royal Art Museum at Berlin, where he died on 8th November 1868. He wrote several popular historical works, dealing chiefly with the war of liberation and the history of Prussia, including a collection of biographical sketches entitled *Preussens Helden im Krieg und Frieden;* and, besides these, three works on Wallenstein; a *History of Frederick William I.* (3 vols. 1835); *Urkundenbuch* (new ed. 2 vols. 1839); and *Die Höfe und Kabinette Europas im 18. Jahrhundert* (3 vols. 1836–39). His *Gedichte* appeared in 2 vols. 1838.

His brother ERNST, painter and writer, was born 8th April 1800. His passion for art was first awakened by Cornelius, under whose direction he executed various fresco pieces in Bonn and

Munich, from 1823 to 1825. An expedition to Italy for the purpose of making drawings from the old masters bore fruit in *Contributions to the History of Modern Art* (1836). From this time he abandoned painting and devoted himself almost exclusively to investigations bearing upon the history of art, his principal books being *Letters on Painting* (1838); *History of German Art* (5 vols. 1851–60); *Monuments of German Architecture, Sculpture, and Painting* (12 vols. 1853–69); *Introduction to the History of Art* (1862); biographies of Fra Angelico (1859), J. G. Müller (1851), Raphael (1867–68), and Cornelius (1874), and a translation, in conjunction with Schorn, of Vasari's *Lives of the Painters.* At the time of his death, on 29th April 1885 at Munich, Förster left two large works unfinished, a *History of Italian Art* (5 vols. 1869–78), and *Monuments of Italian Painting* (4 vols. 1870–82). He also edited the posthumous works of his father-in-law, Jean Paul (1836–38), and wrote several biographical works relating to the great humorist, the chief being the last five volumes of *Wahrheit aus Jean Pauls Leben* (1827–33).

Forster, JOHANN REINHOLD, a German traveller and naturalist, was born in Dirschau, in Prussia, on 22d October 1729. He was educated at Halle and Danzig for the clerical profession, but his favourite studies were languages, botany, and zoology. Repairing to England in 1766, he acted for a few years as a teacher at Warrington in Lancashire, until he was appointed to accompany Cook as naturalist during his second voyage in 1772. On Forster's return his son published an account of the journey from Forster's own note-books, whilst Forster himself wrote *Observations made during a Voyage round the World* (1778), chiefly on physical geography and natural history. Two years afterwards he received the appointment of professor of Natural History at Halle, where he died on 9th December 1798. He wrote also a work on *Mineralogy* (1768), one on the *Byssus of the Ancients* (1770), *Flora Americæ Septentrionalis* (1771), *Zoologiæ Rarioris Specilegium* (1781), an *Account of the South Sea Plants* (1776), and *Geschichte der Entdeckungen und Schiffahrten im Norden* (1784).—His eldest son, JOHANN GEORG ADAM, was born near Danzig, on 26th November 1754. When only seventeen years of age, he accompanied his father in Captain Cook's second voyage, and published, with the assistance of his father, an account of the expedition. After living as professor of Natural History at Cassel and at Wilna, he became librarian to the Elector of Mainz in 1788. Whilst he was on a visit at Paris in 1792, whither he had been sent to request the incorporation of Mainz with the French republic, the Prussians retook Mainz, and Forster lost all his property, including his books and manuscripts. He died at Paris, 12th January 1794. His writings, especially his *Ansichten vom Niederrhein* (1791–94) and his *Beschreibung einer Reise um die Welt* (1784), take a high rank amongst German works descriptive of nature. His Letters were published by his widow in 1829; and a complete edition of his works appeared in 9 vols. in 1843.

Forster, JOHN, an English political and historical writer, was born at Newcastle, 2d April 1812. He was educated for the bar, but early devoted himself to periodical writing. His political articles in the London *Examiner*, for which he commenced writing in 1833, attracted more attention than is usually bestowed on newspaper leaders, owing to their vigour and point, coupled with the love of truth, consistency, and outspoken honesty they displayed. Forster edited the *Foreign Quarterly Review* for some time; then for nearly a year, as Dickens's successor, the *Daily News*, and from 1847 to 1856 the *Examiner*. He was the author of many admirable biographical and historical essays, as the two volumes of *Edinburgh* and *Quarterly* articles reprinted in 1858, and an admirable series dealing with the times and statesmen of the English Commonwealth, under the titles *History of the Grand Remonstrance* (1860); *Arrest of the Five Members* (1860); *Sir John Eliot, a Biography* (1864); and *Lives of the Statesmen of the Commonwealth* (1840). His literary memoirs are *The Life and Times of Oliver Goldsmith* (1848; 2d and improved ed. 1854), accounted one of the best biographies in English literature; *Walter Savage Landor* (2 vols. 1868); *The Life of Charles Dickens* (3 vols. 1871–74); and the first volume of a *Life of Swift* (1875). His life of Dickens was assailed as having exposed with too great frankness the failings of his hero; a more valid objection is that in the method of treatment adopted the biographer is almost as prominent as his subject. Forster's style is clear and forcible. He himself was an indefatigable student and a constant and devoted friend. He was appointed secretary to the Commissioners in Lunacy in 1855, and a Commissioner in 1861. He died 1st February 1876. See Renton, *Forster and his Friendships* (1912).

Forster, WILLIAM EDWARD, statesman, was born at Bradpole, Dorsetshire, July 11, 1819, the son of an esteemed minister of the Society of Friends, who died while on an anti-slavery mission in Tennessee, in 1854. Educated at the Friends' School at Tottenham, he first contemplated going to the bar, but abandoned this intention for commerce, and accepted an appointment in a worsted manufactory near Bradford. He early took an interest in philanthropic and political questions, and during the terrible Irish famine of 1845 visited the distressed districts as almoner of a relief fund raised by his co-religionists. In 1850 he married Jane, eldest daughter of Dr Arnold of Rugby, and sister of Matthew Arnold. Forster unsuccessfully contested Leeds in the Liberal interest in 1859, but two years later was returned for Bradford. After serving for thirteen months as Under-secretary for the Colonies (1865–66), he became in 1868 Vice-president of the Council on Education, and a privy-councillor. He accepted from Mr Gladstone a seat in the cabinet in 1870, and the same year introduced the greatest legislative measure associated with his name, the Elementary Education Bill (see EDUCATION). His conduct of the bill was marked by great ability, but it led him into strong conflict with the Nonconformist members and the Birmingham League, who objected to the 25th clause, which enabled school boards to pay the fees of indigent children at denominational schools out of the rates. In 1872 Forster introduced the Ballot Bill, which he piloted through the House of Commons with much skill. After the resignation of the Liberal ministry in 1874, he visited the United States. His father's memory was warmly cherished by the abolitionists, and Forster himself, who had always been a staunch supporter of the Union, and an uncompromising enemy to slavery, received an enthusiastic welcome. He had counted among his personal friends Emerson, Adams, and Sumner. On the retirement of Mr Gladstone from the leadership of the Liberal party in January 1875, Forster and Lord Hartington were named for the post, but the former wrote withdrawing from candidature, on the ground that he could not hope to unite the various sections of the party. In the ensuing November he was elected Lord Rector of Aberdeen University.

In the Gladstone administration of 1880 Forster accepted the office of Chief-secretary for Ireland, at that time the most onerous post in the government. He had not coveted the appointment, but assumed it patriotically, in the hope of being able

to grapple with the Irish problem. An agrarian and political agitation was then disturbing a large portion of Ireland. Forster was attacked unceasingly in parliament by the Irish members, and his life was threatened by the 'Invincibles,' who afterwards assassinated his successor, Lord Frederick Cavendish, together with Mr Burke. More than one thousand evictions having taken place in Ireland during the first six months of 1880, Forster carried through the House of Commons the Compensation for Disturbance Bill, intended for the relief of deserving tenants evicted for non-payment of rents which they were unable to discharge. The measure was rejected by the Lords; and this proved a great blow to Forster, who believed that by its aid the government would have been able to cope with the rising influence of Mr Parnell, and with the growing agitation among the Irish peasantry. A land act was passed in 1881, but a coercion act was also necessary for the suppression of agrarian crime; and, when the Land League issued its 'No Rent' manifesto, Forster replied by a proclamation declaring the League illegal. Mr Parnell and several members of his party were arrested. Induced to adopt a change of policy by the continued disturbed condition of Ireland, in April 1882 a majority of the cabinet determined to release the 'suspects,' whereupon Forster and Lord Cowper (the Lord-lieutenant) resigned. Considerable excitement arose over what was known as 'the Kilmainham Treaty,' and Forster was much applauded by the Conservatives for his policy in this matter, and for his attitude on the Irish question generally. Forster subsequently condemned the government for their action in Bechuanaland and also in the Sudan; and he supported the unsuccessful vote of censure upon them after the death of General Gordon. He took a profound interest in Imperial Federation. He believed that 'a parliament in Dublin would be fraught with danger to both England and Ireland.' In November 1885 he was again returned for Bradford, but he died in London, 5th April 1886. In character Forster was loyal, honest, unselfish, and courageous. He was an effective parliamentary speaker, from his straightforwardness and earnestness of conviction, but he had none of the shining gifts of oratory. See Life by Sir Wemyss Reid (1888).

Forsyth, Sir Thomas Douglas, K.C.S.I. (1827–86), Indian civilian, born in Liverpool, entered the Company's service in 1848, and was employed in the administration of the Punjab until 1870, being created C.B. for his services during the mutiny. In 1870 he conducted a mission to Yarkand in Eastern Turkestan, and in 1874, having crossed the great ranges that separate Kashgar from India, he concluded a commercial treaty with the emir. The reports of these missions contain much valuable geographical information. On his return Forsyth was made a member of the Legislative Council of India; and in 1875 he succeeded, acting as envoy, in averting war with Burma. See his Autobiography (1888), and Henderson and Hume, *Lahore to Yarkand* (1873).

Fort, Paul, born in 1872 at Reims, began in 1895 to publish the pieces afterwards collected in the many volumes entitled generally *Ballades* and *Ballades françaises*. His so-called 'poèmes en prose' are prose only to the eye.

Fortaleza, capital of Ceará (q.v.).

Fort Augustus, a village on the Caledonian Canal, at the head of Loch Ness, 33 miles SW. of Inverness. A barrack built here in 1716 to awe the disaffected clans was enlarged in 1730 by General Wade, who named it Fort Augustus, out of compliment to William Augustus, Duke of Cumberland. The rebels captured and dismantled it in 1746, but it was soon restored, and garrisoned down to the Crimean war. In 1857 it was sold to Lord Lovat, whose son nineteen years afterwards presented it to the Benedictines (q.v.); and by them during 1876–82 it was converted into a stately abbey, college, and hospice.

Fort de France, capital of Martinique, in the French West Indies, lies on the west coast, and has an excellent harbour; pop. 27,000.

Fort Dodge, on the Des Moines River in Iowa, U.S., at the intersection of four railways, has some manufactures, and is near a vast coalfield; pop. 20,000.

Fortescue, Sir John (1394?–1480?), educated at Exeter College, and called to the bar at Lincoln's Inn, he was in 1441 made serjeant-at-law, and in the following year Lord Chief-justice of the Court of King's Bench. In the struggle between the Houses of York and Lancaster he steadily adhered to the latter, and was attainted by the parliament under Edward IV. He accompanied Margaret of Anjou and her young son, Prince Edward, on their flight into Scotland, and is there supposed to have been appointed Lord Chancellor by Henry VI. In 1463 he embarked with the queen and her son for Holland. During his exile he wrote his celebrated work, *De Laudibus Legum Angliæ*, for the instruction of Prince Edward, who was his pupil. But on the final defeat of the Lancastrian party at the battle of Tewkesbury, 1471, where he is said to have been taken prisoner, Fortescue submitted to Edward IV. He died in about the ninetieth year of his age. The *De Laudibus Legum* was not printed until the reign of Henry VIII.; another valuable work by Fortescue is *The Governance of England; otherwise called the Difference between an Absolute and Limited Monarchy*, written in English (1714; new ed. by Plummer: Clarendon Press, 1885). His collected works were printed for private circulation by Lord Clermont in 1869.

Forteviot, the ancient capital of the Picts (q.v.). Its site is about 7 miles SW. of Perth.

Fort Garry. See Winnipeg.

Fort George, a fortress 12 miles NE. of Inverness, on a low sandy projection into the Moray Firth, here only 1 mile broad. It was built in 1748, at a cost of £160,000, to keep the Highland clans in subjection. It is the depôt of the Seaforth Highlanders.

Forth, a river and firth of Scotland. The river is formed by two head-streams, Duchray Water and the Avondhu, which, rising on and not far from Ben Lomond, at altitudes of 3000 and 1900 feet, run 14 and 9 miles to a confluence near Aberfoyle, the Avondhu traversing Lochs Chon and Ard. From their confluence, 80 feet above sea-level, the Forth itself winds 39 miles to Stirling, then 12½ (the 'Links of Forth') to Alloa, the distances in a straight line being only 18½ and 5⅝ miles. It receives the Teith, Allan Water, and Devon, and traverses or divides Stirling, Perth, and Clackmannan shires.

The Firth of Forth extends 51 miles eastward from Alloa to the German Ocean, between the counties of Clackmannan and Fife on the north, and Stirlingshire and the Lothians on the south. It has a width of ½ mile at Kincardine, 3 miles above Bo'ness, 1¼ at Queensferry, 5 between Granton and Burntisland, 17 at Prestonpans, and 8¼ at Elie. Its waters, 3 to 37 fathoms deep, encircle the islands of Inchkeith (fortified), Inchcolm (with a ruined abbey), Cramond, &c., whilst at the entrance are the Bass Rock (q.v.) and the May. On the two last and on Inchkeith are lighthouses. Rivers falling into it are the Carron, Avon, Almond, Water of Leith, Esk, and Leven.

White Fish are plentiful. In 1882–90 a great railway bridge was erected across the Firth at Queensferry (see BRIDGE), above which is St Margaret's Hope, one of the safest roadsteads in the kingdom. Rosyth, on this bay, is a great naval base. See H. M. Cadell, *The Story of the Forth* (1913).

Fortification has two distinct branches, called Field and Permanent fortification. It consists substantially of the art of so dealing with the soil, of so using natural features, and of so applying to one's purposes suitable materials of all kinds that the enemy's difficulty in reaching you is enhanced. You wish to hold a given stretch of ground with troops that are, necessarily or of design, weaker than those the enemy can, and is likely to, bring against that stretch. He hopes to reach you, and then to use his superior force upon you, by two means; by his fire he will try to beat down the defenders' fire, and through advance by favour of that beating down he means to reach you with superior numbers. Fortification is the antidote, for it aims at giving cover to the defenders, but not that only; it aims also at enabling them to use their weapons in the most effective manner from first to last. Therefore the military engineer plans so to deal with the soil, and with materials such as concrete, masonry, timber, and iron, that cover shall be of the best possible; and he does his best, also, by good siting of the works and by the provision of obstacles in the way of an advancing enemy, to keep him under fire to the utmost possible extent.

This applies, as a general statement of aim, both to Field and Permanent fortification, the former being the comparatively hasty work executed by the troops themselves during war or in face of threats, the latter the more elaborate constructions, using quantities of concrete and iron as well as earth, executed by governments in peace-time. Here it should also be said that during the Great War iron and concrete were pretty freely used in field entrenchments, but this only became possible owing to the stagnation along the fronts of the long period of 'trench warfare.' It should also be said that two developments in the war caused two corresponding additions to the art of fortification. One of the developments was the use in field warfare of very heavy artillery, firing shell of terrific explosive power, guns and shells being also in unheard-of numbers. The second was the perfecting of reconnaissance by aeroplane, enabling the gunners to have immediate and accurate information as to the correctness or incorrectness of their ranging. These two developments added greatly to the necessary depth for overhead cover that was to be safe, and also increased the value of what has come to be called *camouflage*—that is, clever disguising of objects.

The wars of this century have, chiefly owing to increase of power in firearms, brought about a steady development of fortification from the model shapes of earlier times to an astonishing irregularity of treatment. Every case has become a particular case, and it is hardly possible to lay down a type. The change is patent when one looks at figs. 1 and 2, a plan and sections of what may be reckoned a typical redoubt of the last decade of the 19th century. Such a work would be held a mere shell-trap now, capable of being wrecked by a modern enemy at short notice. The work we should now build in place of this would have hardly anything above ground, might have its subterranean parts as much as 30 feet deep, would have no guns in it, and would be surrounded by belt on belt of barbed wire.

This matter of obstacles is reckoned an important branch of fortification. As the aim in planting an obstacle is to keep an advancing enemy longer under fire, it is to be placed within effective range of one's small-arms, and is to be of such a kind that it does not itself afford any concealment. The wire entanglement, woven between strong posts, is, therefore, the best known, while in some cases *inundation* has proved first-rate. Obstacles obtained by digging are not liked, because they give cover, but a deep and wide excavation, such as a canal, is useful for stopping tanks. See ABATTIS.

The names of the various shapes of works of older types are all French. The redoubt in fig. 1 is a *blunted redan*, and would be a plain *redan* or *flèche* if the two faces were continued upwards to meet. The rear face is called the *gorge*, and was often a mere palisade or even left open. A *lunette* had two faces, two flanks, and a gorge, making a plan like the gable of a house seen in elevation. In fig. 1 the *bonnettes* on the forward angles were portions of the parapet higher than the rest; the *barbettes* were gun-platforms high enough to let the artillery fire over the parapet, this method affording a wider field of fire than was given by the *embrasures* to the guns on the flanks, but rendering the guns and their crews more vulnerable. The *traverses* were short masses of earth, perpendicular to the parapet on its inner side, placed at intervals as shelter from enfilade fire—that is, fire arriving in the line of the parapet. The *parados* were banks of earth to guard against fire against men's backs, as *parapet* means the guard of the breast. The ditch was often broad and deep enough to be an obstacle, and was improved as such by a *palisade* in the bottom or by *fraises* projecting from the *escarp* or *counterscarp*. These last are, respectively, the near and the far sides of the ditch.

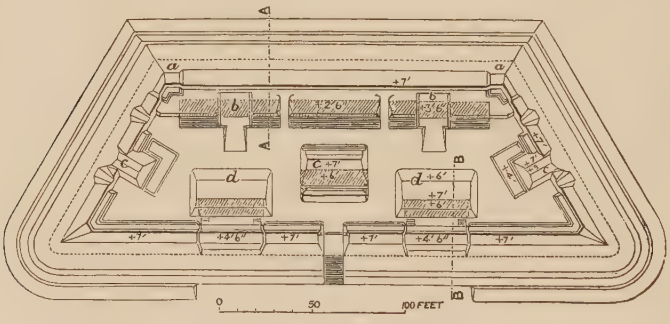


Fig. 1.—Plan of Field Redoubt:

aa, bonnettes; *bb*, barbettes; *cc*, traverses; *dd*, parados. The diagonal shading indicates the position of casemates. NOTE.—In this and in figs. 2, 5, and 6 the reliefs are given in feet relatively to the plane of site (+ above, − below).

The names of other elements of a complete field fortification are as follows: *command*, the height of the crest of parapet above ground; *crest*, highest point of parapet; *berm*, ground left between foot of parapet and ditch; *exterior*, *superior*, *interior slopes* of parapet—the first usually left at natural slope of earth, second nearly level, third steep at $\frac{1}{4}$ or $\frac{3}{4}$, so that the rifleman may stand close up to the crest, such slopes requiring revetments of brushwood, timber, sods, bricks, or other material. The *banquette* is the broad step on which the soldier stands to fire; the *terreplein* is the interior level space of the work. Accessories are *tambours*, small stockades projecting from a face, to provide flank-

ing fire along the face; these were called *caponiers* when in a ditch, where they were roofed over. Such works, when standing quite detached, are *Blockhouses* (q.v.). None of these works, made of the dimensions and materials of last century, is allowable now against an enemy who has modern guns.

During the Great War it was found that in field fortification there must be no approach to putting many of one's eggs into one basket. There must be no crowding of one's men on the defensive; more than ever, in modern war 'death loves a crowd.' It was found that, until the moment of hand-to-hand fighting arrived, there must be nowhere a big human target for the enemy shells. The defender must contrive to do his work with machine-guns, which produce much fire in proportion to the number of men whom their manning exposes to the enemy. By careful siting and disguising, he must contrive to hide as many as possible of these machine-gun nests from the foe, so that when the crisis of the attack is approaching there may still be enough weapons available for those critical minutes when the bayonet-fight is very near. The Germans even tried to make machine-gun emplacements shellproof, by constructing what our men called 'pill-boxes.' These were enormous masses of reinforced concrete, enclosing a small loopholed chamber with exit to the rear, and the best of them were so strong as to resist a direct hit of any but the very largest shells. They were small and difficult targets for the artillery, but the concussion of a hit was sometimes sufficient to kill all the occupants.

The preparation of houses, woods, quarries, existing hedges and ditches for defence is also included in field fortification. Houses or aggregations of houses may be of value for a moment at the first brush with the enemy, but when modern artillery opens on them their remaining strength resides in their cellars and in the cover sometimes afforded by heaps of ruins. Large woods are worth fortifying, for they afford concealment even from the enemy aircraft. When time is short, existing hedges, ditches, and banks may be of value if they are properly sited for your tactical purpose.

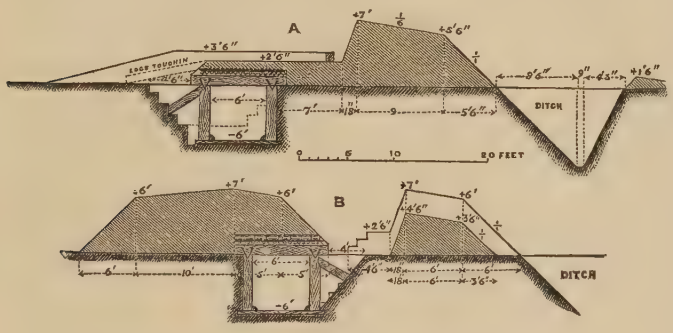


Fig. 2.
A, section through face, AA, fig. 1; B, section through gorge, BB, fig. 1.

PERMANENT FORTIFICATION, for the protection of cities, harbours, tracts of country, bridges (see BRIDGE-HEAD), roads, &c., dates from the earliest ages. Its aim formerly was to keep out the enemy by passive resistance unaccompanied by counter-attacks, except in the form of sorties to destroy his siege-works and batteries. Since 1859, however, the same principle of detached works and free manœuvring ground between them for counter-attack which has been applied to field fortification has been adopted for permanent works. This is due to the vast improvements in artillery and small-arms, the former easily destroying the strongest works at long distances, and the latter, on the other hand, increasing the power of armies in the open field. The change has been gradual but progressive. In Greek history we read of cities surrounded with walls of brick, stone, and rubble. Babylon had a wall of prodigious circuit—100 feet high, 32 feet thick, and surmounted by towers. Jerusalem, at the time of Vespasian's siege, had similar walls, with masonry of enormous solidity. But the square and round towers, which had formed sufficient flanking defence against arrows, and the walls which had resisted battering-rams,

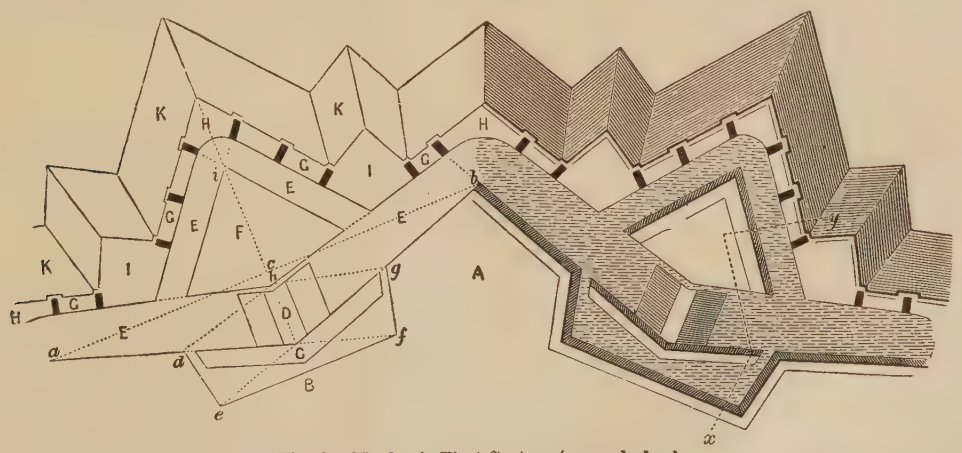


Fig. 3.—Vauban's First System (ground-plan):
A, bastion; B, curtain; C, tenaille; D, caponier; E, ditch; F, ravelin; G, covered way; H, salient place of arms; I, re-entering place of arms; K, glacis.

were soon found to be useless against artillery, and other devices had to be resorted to.

Bastion System.—Early in the 15th century the Italians commenced to flank their walls with small bastions. These are works of *lunette* shape (see above), having two faces, two flanks, and an open

gorge. A *bastion front* consists of a *face* and a *flank* of each of two adjoining bastions, joined by a *curtain* (see fig. 3). Those at Verona, built by Micheli in 1523, are usually looked upon as the oldest extant. Tartaglia and Albert Dürer, painter and engineer; Marchi, an Italian, who died 1599; Errard Bois-le-Duc and De Ville, under Henry IV. and Louis XIII. of France; and the Count de Pagan, whose treatise appeared in 1645, did much towards laying the foundation of that science which Vauban subsequently brought almost to perfection. Born in 1633, this great engineer was equally distinguished in peace and in war. After having taught how fortresses could be rendered almost impregnable, he was led by the restless ambition of his master, Louis XIV., to demonstrate that the reduction of any work was a mere question of time and powder, so that even he himself could not construct a rampart that should withstand the fire brought against it by his system of attack. He constructed thirty-three new fortresses, improved above one hundred, and conducted personally more than fifty sieges. Coehoorn, director-general of the fortresses of the United Provinces, was the contemporary, rival, and opponent of Vauban; his masterpiece was Bergen-op-Zoom. Cormontaigne, Belidor, Bousmard, and Carnot may also be mentioned as conspicuous followers of Vauban's principal theories. Their works all begin by surrounding the place with a continuous polygon, on each side of which a bastion front, covered by outworks, is constructed.

The *enceinte*, or main body of the place, is traced as follows, if the polygon taken is an octagon. The *exterior side*, about 380 yards long, *ab* (fig. 3), is bisected in *c* by the perpendicular *c*C, which is made one-sixth of *ab*; *a*C, *b*C are joined and produced, and the faces of the bastions *ad*, *bg*, each equal to two-sevenths *ab*, are measured along them. Next, from *a* and *b* as centres, with radius *ag*, arcs are described cutting *a*C, *b*C, produced in *f* and *e*; *de*, *fg* form the flanks of bastions, and *ef* the curtain. The rampart is formed from the earth excavated from the ditch, and the parapet built on it. It will be seen from the plan that the faces and curtain provide fire over the country beyond the ditch, while the flanks are built for fire into the ditch under faces and curtain, where an enemy is not visible from the faces or curtain. The *capital* of the bastion is a line bisecting its salient or forward angle, and it is seen that in this direction the defender's fire is not good; consequently the besieger is apt to advance his sap on that line, but is in his turn met by the engineer adding, in front of the curtain, a *ravelin* or *redan* (F in fig. 3). The *covered way*, G, 10 yards wide, is covered by the *glacis*, K, 8 or 10 feet high, and sloping gradually towards the country. Traverses in the covered way prevent its being enfiladed. The *tenaille*, C, is a low parapet sweeping the interior of the ravelin and the ditch; it also protects the scarp revetments of the bastions and curtain.

The *caponier*, D, forming a communication between the tenaille and the ravelin, consists of a passage between two low parapets, each with a glacis sloping towards the ditch, which is swept by their fire. At the re-entering angles of the covered way *places of arms*, I, are formed by setting off 30 yards along each counterscarp for the gorge, and making the faces enclose a salient angle of 100°. These, and the *salient place of arms*, H, are convenient for preparing sorties.

Vauban's second and third systems were methods of improving existing works of simpler design.

Coehoorn's system had counterguards in front of the bastions and parallel to them. The angle of his ravelin was always 70°, and his flanks were protected by curved shoulders called *orillons*.

Cormontaigne widened the gorge of his ravelin, thereby reducing the length of the bastion face exposed to breaching. He also revived the step-like formation of the covered way, originally seen in the system of the great German engineer Speckle (died 1589), which gives defenders a continued line of fire from each traverse along the covered way; and he placed redoubts in the re-entering places of arms.

Modifications led up to the so-called *modern French system*, without great changes. *Horn-works* and *Crown-works* (q.v.) were added in front of ravelins, *fausses brayes* or lower parapets outside the bastions, *cavaliers* (elevated retrenchments) within them. Improved breaching-power in cannon, making escarp masonry an easy prey, then necessitated *counterguards* and *couvre-faces* of masonry and earth.

The *tenaille* or star trace consists of alternate salient and re-entering angles, the latter being not less than 90°. Ravelins and other outworks are added as in the bastion trace. It was chiefly used by Montalembert (1714–1800), but has many defects—e.g. the salients are easily enfiladed; the interior space is confined; the defence of the main ditch from the ramparts is very imperfect; and if

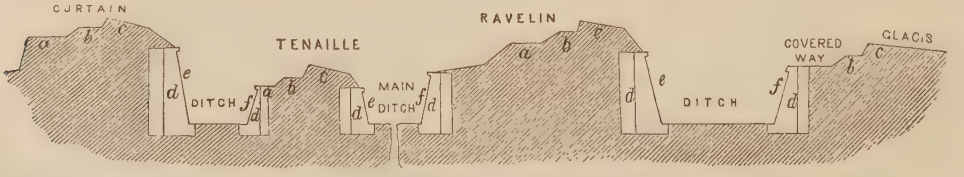


Fig. 4.—Vauban's First System (profile):
a, rampart; *b*, banquettes; *c*, parapet; *d*, revetment; *e*, escarp; *f*, counterscarp.

casemates are used at the re-entering angles to remedy this defect, they can be destroyed by the enemy's fire passing along the ditch.

The Polygonal System.—Early in the 19th century the German Engineers had recognised that the 'polygonal system' of fortification invented by Montalembert was better adapted to the increased range and accuracy of artillery fire. This system placed the parapets of the enceinte along the sides of the polygon, sometimes broken slightly outwards or inwards, and always flanked by strong casemated caponiers projecting from their centres. These caponiers mount thirty to forty guns in two or three tiers, firing through *masks* or *tunnels* in many cases, and are themselves protected by counterguards and ravelins, besides being flanked from batteries in rear. Fig. 5, a half-front of the Antwerp enceinte (1859), as fortified by General Brialmont of the Belgian Engineers, is perhaps the best example of this system. Besides simplicity, each front has greater length (1200 yards as against 400), better bombproof cover, communications, retrenchments, and flank defence. It is more easily adapted to the site. Its ravelins are wider, but support one another less, and it is more vulnerable to attack by mining.

But the fortifications of Antwerp also illustrate another change in this science, by which advanced

works close to the enceinte were replaced by a chain of detached forts 3 to 5 miles from it. The value of a chain of redoubts was proved at Pultowa, Fontenoy, Torres Vedras, and Dresden. D'Arcon first, and Rogniat after him in 1816, both of the French Engineers, strongly advocated the 'camp-fortress,' as it is called by the Austrians, and it soon became the only recognised system of fortification. It was applied to Portsmouth, Plymouth, Paris, the Rhine fortresses, throughout the Franco-German frontier, and wherever modern defences became necessary.

The continuous *enceinte*, built at enormous cost, is now out of favour, any such being untenable against modern guns when once the outer forts are taken. These also in the Great War succumbed quickly under the blows of modern shells, and the defence of the place practically depended on the field army, using field fortification. It is not that the strength of permanent works is valueless, but

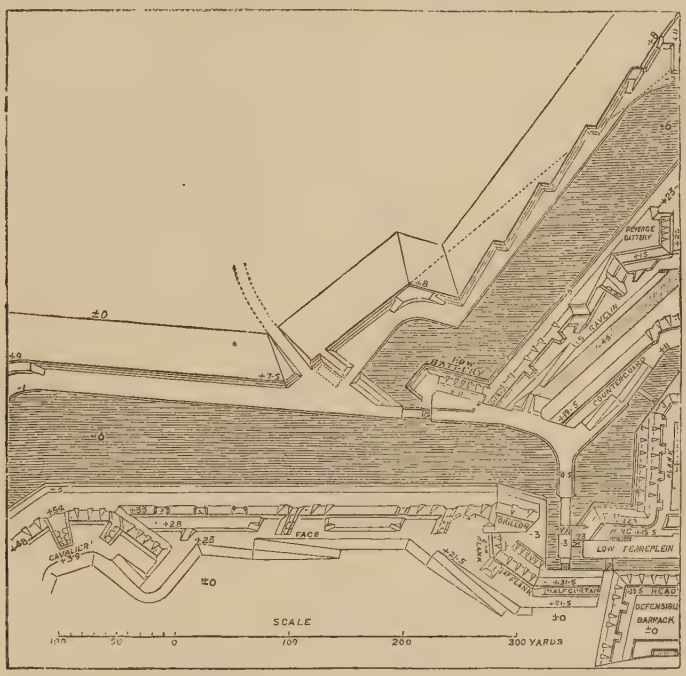


Fig. 5.—Half-front of the Enceinte of Antwerp.

they are to be looked upon as a help to a field army fighting a battle, rather than as a fortress meant to endure a siege with no help outside its own garrisons. When Napoleon was asked his view on fortifications, he replied, 'To gain time;' and it is the case that in the Great War time was gained by the Allies on some critical occasions. Another point is the assailant's necessity of calculating the *effort* required. Liége took thirteen days (5th to 17th August 1914) to capture, and its 25,000 garrison inflicted 42,000 casualties. Namur (19th to 25th August) cost 97,000 shells, which filled 25 long trains. Maubeuge (25th August to 8th September) held up 60,000 Germans, who were wanted on the Marne. Antwerp (28th September to 10th October) kept back 150,000 Germans, used 300,000 shells (100 trains), and 300 more trains for guns and stores.

The most powerful form of detached fort depended substantially on two things: (1) the depth of the underground shelters and the nature of their covering; (2) the resisting-power of the cupolas or overhead shields of the chief guns. These cupolas are of steel, and have hydraulic machinery for raising them when the gun is to fire. In the Great War no cupolas proved really shellproof, so great is the weight of the modern shell, so powerful the shattering energy of its explosive charge, and so accurate its flight. In the case of these permanent works, the enemy usually knows their plan from peace-time, and can find cupola and gun even if these are disguised, while the besieger's guns, installed by night and camouflaged, may take days for the besieged to discover, and can be shifted if threatened. As an example of war experience, the first-class forts of Douaumont and Vaux, of the fortress of Verdun, were disarmed by the French in 1915; when the Germans attacked next spring, the forts were manned only by a company each of infantry.

Coast fortifications used to be held as constituting a different problem, owing to the weight of ships' guns; but it has now been shown that inland warfare can be troubled with artillery just as heavy. Great closed works of permanent type are not needed; the batteries are hidden away carefully; anti-aircraft arrangements are perfected; the guns are put up on high ground if such is available. The enemy is kept at a distance by mines anchored in zones, searchlights help in preventing him sweeping the mines up by night, submarines and destroyers perpetually threaten his near approach. Very seldom have warships successfully attacked coast works of good quality of construction, of armament, and of garrison. In the Russo-Japanese war (1904–5), the Japanese only once fought Port Arthur from the sea, and with no success. In the Great War the Allied fleets never dared attack the German permanent fortifications of the North Sea coast, while they often bombarded with some effect the batteries the enemy built on the Belgian coast. At the Dardanelles in 1915 the Allied fleets destroyed with little trouble the old permanent batteries near the water-level, but were beaten by the big guns installed and concealed high up among the hills, running on rails easily movable, and by the drifting mines floating down from the Sea of Marmora.

The cost of first-class works was coming, towards the end of the 19th century, to be judged prohibitive, and it was being said that the money would be better spent on perfecting the armament and equipment of the field troops. Consequently the patent increase in the destructive force of artillery was seldom adequately met by improvements in existing fortresses, while new ones of the first class meant the expenditure of many millions sterling.

The experience of the Great War has been such that, if permanent works are to be newly built, or old works brought really up to date, the constructions will be on no formal plan. Tunnelling on a great scale, along with roomy subterranean barracks, magazines, and food stores, will be a feature; every part will be knitted to every other part by deep-down passages carrying, in the chief of them at least, tram and railway lines. Infantry will man field entrenchments, prepared on the outbreak or the imminent threat of war, all communicating

with the deep chambers or tunnels by shafts or staircases. An immense number of machine-gun emplacements, rendered inconspicuous by siting and by disguises, will be dotted about everywhere, all having safe communications to the underground regions. There will be a complete network of duplicate and triplicate telephone-lines. The fortress will have an ample endowment of air service, with tunnelled hangars, shellproof. All the guns of the defence, except the lightest, will be on rails, with many alternative emplacements for the deception of the enemy's observers, and every gun will be capable of immediate withdrawal into perfect safety when threatened with being overpowered. The fortress will also have to contain, in conditions of safety from bombardment of every sort, a great outfit of military workshops. See MINES (MILITARY).

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Fortiguerra, NICCOLO, an Italian poet, was born at Pistoia in 1674. He proceeded to Rome at an early period, and was speedily raised to the dignity of bishop and papal chamberlain by Clement XI. The greater part of his attention was given to letters; but he is now remembered only as the author of a satirical epic entitled *Il Ricciardetto* (1738), which is praised by his countrymen for its natural humour, grace of style, and elegance of versification. The best edition is one published at Milan in 3 vols. in 1813. Fortiguerra died at Rome, 17th February 1735.

Fort Madison, capital of Lee county, Iowa, on the Mississippi River, 19 miles SW. of Burlington by rail, with a state prison, and many manufactures; pop. 12,000.

For'trose, a watering-place of Ross-shire, on the inner Moray Firth, 10 miles NNE. of Inverness, was one of the Inverness burghs; and its two portions, Chanonry and Rosemarkie, were constituted a royal burgh in 1590. The seat of a Columban monastery in the 6th century, of the bishopric of Ross from 1124, it retains the south aisle and chapter-house of a cathedral, demolished by Cromwell to furnish stones for his Inverness fort. Pop. 1000.

Fort Royal. See FORT DE FRANCE.

Fort St David, a ruined fortress on the coast of Madras Presidency, 100 miles S. of Madras, on the outskirts of Cuddalore. It became British in 1690, along with all the land round about to the distance of a 'randome shott,' and was an important place during the struggle with the French, forming the chief of the English settlements on the Coromandel coast from 1746 to 1752. It is of interest also from associations with Clive (q.v.), who became governor in 1756.

Fort St George. See MADRAS.

Fort Scott, in Kansas, on the Marmiton River, 98 miles S. of Kansas city. A railway junction, it has foundries, machine-shops, flour and other mills, and trade in coal. Pop. 10,700.

Fort Smith, in Arkansas, stands on the south bank of the Arkansas River, and has a large trade and some miscellaneous manufactures; pop. 30,000.

Fort Sumter. See SUMTER.

Fortuna, called by the Greeks *Tychē*, was in classical mythology the goddess of Chance. According to Hesiod, she was a daughter of Oceanus; according to Pindar, a sister of the Parcæ. She differed from Destiny or Fate in so far that she worked without law, giving or taking away at her own good pleasure, and dispensing joy or sorrow indifferently. She had temples at Smyrna, Corinth, and Elis. In Italy she was extensively worshipped from a very early period, and had many titles, such as *Patricia, Plebeia, Equestris, Virilis, Primigenia, Publica, Privata, Muliebris, Virginensis*, &c., indicating the extent and also the minuteness of her superintendence. Particular honours were paid to her at Antium and Prænestē; in the temple of the former city two statues of her were even consulted as oracles. Greek poets and sculptors generally represented her with a rudder, as a symbol of her guiding power; or with a ball, or wheel, or wings, as a symbol of her mutability. The Romans proudly affirmed that when she entered their city she threw away her globe, and put off her wings and shoes, to indicate that she meant to dwell with them for ever.

Fortunate Islands, or ISLANDS OF THE BLEST. See ATLANTIS, AVALON, ANTILLES, BRENDAN, CANARY ISLANDS, ELYSIUM, HESPERIDES.

Fortunatus is the title of one of the best people's books (*Volksbücher*) ever written. It originated about the end of the 15th century, though many of the tales and legends included in it are of much older date. The opinion that it was worked up into German from a Spanish or English original may safely be set aside. The substance of the book is that Fortunatus and his sons after him are the possessors of an inexhaustible purse of gold and a wishing-cap, which however, in the end, prove the cause of their ruin. The moral is that worldly prosperity alone is insufficient to produce lasting happiness. The oldest printed edition of the book now extant bears the date 1509. Later German editions mostly bear the title, *Fortunatus, von seinem Seckel und Wunsch-hütlein.* It has been reprinted in the third volume (1846) of Simrock's *Deutsche Volksbücher.* Versions of the story have appeared in French, Italian, Dutch, Danish, Swedish, and even Icelandic. The first to dramatise the subject was Hans Sachs, in *Der Fortunatus mit dem Wunschseckel* (1553), after whom comes the English Thomas Dekker, with his *Pleasant Comedie of Old Fortunatus* (1600), a work which had the honour to make its reappearance in German about the year 1620. The most poetical edition of the story is that given by Tieck in his *Phantasus.* See Schmidt, in Ersch and Gruber's *Encyklopädie* (sect. 1, vol. xlvi.).

Fortune, ROBERT, a botanist and traveller in China, was born in the county of Berwick in 1813. After serving an apprenticeship as a gardener, he obtained employment in the Royal Botanic Garden at Edinburgh, and afterwards in the gardens at Chiswick. His real life-work began, however, in 1843, with the first of his journeys to China, on behalf of the Botanical Society of London. The results of this journey, the fruits of his observation of the flora of the country, its tea and cotton culture, appeared in 1847 in *Three Years' Wanderings in Northern China.* He subsequently visited China on three separate occasions, to study the methods of tea-cultivation, to carry plants from that country to India, and to collect seeds and plants for the government of the United States. *Yedo and Peking* (1863) was written after his fifth and last journey to the East. His other two books are *A Journey to the Tea Countries of China* (1852), and *A Residence among the Chinese* (1857). Fortune was for a few years director of the Botanical Gardens at Chelsea. He died 16th April 1880.

Fortune-telling. See DIVINATION, PALMISTRY, and GYPSIES.

Fortuny y Carbo, MARIANO, an eminent Spanish painter, was born at Reus in Tarragona, in 1839, and studied in the Academy of Barcelona and in Italy. When Spain declared war against the sultan of Morocco, Fortuny followed the army

to Africa, and filled his portfolios with studies of Eastern life. He received a commission for his 'Battle of Tetuan,' which now hangs in the Chamber of Deputies, Barcelona; but the subject was little to his taste; and, disputes having arisen, this large work was never quite completed. It was the domestic and ceremonial aspects of Eastern life that Fortuny chose to portray, and these mainly for their purely artistic possibilities; the painter treating his subjects simply as colour-schemes made up of dusky countenances, and gorgeous draperies, and vivid sunlight. His touch was particularly incisive and dexterous, and the effects he aimed at were those depending on the sparkle and brilliancy of points of potent, infinitely varied colour. He afterwards stayed much in Paris, Granada, and in Madrid, where he studied the great Spanish masters, and married the daughter of Madrazo, the director of the Academy. The preliminaries of his own wedding suggested to the painter his celebrated picture of 'The Spanish Marriage,' and among other of his later works are his 'Book-lover in the Library of Richelieu' and 'Academicians choosing a Model.' He also left some etchings of Eastern subjects. He died at Rome, 21st November 1874. See monographs by Davillier (illus. Paris, 1875) and Yriarte (Paris, 1885).

Fort Wayne, capital of Allen county, Indiana, at the confluence of the St Joseph and St Mary's rivers, which form the Maumee, and on the Wabash and Erie Canal, 148 miles ESE. of Chicago. It is an important railway centre, and has several railway workshops, foundries, and manufactures of organs, woollens, and engines. It is the seat of a Catholic bishop, and contains a Catholic hospital, convents, and academies, besides several colleges of other churches. Pop. (1870) 17,718; (1880) 26,880; (1890) 35,392; (1910) 63,933; (1920) 86,549.

Fort William, a police-burgh of Inverness-shire, near the head of salt-water Loch Linnhe, the west base of Ben Nevis, and the south end of the Caledonian Canal, 66 miles SSW. of Inverness. A fort, built by Monk in 1655, and rebuilt in 1690, was vainly besieged by the Jacobites in 1746, about 1860 dismantled, and in 1890 demolished. Fort William, long one of the keys of the Highlands, is now a tourist centre. Pop. 2000.

Fort William, a port of Ontario, Canada, on Lake Superior, 420 miles from Winnipeg, is the connection between the eastern and western sections of the Canadian Pacific Railway, and has a large trade, principally in grain; pop. 20,500.

Fort William (India). See Calcutta.

Fort Worth, capital of Tarrant county, Texas, on the west fork of the Trinity River, 30 miles W. of Dallas, is a railway centre, with flour-mills, iron and oil industries, helium works, and stockyards; pop. (1880) 6663; (1910) 73,312; (1920) 106,482.

Forty, a number regarded with superstitious veneration alike by Jews and Moslems, prominently figures in the Bible and in Mohammedan writings. To cite some interesting examples from the notes to Mr W. A. Clouston's *Group of Eastern Romances and Stories* (privately printed, 1889): The Flood continued 40 days (Gen. vii. 17); Isaac was 40 years old when he took Rebekah to wife (Gen. xxv. 20), and Esau was of the same age when he wedded the two Hittite damsels (Gen. xxvi. 34); Joseph and his kinsmen fasted 40 days for their father Jacob (Gen. l. 3); thrice Moses fasted 40 days (Exod. xxiv. 18, xxxiv. 28; and Deut. ix. 9-25); during 40 days the Hebrew spies searched Canaan (Numb. xiii. 25); the Israelites were condemned to wander in the wilderness 40 years (Numb. xiv. 33); Eli judged Israel 40 years (1 Sam. iv. 18); Goliath defied the Hebrew army 40 days (1 Sam. xvii. 16); David and Solomon each reigned 40 years (2 Sam. v. 4; 1 Kings, ii. 11, xi. 42); Elijah fasted 40 days (1 Kings, xix. 8); Nineveh was to be destroyed after 40 days (Jonah, iii. 4); Ezekiel bore the iniquities of the house of Judah 40 days, a day for a year (Ezek. iv. 6); Christ was tempted by Satan in the wilderness after having fasted 40 days (Matt. iv. 2, and Mark, i. 13), and continued 40 days on earth after his resurrection (Acts, i. 3). For further biblical instances, see Exod. xxvi. 19; Josh. xiv. 7; Judges, iii. 11, viii. 28, xiii. 1; 2 Sam. xv. 7; 1 Kings, vi. 17, vii. 38; 2 Kings, viii. 9; Ezek. xxix. 11, 12; Acts, xxiii. 21; 2 Cor. xi. 24.

Moslems mourn 40 days for their dead, and they deem a woman ceremoniously unclean during 40 days after childbirth; among the Israelites the period was 40 days when she had given birth to a male child, and twice 40 in the case of a female child. In Moslem fictions the number 40 very frequently occurs; for instance, in the well-known Arabian 'Tale of the Third Calender,' his voyage is prosperous for 40 days; he is entertained by 40 fairy damsels who absented themselves for 40 days. In the ever-fresh tale of 'Aladdin and his Lamp,' when the magic palace has disappeared the sultan allows him 40 days to find it and the fair princess. In the Persian romance of *Násir*, the hero is directed by the 'last will' of a pious hermit, whom he found dead in his cell, to spend 40 days in prayer for the restoration of the fairies' fountain; he shoots an arrow through a suspended finger-ring 40 times in succession; but his too expert archery caused an accident to the king, from which his majesty did not recover until he had been 40 days under medical treatment. In a subordinate story in the same romance poor Shah Mansur was in the power of a cruel sorceress for nearly 40 days: and in another interwoven story a young prince was tossed about in the sea in a boat for 40 days. The general number of a gang of robbers in Eastern tales is 40: we have a very familiar instance of this in the Arabian tale of 'Ali Baba and the Forty Thieves,' and another example is afforded us in the story of 'Ahmed the Cobbler' (Malcolm's *Sketches of Persia*), where the king's treasury is plundered by 40 robbers.

In Wales 40 loaves of bread and 40 dishes of butter are a common quantity in the records of rent paid to the Bishop of Llandaff. The fee of a bard for his song was 40 pence when he was a disciple, and twice forty for a master. The unthrifty 'Heir of Linne,' according to the fine old ballad, tried to borrow 40 pence of John o' the Scales, who had become the owner of his lands.

In Athens the 'Forty' (four from each tribe) tried cases when the damages claimed were under ten drachmæ. See Aristotle, *Athenian Constitution.*

Forty-shilling Freeholder. See Parliament, Freehold.

Forum, the name applied by the Romans to a public space, especially the market-place in a city, as the principal place of meeting where public affairs were discussed, courts of justice held, and money transactions carried on. In Rome the name applied particularly to the famous *forum* or *forum magnum*, the low level space extending from the foot of the Capitoline Hill to the north-east part of the Palatine. Unlike the *fora* of the emperors this was a slow growth, and was only possible after the valley had been drained by the great *cloacæ*. The central space was the meeting-place of the plebs, *Comitia Tributa;* while the patricians, *Comitia Centuriata*, met on the Comitium, adjoining the Forum. See Rome.

Forum Competens, in Law, is the court to the jurisdiction of which the party is amenable.

Fos'cari, Francesco, Doge of Venice during the most flourishing period of the Venetian power. Born about 1370, and elected doge in 1423, his ambition speedily involved the state in a conflict with Milan, which, however, in consequence of the doge's great military ability resulted in the aggrandisement of Venice by the Treaty of Ferrara (1433). The last years of the doge were embittered by the misfortunes that overtook his son, Giacopo, who was, by authority of the Council, three times tortured in his father's presence and banished, on the first two occasions on false charges, on the third occasion for having besought foreign intercession against the injustice to which he was being subjected. Giacopo died in Candia shortly after his last cruel torturing and banishment. The old doge was allowed to resign office in 1457, and died seven days later, on 1st November. Byron made the tragic history of father and son the subject of *The Two Foscari.*

Fos'colo, Ugo, originally Niccolo, an Italian author, was born in Zante, one of the Ionian isles, on 26th January 1778. His education was begun at Spalato, and completed at Padua, where Cesarotti inspired him with his first love for literature. A man of passionate temperament, and withal an ardent patriot, Foscolo was bitterly disappointed when by the Treaty of Campo Formio Venice was given to Austria, and his disappointment found vent in the *Lettere di Jacopo Ortis* (1802), a sort of political Werther. Still, believing that France was destined to liberate Italy, he served in the French armies, and was present at the battle of the Trebbia and the siege of Genoa. But, becoming finally undeceived as to Napoleon's intentions with regard to his native land, he returned to Milan, where he published in 1807 his best poem, *I Sepolcri,* a work composed in the spirit of the ancient classic writers, and remarkable for its smooth and polished versification. About this time he wrote a translation of Sterne's *Sentimental Journey,* and two tragedies, *Ajace* and *Ricciarda,* both showing political tendencies. In 1809 he was appointed to the chair of Eloquence in Pavia, and occupied the post until the professorship was suppressed in all the colleges of Italy. His inaugural address, *Dell' Origine e dell' Ufficio della Letteratura,* although full of the same love of classic beauty which marks the *Sepolcri,* is turgid and affected in style, like the man himself. When in 1814 the Austrians entered Milan, Foscolo withdrew to Switzerland, and in 1816 he went on to London. There some of his best writings were published—viz. *Essays on Petrarca, Discorso sul testo del Decamerone, Discorso sul testo di Dante,* and various papers in the *Quarterly* and *Edinburgh Reviews.* His last years were embittered by poverty and neglect. He died October 10, 1827, of dropsy, near London. His remains were finally deposited in the church of Santa Croce, Florence, in 1871. His works and letters were published at Florence in 12 vols. by Le Monnier (1850–62). See Lives by Pecchio (1836), Carrer (1842), Artusi (1878), Antona Traversi (1884), De Winckels (1885–86), and Chiarini (1910); *Studi* by G. Manacorda (1921).

Foss, or Fosse (Lat. *fossa,* from *fodio,* 'I dig'), in Fortification, is a ditch or moat, either with or without water, the excavation of which has contributed material for the walls of the fort it is designed to protect. The foss is immediately without the wall, and offers a serious obstacle to escalading the defences. See Fortification.

Fossa et Furca. See Pit and Gallows.

Fossano, a town of Piedmont, North Italy, picturesquely situated on a hill over the Stura, 15 miles NE. of Cuneo by rail, with a cathedral, a 14th-century castle, and remains of the old town walls. Its streets have an antique and gloomy appearance, the houses being built over low arcades, under which run the footways. It has an academy of sciences, a seminary, technical and veterinary schools, and manufactures of silk, leather, and hemp. Pop. 20,000. See Borgognone.

Fossil (Lat. *fossilis,* 'dug out of the earth'), a term formerly applied, in accordance with its derivation, to whatever was dug out of the earth, whether mineral or organic. The term is now restricted to remains and relics of plants and animals which have become embedded by natural causes. These fossils may consist of the harder and more durable parts of animals and plants, or they may be merely the casts or impressions of such remains, or the footmarks or tracks which animals may have left behind them on some soft surface which has been subsequently covered up and consolidated. They occur in nearly all the stratified aqueous rocks, which have on this account been called Fossiliferous strata. It is difficult or impossible to detect them in metamorphic aqueous rocks, for the changes that altered the matrix have also affected the organisms, so as either almost or altogether to obliterate them. In the archæan schists they have escaped notice, if ever they existed; but they have been detected in schistose rocks of Palæozoic age in different parts of the world.

The conditions in which fossils occur are very various. In some Pleistocene beds the organic remains are but slightly altered, and are spoken of as sub-fossil. In this state are the shells in some raised sea-beaches, and the remains of the huge struthious birds of New Zealand, which still retain a large portion of the animal basis. In the progress of fossilisation every trace of animal substance disappears; and if we find the body at this stage, without being affected by any other change, it is fragile and friable, like some of the shells in the London clay. Most frequently, however, a petrifying infiltration occupies the cavities left in the fossil by the disappearance of the animal matter, and it then becomes hardened and solidified; hence fossils were formerly, and still often are, called *petrifactions.* Sometimes the whole organism is dissolved and carried off by water percolating the rock, thus leaving a cavity which may be filled up with calcite, pyrite, gypsum, flint, chalcedony, or some other mineral; and we thus obtain the form of the organism, with the markings of the outer surface, but not exhibiting the internal structure. Not infrequently, as in the case of shells of molluscs, &c., after the soft parts of the organism have been removed and replaced by inorganic matter (either before or after burial), the shell itself may be dissolved out so as to leave a cavity which shows the mould of the outer surface of the shell, and a cast of the interior. If the shell-space is not subsequently filled up by introduced mineral matter, the internal cast lies loose in the cavity like the kernel of a nut. Most commonly, however, the shell itself is replaced by hydrated mineral matter. The most advanced and perfect condition of fossilisation is that in which not only the external form, but also the most minute and complicated internal organisation, is retained; in which the organism loses the whole of its constituents, particle by particle, and as each molecule is removed its place is taken by a molecule of another substance, as silica or pyrites. In this way we find calcareous corals perfectly preserved in flint, and trees exhibiting in their silicified or calcified stems all the details of their microscopic structure—the cells, spiral vessels, or disc-bearing tissue, as well as the medullary rays and rings of growth.

Pteridosperms. — As the name indicates, a group of plants forming a link between ferns and seed-bearing plants. Known only in the fossil condition, they undoubtedly formed one of the

dominant types of vegetation during Carboniferous times; indeed, evidence accumulated in recent years by the patient researches of palæobotanists shows that the group embraces the majority of the so-called 'ferns' of that age. The distinguishing feature in their structure is that their leaves, to all appearance ordinary foliage leaves, yet bear seeds. The composite character of these plants is well seen in a common type such as *Lyginodendron*, the leaves of which belong to the old 'fern' genus, *Sphenopteris*. The roots of *Lyginodendron* in the young condition closely resemble those of Marattiaceous ferns; at a later stage, unlike ferns, they show secondary thickening, and thus show affinities with the roots of gymnosperms. The general anatomy of the stem suggests at once the Cycad type, but the occurrence of centripetal wood in the primary bundles indicates a more primitive character. (In other genera of Pteridosperms the stem is decidedly fern-like.) *Lyginodendron* further resembles ferns in the general aspect of its foliage, and in the fact that its reproductive organs are borne directly on the leaves; the seed in its complex organisation, however, except that it does not contain an embryo, closely approaches that of a typical gymnosperm. Among the ever-increasing number of Carboniferous 'ferns' now regarded as Pteridosperms are included other common genera such as *Neuropteris* and *Alethopteris*. For fossil ferns proper, see FERNS.

FOSSIL FORESTS have been frequently observed in the Coal-measures. The seams of coal having in general been formed from the vegetation of the locality where they occur, it is to be expected that when the coal is removed the stools and roots of the trees will be observed in the immediately subjacent bed of clay or shale—the ancient soil. Such a forest was laid bare in an open work at Parkfield Colliery, near Wolverhampton, in 1844. In the space of about one-fourth of an acre appeared the stumps of 73 trees, with their roots attached. The trunks, broken off close to the root, were lying prostrate in every direction, often crossing each other. One of them measured 15, another 30 feet in length, but they were generally shorter. They were invariably converted into coal, and flattened to the thickness of 1 or 2 inches. The upright stems show that some of them had a circumference of more than 8 feet. A fossil forest was uncovered near Glasgow in 1887. Similar fossil forests have been observed in the coalfields of Nova Scotia, and have been carefully described by Lyell, Logan, and Dawson. The usual height of the trees observed by Lyell was from 6 to 8 feet; but one tree was about 25 feet high, and 4 feet in diameter. Brongniart describes the remains of a fossil forest preserved in an upright position, in strata of micaceous sandstone, belonging to the Coal-measures at St Etienne, near Lyons. Though most abundant in strata of the Carboniferous period, fossil forests have been observed in other formations. The Dirt-bed (q.v.) of the Lower Purbeck series is the remains of an ancient forest. Instances are also abundant in strata of later age.

The remains of ancient forests belonging to a geologically recent period are to be found in and underneath beds of peat. There is good evidence that some kinds of peat had their origin in the destruction of forests. Trunks and branches of oak, hazel, fir, &c. are found in them, and the roots of the trees may be traced in the underclay. Round the coasts of the British Islands and the opposite shores of the Continent remains of ancient forests are frequently to be seen at low-water, the stools of the trees evidently occupying the place of growth. The occurrence of these so-called 'submerged forests' shows that within recent times there has been a loss of land in north-western Europe. See GEOLOGY, PALÆONTOLOGY, PLEISTOCENE SYSTEM, &c.

The discussion of fossil footprints, the tracks of animals or other moving things, on mud or sand now indurated into rock, is sometimes called Ichnology.

Fossombrone, a town in the Italian province of Urbino-Pesaro, on the Metauro, here spanned by a fine modern bridge, 10 miles E. of Urbino, has a cathedral, mineral spring, and silk-works. Here stood the *Forum Sempronii*, of which interesting remains have been found. Pop. 11,000.

Foster, BIRKET, artist, was born at North Shields, of Quaker parentage, 4th February 1825, but from his sixth year was brought up in London. He could draw before he could speak, and, as pupil to Landells, the wood-engraver, from 1841 to 1846, he produced a large number of subjects for wood-engravings, the earliest for Mr and Mrs S. C. Hall's *Ireland* (1843), and many for the *Illustrated London News*. Afterwards, in conjunction with John Gilbert, he illustrated *Evangeline* and many of the poets, his share being dainty poetic landscapes and rustic scenes, nowhere better exemplified than in his *Pictures of English Landscape* (1862). Between them the two did more than any others to educate popular taste. In 1859 Foster exhibited the first of many water-colours, and in 1860 was elected an associate, in 1861 a member of the Water-colour Society. He died at Weybridge, 22d March 1899. See Life by Cundall (1906).

Foster, JOHN, 'the essayist,' was born in the parish of Halifax, Yorkshire, 17th September 1770. Elder son of a yeoman-weaver, he was trained for the ministry at Brierly Hall and the Baptist College in Bristol, but, after preaching for twenty-five years with very indifferent success to small congregations at Newcastle, Dublin, Chichester, Frome, &c., in 1817 he finally relinquished the pastoral office, to devote himself wholly to literature. His *Essays, in a series of Letters* (1805), were only four in number —the best known that 'On Decision of Character' —yet they showed him, said Mackintosh, 'to be one of the most profound and eloquent writers that England has produced.' In 1808 Foster married the Miss Maria Snooke to whom they were originally addressed. In 1819 appeared his celebrated *Essay on the Evils of Popular Ignorance*, in which he urged the necessity of a national system of education. Between 1806 and 1839 he contributed 184 articles to the *Eclectic Review*, 59 of which were edited by Dr Price in 1844. He died 15th October 1843, at Stapleton, Bristol, his home for twenty-two years. Foster was a man of deep but sombre piety. His thinking is massive and original; and at times, when his great imagination rouses itself from sleep, a splendour of illustration breaks over his pages that startles the reader by its beauty and suggestiveness. See his Life by Ryland (1846).

Foster, SIR MICHAEL (1836–1907), born at Huntingdon, and bred at University College, London, was professor of Physiology there, and in 1883–1903 at Cambridge. Secretary of the Royal Society and President of the British Association, he wrote a text-book and a history of the science he did so much to extend. He was elected M.P. for London University in 1900.

Foster, STEPHEN COLLINS, song-writer, was born in 1826 in Pittsburg, Pennsylvania, and in 1842 was still a merchant's clerk in Cincinnati. Of more than a hundred negro melodies and sentimental ballads, the best known are 'The Old Folks at Home,' 'Nelly Bly,' 'Uncle Ned,' 'Old Dog Tray,' 'Gentle Annie,' 'Old Kentucky Home,' 'Willie, we have missed you,' and 'Come where my Love lies dreaming,' the airs and words of

which alike were his own composition. He died in New York, 13th January 1864.

Fosterage, the relation which arises when children are nursed and brought up by others than their own parents, may anywhere establish a very close bond between foster-parents and foster-children. But in ancient Ireland, under the Brehon Laws (q.v.), the systematic fosterage of the children of the wealthy in poor families, and their education there from infancy till the age of thirteen in the case of daughters and seventeen in the case of sons, was recognised and organised in the most elaborate manner, the respective duties and privileges being carefully specified and guarded. Thus, the foster-parents were entitled not merely to the fosterage fee, but to support in their old age from the foster-child; the foster-father was liable to mulcts incurred by the foster-child; and, if the foster-child was found to have been improperly or imperfectly educated in any of the specified branches, the foster-father had to refund the fees in due proportion.

Fotheringhay, a village of England, in Northamptonshire, on the river Nen, 9 miles SW. of Peterborough. In the ancient castle of Fotheringhay, founded shortly after the Conquest, Mary, Queen of Scots, was beheaded in 1587. It was allowed to fall into decay after the accession of James I. to the throne of England.

Foucault, Jean Bernard Léon, French physicist, was born in Paris, 18th September 1819. His first work in the physical sciences was the improvement of Daguerre's photographic processes, and his next a series of investigations, conducted in co-operation with Fizeau, on the properties of light. Continuing his optical inquiries, he was enabled to demonstrate in 1850 that the velocity of light is greater in air than in water, and that in different media the velocity varies inversely as the refractive indices of the respective media. For his remarkable proof in 1851 of the rotation of the earth by means of a freely-suspended pendulum, see Pendulum. Two years after his appointment (1855) as physical assistant in the observatory at Paris Foucault invented his polariser; and two years later (1859) his reflector for the great telescope at Paris was completed. Foucault also invented apparatus for the better application of the electric light, and showed that the sun may be viewed without injury to the eyesight if the object glass of a large telescope be covered with a thin film of silver. He died at Paris on 11th February 1868. Foucault edited the scientific part of the *Journal des Débats* from 1845, and was elected a foreign member of the Royal Society of London in 1864. His papers were printed in *Comptes Rendus* (1847–69). Compare also *Recueil des Travaux Scientifiques de Foucault* (ed. by Gariel and Bertrand, 1878).

Fouché, Joseph, Duke of Otranto, minister of Police under Napoleon, was born at Nantes, 29th May 1763. Although educated for the church, he hailed the Revolution with extravagant delight; and, on being elected to the National Convention in 1792, attached himself to the extreme party of the Mountain, and voted for the execution of Louis. He was commissioned by the Committee of Public Safety to castigate the obdurate city of Lyons (1794), and in that business rivalled his associates, Collot d'Herbois and Couthon, in cruelty and bloodthirstiness. In 1794 he was expelled from the National Convention as a dangerous Terrorist. Yet in September 1799 he had so far recovered ground that he was appointed minister of Police, a post which he held, though with several interruptions, down to 1815. Having made himself indispensable to Napoleon, whom he materially assisted during the revolution of 18th Brumaire (5th November 1799), he proceeded to organise a system of police espionage; but this soon grew intolerable to the First Consul, who in 1802 abolished the ministry. In compensation Fouché was nominated senator of Aix, and rewarded with a large sum of money. Yet two years later Napoleon found it necessary to reinstate him in the office. Once more dismissed by the emperor in 1810, Fouché, after a period of flight in Tuscany, received the appointment of governor-general of Laibach and Rome (1813), and then of ambassador at Naples. Once more he was restored to his former post by Napoleon after his return from Elba, but seeing the downfall of the latter to be inevitable, he made terms with the Bourbons. Under Louis XVIII. he retained his position until the king was constrained by the popular voice to dismiss him in September 1815. Appointed ambassador to Dresden, he was there struck in 1816 by the decree of banishment pronounced against the executioners of Louis XVI.; and henceforward he led an exile's life at Prague, Linz, and Trieste, where he died, 25th December 1820. Fouché was a man with one aim only, his own political success. Unscrupulous, yet politic and sagacious, crafty, and fond of intrigue, he made an admirable head of police in the troublous days of Napoleon's reign, and by the firmness and skill which he displayed in the internal government of France, which was left almost entirely in his hands during the emperor's absence on his many campaigns, he was largely instrumental in preserving his country from anarchy. The *Mémoires de J. Fouché* published (4 vols. 1828–29) were declared not genuine by his sons—though Fouché was known to have composed *mémoires* during his last years of banishment. The standard Life is that by Madelin (2 vols. 1901).

Fougasse, an explosive mine so arranged as to hurl a volume of stones in the faces of an attacking force.

Fougères, a town in the French department of Ille-et-Vilaine, 23 miles by rail N. of Vitré (on the main line from Paris to Brest). It has a picturesque old castle, a college, and considerable manufactures of bootmakers' materials, sailcloth, and leather, besides granite-quarries. Here the Vendean royalists defeated the republicans in November 1793. Pop. 21,000.

Foula, a lonely island of Shetland, 16 miles WSW. of the nearest point of the mainland. Measuring 3¼ by 2½ miles, it is 5 sq. m. in area, and attains in the Sneug a maximum altitude of 1372 feet. Foula is chiefly remarkable for the Old Red Sandstone cliffs on its north-west side, which, rising almost sheer from the sea to a height of 1220 feet, are unmatched for grandeur in the British Isles. They are denizened in the breeding season by myriads of seafowl—puffins, kittiwakes, and the rare great skua or 'bonxie' (*Lestris cataractes*), which formerly was preserved by the islanders to keep down the eagles. The only landing-place is at the fishing hamlet of Ham, on the south-east. Foula was the last island where the old Norse tongue lingered on into the 19th century. It has Congregational and Established chapels. The population is about 150. See Tudor's *Orkneys and Shetlands* (1883).

Foulahs. See Fulahs.

Fould, Achille, French financier and politician, was born in Paris, 31st October 1800, of Jewish parents. Early in life he was initiated into financial business in his father's bank. His political career began in 1842 by his election to the Chamber of Deputies for the Basses-Alpes. After the revolution of 1848 Fould accepted the new régime of the republic, and rendered considerable service to the provisional government in its financial

affairs. During the presidency of Louis Napoleon he was four times minister of Finance between 1849 and 1852. Whilst in office Fould gave the first impulse to the foundation of the *Crédit Mobilier*. Early in 1852 he finally resigned, in consequence of the confiscation of the property of the Orleans family. The same day, however, he was created a senator, and shortly afterwards returned to power as minister of state and of the imperial household, which position he held until 1860. In 1861 he was reappointed finance minister, and retained that post until 1867. On the 5th October following he died at Tarbes.

Foulis, ROBERT and ANDREW, Glasgow printers, were born the one in 1707, the other in 1712. Robert for some years practised as a barber, but meanwhile attended Professor Hutcheson's lectures on moral philosophy. Andrew had been bred for the ministry. In 1741, after two tours with his brother in England and France, Robert set up as a Glasgow bookseller, in 1743 was appointed printer to the university, and between 1742 and his death published 554 works—classics, translations, poetry, plays, &c. The most celebrated are the 'immaculate' *Horace* (1744), which contains, however, six misprints, and the splendid folio *Homer* (4 vols. 1756–58). With the view of promoting the fine arts in Scotland, Robert, after a fourth visit to the Continent, established in 1753—fifteen years before the foundation of the Royal Academy—an academy at Glasgow for engraving, moulding, modelling, and drawing. During the first ten years of its existence this institution produced 1112 prints, besides statues, busts, oil-paintings, and crayons; David Allan owed to it his early training. But the heavy attendant expense led to the decline of the printing business, and the death of the quiet, unwearying Andrew on 18th September 1775 proved the finishing blow. Eight months later Robert sold off his collection of 'old masters' at Christie's in Pall Mall; when all costs were defrayed the balance in his favour was just fifteen shillings. He died suddenly in Edinburgh, on his way back to Glasgow, 2d June 1776. For a full account of this *par nobile fratrum*, the 'Scottish Elzevirs,' see Richard Duncan's *Literary History of Glasgow* (Maitland Club, 1831; new ed. 1886).

Foundation. By this term is generally meant the ground on which the walls of a building rest. But of the walls themselves, whether of brick or stone, the lower courses, or those under the surface of the ground, are called foundation courses. The first thing to determine regarding the site for a building is whether the ground is natural or artificial. By the latter is understood some deposit of waste material, such as loose earth or builder's rubbish, which has been used to level up a piece of ground or put down for some other purpose. It is always necessary to sink the foundation trenches or tracks through made-up ground till the natural surface is reached. Supposing that on the site chosen there are no springs of water, and that it is well drained, then there is a likelihood that whatever the natural foundation, whether of rock, clay, sand, or gravel, it will be a safe one. Sometimes, however, even with these, some means has to be taken to prevent unequal yielding under the pressure of the walls. There may, for example, be hard and soft parts on a piece of ground of the same general character.

In the case of compressible soils of whatever nature the walls require a sufficiently thick bed of Concrete (q.v.) underneath them. More rarely Piles (q.v.) are driven in to support a platform upon which the walls rest, and sometimes inverted arches are used for distributing pressure over a foundation where it would otherwise come only on a few points.

Except where a building is erected on solid rock, what are called 'footings,' or, in Scotland, 'scarcements,' form the first or foundation courses of the walls. Stone footings consist of large flat-bedded stones, which in the lowest course are generally twice as broad as the wall above is thick. Two or more of these projecting courses are first laid, which give a stepped section to those portions of the walls underground. Brick footings resemble those of stone, only in them there are, of course, more joints from the smaller size of bricks. For foundations under water, see CAISSON, COFFERDAM.

Foundations. See CHARITIES, CORPORATION.

Founder, also called LAMINITIS, consists of inflammation of the vascular sensitive laminæ of the horse's foot. It is sometimes met with in cattle, but rarely in sheep, the corresponding structures being in them less developed. Occasionally the laminæ are strained from severe exertion; more frequently they suffer from the morbid effects of cold, which is especially injurious after excitement and overfatigue. Very commonly also they become inflamed from their close sympathy with diseases of the digestive organs, often following engorgement of the stomach or bowels. All the feet are sometimes affected, more usually the forefeet only. They are hot and tender; the animal stands as much as possible upon his heels; trembles and groans when moved; and is in a state of acute fever and pain. Except when following superpurgation or internal disease, bleeding is useful. The shoes must at once be removed, and the toes, if long, reduced, but no further rasping or cutting is permissible. The feet must be enveloped in hot bran poultices, and kept off the hard ground by a plentiful supply of short litter. Soap and water clysters, repeated if necessary every hour, usually suffice to open the bowels, which are very irritable; and physic, if required, must therefore be used with extreme caution. Two drachms of aloes is an ample dose in founder. Have the strain taken off the inflamed laminæ by getting the animal if possible to lie down, or, if he be afraid to do so, let him be 'cast' and kept down. As a rule when once down he will, from the relief to pain, often remain in the recumbent position; he should then be turned at least twice a day, and his bedding kept dry and clean to prevent chafing of the skin or 'bed-sores.' After the acute symptoms pass, thin heeled shoes, barred or plain, as suit the feet, should be put on, cold applications made to the feet, and then a mild blister put round the coronet.

Founding, or METAL-CASTING, is the art of working metals by pouring them, while in a fluid condition, into moulds in which they solidify and harden into the form of the mould which they fill. In general the terms are restricted to metal-work; but glass, plaster, cement, wax, gutta-percha, &c. are cast in moulds precisely in the same manner as the metals.

Casting is the most important of all the operations by which metals are fashioned into useful or ornamental forms; but there are certain metals which cannot be in practice treated by this process. It is essential that the metal employed should be meltable at a temperature which can be reached in foundry practice, that it should flow freely, and should fill the mould well without forming air-bubbles in the mass. Malleable iron cannot be treated by casting, on account of the excessive temperature at which it becomes fluid; and neither copper nor aluminium becomes sufficiently limpid to flow and fill a mould properly. Iron-founding, in which the special form of pig-iron known as 'foundry pig' is used, is the greatest of metal-

casting industries; after which come brass-founding, bronze-casting, zinc, German silver, gold and silver casting, and typefounding and stereotyping. The last two will be dealt with under their own proper heads, and the casting of the minor metals will receive such notice as they require in connection with the metals themselves.

The general process of founding or casting embraces numerous and complex operations connected with (1) the preparation of a mould or form into which the molten metal is run, (2) the melting of the metal or alloy, and (3) the pouring of the molten metal into the mould, in which it solidifies and hardens. According to the form, size, and intricacy of the object to be cast, and the nature and value of the metal used, the variations of working are very many, and it will not be possible here to describe more than two or three typical processes.

Bronze-casting is the most ancient of all metallurgical arts, and an outline of its development may serve to illustrate the processes employed in dealing with that alloy. The earlier forms of bronze axe used by prehistoric man were solid castings made in moulds, which consisted of two flat stones, having in the faces of each hollowed-out depressions which corresponded to two equal halves of the axe. The stones, when placed accurately face to face, had thus between them a hollow space which represented the form of a perfect axe, and into that hollow from the outer surface a channel or 'gate' was formed, by which the molten metal was poured in, till the hollow or mould was filled up. In later times, with the view of saving valuable metal, the practice was introduced of forming a core within moulds of large objects, around which the bronze was poured, which thus formed only an outer surface or skin. Iron appears to have been the material at first selected as suitable for such cores. But at a very early period the Greek sculptors discovered the art of casting their figures, &c. so that the core around which the metal flowed was removable, thus forming hollow castings. By whatever process the early artists worked they were able to produce castings which for beauty of surface, intricacy of pattern, size of casting, and economy of metal cannot be excelled with all the resources of modern ingenuity. Their process was probably that employed to the present day for the finest products of bronze-casting, known as *cire perdue*. In this process a rough model of the statue or other object to be cast is formed slightly smaller than the work to be cast. This model is coated over with beeswax; and to the wax surface the most finished form and touches of the artist are given. The whole surface then receives two or three coatings of a potter's slip or fine cream of ground brick, clay, and ashes, which forms a closely adherent skin around the wax. Then the mould is built up of clay, packed around all the parts to form a solid mass, which is clamped up within a strong iron framework. At certain intervals iron pins are stuck through the clay and wax into the central core, and suitable 'gates' are made for pouring in the bronze and allowing the wax to escape. The clamped-up mass is now placed in the furnace, and slowly heated up till all the wax runs out, and the clay of both mould and core are dried and sufficiently baked. The space at first occupied by the wax is now vacant, and it only remains to pour in molten bronze to occupy the space and assume the form and the thickness of the original wax. In modern bronze-casting for which the *cire perdue* process is not employed, objects of large size, such as heroic figures, are cast in sections, which have afterwards to be fused together at their edges. Models in plaster of the separate pieces are first made, from which moulds in sand and plaster are obtained. Within these moulds cores are cast, and these when baked and dry are uniformly scraped down all over according to the thickness desired in the finished object. The cores so reduced are again placed and supported within the moulds, and thus there is a space between mould and core into which the molten bronze is poured. The various pieces are subsequently brazed together and finished. Some of the recorded works of early Greek sculptors were cast of gigantic proportions. The Colossus of Rhodes is variously stated at from 90 to 120 feet in height. There yet remains in the Hippodrome at Constantinople a pillar of bronze in the form of three twisted serpents, cast 479 B.C., which in its perfect condition was 20 feet high. Schwanthaler's figure of 'Bavaria' in Munich, finished in 1850, stands 67 feet in height, and contains nearly 63 tons of bronze. 'La Vierge du Puy,' by Bonnassieux, is 51 feet high, and contains about 100 tons of bronze. For Bartholdi's 'Liberty' and other famous bronze figures, see COLOSSUS.

Iron-founding, from the nature of its operations and the gigantic scale on which it is carried on, may be regarded as a separate and distinct industry. The large-grained, gray pig-iron, on account of the highly fluid condition into which it can be brought, is the material principally employed; but according to the size of the castings required and the purposes for which they are to be used mixtures of finer grained pig are also melted up. The metal is melted with coke in a round firebrick furnace called a *cupola*, the heat being urged by means of a powerful blast created by rotary blowers (superseding fanners). The molten metal is run from a tap at the bottom of the furnace into a malleable iron ladle lined with loam, from which it is poured into the mould through holes called *runners* or *gates*. When the mould is newly filled numerous jets of blue flame issue from as many small holes pierced in the sand. These perforations are necessary for the escape of air and other gases produced by the action of the hot metal on the mould. Care must also be taken not to have the mould too damp, otherwise steam is generated, which may cause holes in the casting, or even force part of the metal out of the mould. The casting remains covered up for a time in order to cool slowly, and is then removed by breaking away the sand and drawing out the core.

In the case of a fluted or otherwise ornamented pillar the pattern would require to be in at least four pieces instead of two, because it is only a plain pattern that will come out of the mould in halves without tearing away the sand. When a pattern is necessarily made in several pieces it is drawn out of the mould bit by bit, to the right or left as the case may be, and so parts from the sand without breaking it.

Suppose that a small ornamental vase were to surmount the pillar, the founder would prepare the pattern of this in a more elaborate manner. He would first mould it in wax or clay, from which a cast in plaster of Paris is made; from that again a cast is taken in an alloy of tin and lead, which, after being sharply chased and divided into the required number of pieces, is used as a pattern to cast from. All ornamental patterns, such as figures, scrolls, leaves, enriched mouldings, and the like, are made in this way, whatever metal the ultimate casting is to be produced in.

Very large engine cylinders, pans, and such vessels are cast in loam-moulds, which are built of brick, plastered with loam, then coated with blacking, and finally dried by means of a fire. This method is adopted with large plain objects where a pattern would be expensive, and when few castings

of one kind are required. Iron moulds, coated with blacklead or plumbago, are now used for water and gas pipe founding, which forms an extensive special industry. They are greatly more expensive than any other kind, but they enable the founder to dispense with a pattern, as, when once made into the required form, they are not destroyed like moulds of sand or loam at each casting.

For *chilled* castings, also, metal moulds or moulds partly metal and sand are employed. In these the molten iron solidifies and cools with great rapidity, owing to which it acquires extreme hardness, a quality of peculiar value for shot and for many purposes where wear-resisting properties are of more importance than toughness. In *malleable* castings the opposite effect of rendering the metal soft, tenacious, and partially malleable is obtained. For this end the finished casting is embedded in powdered hematite ore or other iron oxide, packed in an iron chest, and exposed for two or three days to a red heat in a furnace. Thereby the cast-iron parts with its carbon, and assumes the softness, tenacity, and infusibility of malleable iron. The process may be continued till the effect is produced throughout the mass acted on, or it may be stopped when merely a skin is decarbonised, leaving the core of unaltered cast metal.

In iron-casting, and especially in steel-casting, bubbles of carbonic oxide and other gases are formed, which partly escape and partly remain imprisoned in the mass, tending to render it vesicular and less sound than it might otherwise be. Various means have been adopted to promote the escape of imprisoned gases, and thereby to render the casting more homogeneous and strong. In Krupp steel the addition of silico-spiegeleisen to the cast metal acts favourably by stopping the evolution of the gases. To force out the gases the late Sir Joseph Whitworth in casting steel adopted the expedient of casting under pressure. While the metal was in a fluid condition he applied pressure of as much as from 6 to 9 tons per square inch over its surface, and by preventing the formation of air-bubbles he thereby obtained a remarkable increase in the strength of the castings so operated on.

The variety of articles produced by founding or casting are very numerous. Besides others incidentally alluded to, we may mention cylinders, cisterns, paper-engines, beams, boilers, pumps, and the heavy parts of machinery generally, gates, railings, lamps, grates, fenders, cooking-vessels, and the like in iron; cannon, many portions of machinery, and numerous ornamental objects in brass, bronze, and the more costly metals.

Machine-moulding.—Much moulding is now done by machinery of many different types. A gear-wheel moulding-machine requires only a pattern of two or three teeth to mould a complete toothed wheel.

Foundling Hospitals, strictly speaking, are institutions in which children that have been deserted by their parents or guardians are received to be nourished and cared for by private charity or at the public expense. Their primary purpose is to serve as a preventive of infanticide and the wilful procurement of abortion, and to counteract the temptation on the part of unmarried women to abandon their illegitimate offspring, and of married women to leave exposed on the streets children they are themselves either unwilling or unable to nurture and support. Although the practice of infanticide was largely prevalent amongst some of the nations of antiquity, especially the Greeks and Romans, amongst whom the father of a family possessed an almost absolute right of life and death over his children, even to selling them into slavery or to slaying them, nevertheless the state was not altogether careless of the preservation of foundlings and abandoned children. Private persons were encouraged to take care of deserted infants, and to educate them, by decrees which assigned them as slaves to those who should thus adopt them. Of the rest—such as were not thus taken charge of—many were educated at the public expense. The ancient Egyptians, Jews, and Thebans (in Greece), however, looked upon infanticide as a crime; and this also was the sentiment of the ancient Germans. But from the time when Christianity became the state religion of the Roman empire a sensible change began to show itself amongst its leading peoples in relation both to infanticide and to the exposure of children. The more enlightened emperors, as Constantine, Valentinian, and Justinian, devised legislative measures for the prevention of both offences. But it was only when the church turned its attention to the matter seriously that the preservation of those unfortunates began to be carried out in a systematic way. In spite, however, of imperial edict and ecclesiastical exhortation, exposure and the selling of offspring, especially in times of public calamity or distress, still continued to be largely practised, more particularly in the Western empire. Iceland, *circa.* 1000, declined to accept Christianity unless the church permitted 'exposition' of children. The germ of the modern foundling hospital may perhaps be found in an institution which owed its existence to the Bishop of Trèves in the 6th century: in the cathedral porch a large marble basin was built, in which children might be placed, to be afterwards reared by members of the church under the superintendence of the ecclesiastical officers. Similar arrangements are mentioned in some of the capitularies of the Frankish kings. But the first well-authenticated instance of a foundling hospital, as we now understand the term, is one that was established at Milan in 787. From the end of the 11th to the end of the 14th century several institutions of a similar character were founded in some of the chief towns of France, Italy, and Germany. It is in France that they have been most thoroughly studied and organised.

At Paris foundlings were generally deposited in the porch of Notre Dame. For the reception of children so exposed Marguerite de Valois opened a special home in 1536, and nine years later the government afforded shelter to 136 orphans in the Trinity hospital. But, no provision being made for their sustenance, they were dependent upon the alms which their nurses begged on the streets or which they themselves could collect when old enough to go a-begging; till in 1552 the parliament of Paris set apart for their maintenance the proceeds of a special tax. Amongst these children the mortality averaged 90 per cent. About the same time the Bishop of Paris built another house of refuge for foundlings picked up within his diocese; this was known as the *Couche.* But the accommodation was insufficient, and children were selected for admission by lot, those who were not elected being generally left to die on the street. Subsequently the inmates of the Couche became the objects of a brisk traffic, children being sold to professional beggars, acrobats, and others at the fixed price of 20 sous each. These evils at length attracted the attention of St Vincent de Paul, who in 1638 established a more satisfactory home and a humane system of treatment. Out of this grew the celebrated Foundling Hospital of Paris, which was incorporated in 1670. With it the Couche, reformed and enlarged, was joined in 1688, and Marguerite de Valois's orphanage in 1772. Under the Revolution all illegitimate children and foundlings were virtually adopted by the state, which in 1793 issued a decree bestowing a premium upon all girls who should declare themselves to be the mothers of ille-

gitimate children, and, as the Emperor Trajan had done, proclaiming all such infants 'children of the country.'

At the Foundling Hospital of Paris children are admitted (since 1886) under conditions which allow any person to leave a child openly without giving an account of it; in fact, the system in vogue is that of indiscriminate admission under the cover of secrecy. The infants admitted belong to the following categories: foundlings proper—i.e. children deserted by parents who are unknown; children who are abandoned by parents who are known; and orphans left destitute, the general designation for them all being not *enfants trouvés*, but *enfants assistés;* besides these, the hospital also takes in children *moralement abandonnés*—i.e. incorrigible children sent by the law-courts, by the prefecture of police, or by their parents. The scope of the institution is not, however, confined to this; it also gives presents of money, baby-clothes, and cradles to mothers who are poor, and sends out nurses to give suck to the infants of such women as cannot themselves perform that service for their offspring. As a rule infants only remain in the establishment at Paris a short time—the average is four days; when adjudged strong enough to travel, they are sent with their nurses into the country, to be boarded with peasants or artisans. For the custody of each child the government pays a monthly subsidy, decreasing from 15 francs during the first year to 6 francs during the twelfth. Once that age is reached nothing further is paid; the child is then generally apprenticed to its foster-father if he is an artisan, or becomes his domestic servant if he is a peasant engaged in agriculture. The central administration, however, still keeps its eye upon these children through its provincial inspectors, nor does it lay down its guardianship or cease its surveillance of them until after they have attained twenty-one years of age. These inspectors also keep the provincial hospitals and the central hospital at Paris supplied with wet-nurses, recruited from the women of the countryside. Parents are allowed to reclaim a child at any time on satisfactorily establishing their title to it, and that without recouping the expense of rearing it. Also, persons who prove to the satisfaction of the hospital administrative authorities that their motives are sincere and laudable are allowed to adopt a child from amongst those whose parents are altogether unknown.

In the United Kingdom and Germany the care of foundlings is for the most part left to the active philanthropy of the charitable or to the operations of the poor-law administration. Britain lagged behind other lands in this form of philanthropy, though the idea of foundling hospitals had long been familiar. Christ's Hospital (1553) was originally a foundling hospital, but only for a short period. It is probable that an essay by Addison (*Guardian*, cv.) in 1713 prepared the way for the success of the project of Thomas Coram (q.v.), who after seventeen years of untiring effort founded in 1739 the institution known as the London Foundling Hospital, of which the real title is 'The Hospital for the Maintenance and Education of Exposed and Deserted Young Children.' The term 'Foundling' Hospital is indeed not strictly appropriate, but this famous institution claims more than passing notice.

The work began in Hatton Garden, but was transferred in 1745 to its present home in Guilford Street. The hospital quickly won support, and a notable feature of its early history is its association with the arts. Hogarth was a member of the original committee, and two of his finest paintings are in the hospital. The annual art exhibitions there led to the formation of the Royal Academy. Handel conducted annual performances of *The Messiah* in the chapel, the funds profiting to the extent of £7000. Music has all along been cultivated at the Foundling, and the massed choir of children's voices lends attraction to the chapel services. The boys are taught musical instruments, and no less than some 80 per cent. enlist as regimental bandsmen.

A disastrous episode in the early history of the hospital was its period of indiscriminate admission, aided by large subsidies from the state, when branch hospitals were established at Ackworth, Shrewsbury, Westerham, and elsewhere. Grave abuses arose, and after four years' trial indiscriminate admission ceased in 1760, the country hospitals being successively sold.

The system of admission now in operation has been found satisfactory. A child is admitted, if not over twelve months old, on personal application of the mother, who must have been deserted by the child's father, and whose previous character has been good. Children of married women and widows are not received. No money is accepted for admission. On reception children are put out to nurse with cottagers (usually outside London), and are brought back to the hospital at the age of five. Boys enlist or are apprenticed, &c., when fifteen. Girls become domestics at sixteen, and are visited from time to time. Rewards are given annually to deserving ex-Foundlings until they come of age. There are usually between 600 and 700 children in hospital and at nurse.

Great Britain possesses numerous orphanages and homes for waifs and strays.

Russia possesses two large foundling hospitals, one at Moscow, admitting 13,000 children per annum, and the other at Petrograd, which accommodates an annual average of 7500. Here infants prematurely born are reared in 'frames very like those used for melon culture,' padded inside, and surrounded outside with a jacket of hot water, so that the temperature may be kept uniform.

Italy has many foundling hospitals. Among the most notable are those at Rome (where a department of the ancient foundation San Spirito maintains about 3000 foundlings), Venice, and Florence. The methods followed at Florence were studied by Coram's committee when the London Foundling Hospital was being planned (*supra*). Foundling hospitals exist in most of the countries of Europe, particularly in Austria, Spain, and Scandinavia.

In the United States deserted children are for the most part sent to the almshouses, or are taken care of in private charitable institutions, like the foundling asylum of the sisters of charity, for instance, in New York city, established in 1869; the infants' hospital, established in 1868; the nursery and child's hospital; and the infant asylum, organised in 1871—all at New York. There are large foundling hospitals at Mexico, Rio de Janeiro, and at Buenos Aires (founded in 1774, with an annual average of about 1200 to 1300 inmates). China, it should be stated, has admirably conducted establishments for the care of destitute and abandoned children in nearly all the large cities of the empire.

During the early part of the 19th century it was customary for foundling hospitals to be provided with a revolving pillar or basket or wheel, a contrivance by means of which a child could be deposited at a foundling asylum without the person who left it there being seen or any questions asked. This apparatus, which was indeed first used at Marseilles about the beginning of the 13th century, was largely employed in France, Belgium, Italy, and elsewhere; and, though it has been almost entirely abolished, it still survives in a few foundling hospitals of Italy. And the new regulation put in force at the Paris hospital in 1886 is virtually

a return to the principle underlying the use of this apparatus—viz. secret and indiscriminate admission. The revolving box was condemned on the ground that it acted as an encouragement to parents to abandon their offspring, and thus weakened the sense of parental responsibility.

Foundling hospitals have been condemned on the ground of the great mortality which takes place in them. For instance, at London, when admission was indiscriminate, the death-rate was over 60 per cent.; and the Dublin hospital, which for several years from 1704 received from 1500 to 2000 children annually, was finally closed in 1835 on account of the excessive mortality, the death-rate being 4 in 5. Again, the asylums of Russia have for many years lost 50 to 60 per cent. of the infants annually sent to them; in Vienna it rose even as high as 75; and it stood at a high figure in France, Italy, and Portugal. But in the case of France and London at least a great improvement has been effected, the percentage for each being less than 4, except in the case of children under one year of age boarded in the rural districts in France. Another system of rearing—sometimes killing off—illegitimate children is known as baby-farming.

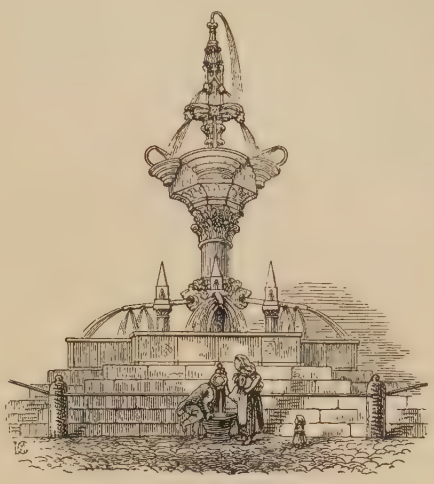
See Terme and Montfalcon, *Histoire Statistique et Morale des Enfants Trouvés* (Paris, 1837); De Gouroff, *Recherches sur les Enfants Trouvés* (Paris, 1839); Epstein, *Studien zur Frage der Findelanstalten* (Prague, 1882); Sennichon, *Histoire des Enfants Abandonnés* (1880); Warner, *American Charities* (1894); Folks, *Neglected and Dependent Children* (New York, 1901); B. K. Gray, *History of English Philanthropy* (London, 1905); G. L. Brace, *Gesta Christi*. Also the articles ITALY, ILLEGITIMACY.

Found Property. See LOST PROPERTY.

Fountain, a basin or an artificial structure for the supply or the ornamental display of water. In civilised countries fountains have at all times been considered as public monuments of the greatest importance; and, where the source of their supply has not been provided by nature on the spot, immense labour and expenditure have been incurred to make up for the deficiency. The splendid Aqueducts (q.v.) of the Romans are instances of the important light in which they regarded the fountains of their cities. Every Roman town had at least one aqueduct, the water from which was distributed to as many fountains as the population required.

In early times utility was the first object of a fountain, and the ornamental features of the structure into and through which the water was led were strictly developments of their original utilitarian purpose. Springs were highly valued, especially in lands where water was scarce; many of them were associated with the names of saints, and sacred traditions accumulated around them. Sometimes, therefore, such springs were built around for protection, statuary figures of their patron saint were placed in niches, and artificial basins were provided to contain the water. In towns where a number of persons might require to draw at one time a large basin was erected with a pillar in the centre, from which pipes radiated all round—each with its separate jet to supply the running water—while the basin was used for washing the pitchers. Many examples of this kind of fountain remain throughout Italy and in the older German towns, of which the fountain at Viterbo and the Schöner Brunnen at Nuremberg may be mentioned as examples. The pillar is sometimes surmounted by a statue, or has one or more smaller basins with ornamental streams and jets of water falling from tier to tier. A beautiful fountain of this nature existed in the royal palace at Linlithgow, and a modern reproduction of it may be seen in front of Holyrood Palace at Edinburgh.

Where modern views of water-supply and sanitation are carried out, under which water is led into each household by gravitation, great public fountains have become purely ornamental structures.



Fontana Grande, Viterbo.

Small pillar fountains are yet commonly placed on streets and places of public resort for wayfarers, and similarly basin fountains are provided for horses and other animals. The Metropolitan Drinking Fountain Association was formed in London in 1859. Of ornamental fountains the most magnificent display is at Versailles. Paris also contains several very remarkable fountains, and in England the display at the Crystal Palace, Sydenham, is very fine. Chatsworth is remarkable for its fountains, one of which is said to throw a jet of water 267 feet high. Although Rome has lost four-fifths of the aqueducts which so lavishly supplied her with fresh water in the time of the Empire, she is still unsurpassed for the number, beauty, and utility of the public fountains which adorn her streets and palaces.

Fountains Abbey, one of the largest and best-preserved monastic edifices in England, in the West Riding of Yorkshire, 3 miles SW. of Ripon. Founded for Cistercians in 1132, it was not completed till the 16th century, so offers every variety of style, from Norman to Perpendicular. See Walbran's *Fountains Abbey* (Surtees Soc. 1863 *et seq.*).

Fountain Shell. See STROMBUS.

Fouqué, FERDINAND ANDRÉ (1828–1904), French petrologist and geologist, was born at Mortain (La Manche), studied at the École Normale in Paris, and became curator of the scientific museum. Afterwards he held various academic appointments, including a chair in the Collège de France, and took part in many expeditions. He did stratigraphical work for the French geological survey, but turned later to petrology and the study of volcanoes, especially to experimental research. He collaborated much with Michel-Lévy.

Fouqué, FRIEDRICH HEINRICH KARL, BARON DE LA MOTTE, German romanticist, was of Huguenot ancestry, and grandson of the Prussian general of the name (1698–1774) distinguished in the Seven Years' War. Born at Brandenburg, 12th February 1777, Fouqué served as Prussian cavalry officer in the campaigns of 1794 and 1813. The interval between these campaigns was devoted to literary pursuits in the country, and the rest of his life was spent alternately in Paris and on his estate at

Nennhausen, and after 1830 at Halle. He died in Berlin, 23d January 1843. Fouqué appeared first under the pseudonym Pellegrin, as author of *Dramatische Spiele* (1801). Norse legend and old French and German poetry attracted him most strongly; one sees this in his long series of romances, both prose and verse, which picture the life of medieval Europe. These include *Sigurd* (1808), *The Magic Ring*, *Thiodulf the Icelander*, *Aslauga's Knight*, *Sintram and his Companions*, *The Two Captains*, and *Undine*. His masterpiece is *Undine* (1811); its tender grace and fairy glamour are exquisite. Otherwise Fouqué is too often chargeable with all the extravagances of the romantic school. Straining after fantastic conceits, he seems fascinated by the antique life which he pictures, rather merely from its quaint contrast with modern manners than as a form into which the life of actual living men had shaped itself in bygone days. He himself edited a selection of his works (12 vols. Halle, 1841). His second wife, Karoline (1773–1831), is also known in Germany as a romance-writer.

Fouquet, Charles Louis Auguste. See Belleisle.

Fouquet, or Foucquet, Jehan, French painter of the 15th century, best known as a miniaturist and book-illuminator, but excelling also in portraits and altar-pieces, was born at Tours about 1415. He visited Italy, painted a portrait of Pope Eugenius IV., returned to France, and was court painter to Louis XI. He probably died about 1485 or 1490. Owing much to Italian and Flemish art, he may be regarded as the founder of a French school. His most notable book-illustrations are those for a *Book of Hours* and for a Josephus. His portraits include Charles VII., Count Wilczek, and Jouvenal des Ursins. A diptych, formerly in Notre Dame de Melun, exhibits Agnes Sorel as the Virgin. See a work by G. Lafenestre (Paris, 1902).

Fouquet, Nicolas, Viscount of Melun and of Vaux, and Marquis of Belle-Isle, finance minister under Louis XIV. of France, was born at Paris in 1615. Attaching himself closely to Mazarin, he received in 1650 the important appointment of *procureur-général* to the parliament of Paris, and three years later was advanced to be superintendent of finance. His rapid advance made him ambitious of succeeding Mazarin as first minister, and in order to secure himself friends and a party he distributed money with a lavish hand; but he had a formidable rival in Colbert. Fouquet's plans were, however, brought to nought; for in the first place Louis himself took the reins of power into his own hands when they slipped from the grasp of the dead cardinal, and in the second place, instigated thereto by Colbert, he suddenly arrested Fouquet in September 1661. After a trial extending over three years, Fouquet was sentenced to perpetual exile and the loss of all his property, but the sentence was afterwards altered to life-long imprisonment in the fortress of Pignerol, where he died 23d March 1680. As an example of the extravagance and gorgeous display made by Fouquet, it may be mentioned that shortly before his arrest he entertained the king at a banquet which cost 120,000 livres in his castle of Vaux, erected by him on a plan very similar to that afterwards embodied in the royal palace at Versailles. From the circumstance of his imprisonment at Pignerol, Fouquet, though he died in 1680, has been identified with the Man with the Iron Mask (q.v.; who died in 1703). See Lives by Chéruel (1865), Lair (1890), and Cheales (1899).

Fouquier-Tinville, Antoine Quentin, one of the most notorious actors in the French Revolution, was born in the village of Hérouelles, in the department of Aisne, in 1747. Originally an attorney of dissolute habits, he ranged himself, on the outbreak of the Revolution, in the ranks of the most violent among the democrats. Appointed by Robespierre and Danton public prosecutor to the Revolutionary Tribunal on 10th March 1793, he superintended during the Reign of Terror, until 28th July 1794, all the political executions decreed by the tribunal. His performance of his duties was characterised by pitiless rigour, brutality, and callous indifference. He apparently regarded it as his mission to supply the guillotine with a regular supply of victims, and no bribes were able to turn him from his purpose. And he sent his friends, among them Robespierre, Danton, and Hébert, to execution in the same spirit in which he sent their enemies. On the overthrow of the Reign of Terror he was himself guillotined on 7th March 1795. See the Life by Alphonse Dunoyer (1912; trans. 1913).

Fourchambault, a town in the French department of Nièvre, 5 miles NNW. of Nevers, near the right bank of the Loire. There are large iron-foundries, nail-works, and wire-works. Pop. 5000.

Fourcroya, a neotropical genus of Amaryllidaceæ, nearly allied to Agave (q.v.), and yielding a similar fibre.

Fourier, François Marie Charles, a French socialist, was born at Besançon, 9th April 1772. His father, a prosperous draper, had him educated in the academy of his native town. The boy excelled in the studies of the school, especially geography, and was passionately fond of flowers and music. He regretfully abandoned his studies for a business career, which he followed with zeal and integrity in various towns of France. As a commercial traveller he also visited Holland and Germany, where with remarkable insight and accuracy he took note of everything interesting in climate, productions, and manners. From his father Fourier inherited a fortune of about £3000, but, having started business for himself at Lyons, he lost nearly all he had at the siege of that city by the Jacobins during the Reign of Terror (1793). He was even thrown into prison, and narrowly escaped the guillotine. After his release and two years' experience as a soldier he returned to a commercial career.

At a very early age Fourier had his attention called to the abuses of commerce. When only five he was punished for speaking the truth about certain goods in his father's shop; and in 1799, while employed in a house at Marseilles, he had to superintend the destruction of an immense quantity of rice held for higher prices, in the midst of a scarcity of food, till it had become unfit for use. Believing that a system which involved such abuses and immoralities must be radically evil, Fourier set himself to discover an entirely new social theory, which he elaborated chiefly in three considerable works. In 1808 he published his *Théorie des Quatres Mouvements et des Destinées Générales;* in 1822 his *Traité d'Association Domestique Agricole;* in 1829 *Le Nouveau Monde Industriel et Sociétaire.* Written under the most discouraging circumstances, these works for many years found few readers and scarcely any disciples; only the most ardent faith in his own principles could have carried him through so many difficulties. For the last ten years of his life he waited at noon every day in his apartments for the coming of the wealthy capitalist who should furnish means towards the realisation of his schemes. It was chiefly after the decline of the Saint-Simon movement that he gained a hearing and a little success. A small group of enthusiasts gathered round him; a journal was started for the advocacy of his views; an attempt to establish a society on his principles was made

in 1832 near Versailles, but without success. At Paris, October 8, 1837, Fourier died, poor, but warmly appreciated by a circle of devoted disciples. In his private life he seems to have been a model of kindness, simplicity, and integrity.

The great aim of Fourier is to reconstruct society on principles which are entirely new. But his social system is more or less moulded and coloured by his peculiar views on cosmogony and psychology. His views of God incline, though not decidedly, to pantheism. The will of God pervades the world as a universal attraction. Whereas Newton proved that this universal attraction governs one movement of the world, Fourier shows that it rules the world in all its movements, which are four—material, organic, animal, and social. From this law of universal attraction there follows a universal analogy, according to which everything in one department of the world has its parallel elsewhere.

Fourier believed that the world has scarcely yet reached the adult stage, having existed only seven thousand years, whereas it is destined to last for eighty thousand years, a long period of progress being followed by a corresponding period of decline. At present mankind is oppressed by an endless variety of evils, which he sums up in one obnoxious word, *civilisation*, and which are due to the fact that we have run counter to the Creator in pronouncing passions to be bad that are simply natural. To effect the passage from social chaos to universal harmony there is but one way—to give a free and healthy development to the human passions.

This brings us to the psychology of Fourier, who recognised twelve radical passions, with three points of attraction; five sensitive (tending to enjoyment), sight, hearing, taste, smell, and touch; four affective (tending to groups), friendship, love, ambition, and familism or paternity; three distributive (tending to series), the emulative, alternating, and composite. The meaning of the first nine is obvious enough. The emulative passion leads to intrigue, the alternating involves love of change; and the operation of the two might cause jealousy, disharmony, and war, were they not controlled by the composite passion and by a higher unity. Out of the free play of all the passions harmony is educed, like white from the combination of the colours.

But for the realisation of this ideal new social arrangements are necessary. These are provided in the *phalange*, an institution in which the interests of social union and individual liking are to be thoroughly reconciled. Each *phalange* was to consist of 1800 persons, a number sufficient to include the whole circle of human capacities, adequately various, and yet not too large for a convenient common life. The individuals constituting the *phalange* were to be arranged in groups of seven or more persons; from twenty-four to thirty-two groups were to form a series, and a number of series united to form a *phalange* of the requisite size. The pervading idea of the whole organisation was a harmonious social life combined out of the free play of the most varied likings and capacities. The dwelling of the *phalange* was the *phalanstère*, a vast, beautiful, and commodious structure in the centre of a highly cultivated domain, a square league in extent, where life would be arranged to suit every one, common or solitary, according to preference. As regards the institution of marriage Fourier would permit a freedom which would be subversive of such social order as now exists.

It is an obvious deduction from Fourier's principle of universal attraction that human life generally, and labour in particular, should be attractive. In the *phalange* labour is accordingly made attractive by constant regard to the likings and capacities of every one, and by continual change of occupation. The results of labour were to be distributed in the following manner. Out of the common gain of the *phalange* a very comfortable minimum was apportioned to each member, and the remainder was divided into twelve shares, of which five went to labour, four to capital, and three to talent. In distributing the reward to labour, the reverse of the present method was to be followed—i.e. necessary labour would be best paid, useful labour would come next, and pleasant labour would be worst paid.

So convinced was Fourier of the beauty and practicability of his social system that he believed it only required to be understood in order to be universally appreciated, and that in a very few years his *phalanges* would cover the whole world. The *phalanges* would arrange themselves in convenient groups with a common chief, and all would finally be united in a great federation, with Constantinople as capital. There never has been the least symptom of the realisation of such a dream. The system of Fourier has so little touch with fact and reality that it is hardly worthy of serious discussion. His road to the social millennium is far too easy. Yet his works are full of ingenious suggestion; and his criticism of the existing social order is often most searching and pungent. His theories may still be very profitably studied by the social economist.

Fourier's complete works were published at Paris (6 vols. 1840–46; new ed. 1870). The most eminent expounder of Fourierism was Victor Considérant, *Destinée Sociale* (1835); Gatti de Gamond's *Fourier et son Système* is an excellent summary. See also SOCIALISM; Pellarin, *Fourier* (5th ed. 1871); L. Reybaud, *Réformateurs Modernes;* Sargant, *Social Innovators* (1859); and several works by Alhaiza (1890–95).

Fourier, JEAN BAPTISTE JOSEPH, BARON DE, French mathematician, was born at Auxerre, 21st March 1768. He became a pupil, and in 1789 a professor, in the military school of his native place; was afterwards removed to the normal school in Paris, and then to the Polytechnic, and accompanied Bonaparte to Egypt in 1798. On his return to France he became a contributor to the *Description de l'Égypte*, and also wrote the historical introduction. At the same time (1802) he was made prefect of the department of Grenoble, an office which he held till 1815, and was created baron in 1808. After Napoleon's escape from Elba Fourier took up his abode in Paris, and devoted himself exclusively to science, becoming a member of the Academy of Sciences in 1816, and afterwards secretary for life, conjointly with Cuvier. He died at Paris, 16th May 1830. His most famous work is the *Théorie Analytique de la Chaleur* (Paris, 1822), in which he applied new methods of mathematical investigation. An allied subject is discussed in his treatise on the temperature of the globe (1827). His analysis of Determinants, distinguished both for its substance and manner of exposition, and left unfinished at his death, was completed and published by Navier (Paris, 1831).

Four Lakes, a chain of deep lakes (Mendota, Menona, Waubesa, and Kegonsa) in Dane county, Wisconsin, connected by short outlets. Madison, the state capital, stands on an isthmus between Mendota and Menona.

Four Masters, ANNALS OF THE, an historical work composed in the Irish language, at the monastery of Donegal, by Michael O'Clery, a Franciscan monk, who enjoyed some reputation as a trained antiquary and historical writer. The work, which covers the history of Ireland from 1172 to 1608, with additions bringing the narrative down to 1616, was begun in the year 1632 and completed in 1636. Michael O'Clery was assisted in the work

of compilation and copying by his brother, Conary O'Clery, by a relative, Cucogry O'Clery, and by Cucogry O'Duigenan; hence the title of the book. See the edition (text and Eng. trans.) by Donovan (3 vols. Dublin, 1848).

Fourmies, a town in the French dep. of Nord, 12 miles SE. of Avesnes by rail, with mines, iron-works, and mills. Pop. 11,000.

Fowey, or Foy, a municipal borough and old port of Cornwall, on the river Fowey, 11 miles SSE. of Bodmin, cures pilchards, and exports 'china-stone' and ores; pop. 2000.

Fowl. See Poultry.

Fowler, Henry Hartley, Lord Wolverhampton (1830–1911), born at Durham, became a solicitor at Wolverhampton, which in 1880 returned him to parliament. He held a succession of offices in Liberal governments, being President of the Local Government Board, Secretary of State for India, and Chancellor of the Duchy of Lancaster. He was made Viscount Wolverhampton in 1908. See Life by his daughter, Edith H. Fowler (1912).—His elder daughter, Ellen Thorneycroft Fowler, who in 1903 became Mrs Felkin, made a name by *Isobel Carnaby*, *The Farringdons*, *Kate of Kate Hall* (with her husband), *The Wisdom of Folly*, and other novels.

Fowler, Sir John, born at Sheffield in 1817, became distinguished in railway engineering, river improvement, and the construction of large docks, and on the completion of the Forth Bridge, designed by him and Sir B. Baker, he was made a baronet. He died 20th November 1898. See Bridge.

Fowler, Thomas (1832–1904), philosopher and historian of his college, was born at Burton-Stather in Lincolnshire. He graduated at Merton College, Oxford, in 1854, and was ever after closely connected with that university, first as tutor of Lincoln College, afterwards as professor of Logic from 1873, and as president of Corpus Christi College from 1881. His principal works are *Elements of Deductive Logic* (1867); *Elements of Inductive Logic* (1870); editions of Bacon's *Novum Organum* (1878), and Locke's *Conduct of the Understanding* (1881); *Progressive Morality* (1884); and *Principles of Morals* (1887). Others are *Locke* in 'English Men of Letters,' *Bacon*, and *Shaftesbury and Hutcheson* in 'English Philosophers.'

Fowler's Solution. See Arsenic.

Fowling. See Wild-fowl.

Fox, the name of a number of species of the family Canidæ (q.v.), which are now usually referred to the genus Canis (see Dog), but are sometimes regarded as forming a distinct genus, Vulpes, distinguished by certain minute differences in the form of the skull and of the teeth, the more elongated body, slender, pointed muzzle, elliptical, somewhat oblique pupil, and bushy tail. Representatives are found in the greater part of the northern hemisphere, but are conspicuously absent from South America.

The following species demand separate notice: (1) The Common Fox (*Canis vulpes*) measures on an average 4 feet in length, of which 16 inches are occupied by the tail; and 14 inches in height; the weight is from 15 to 22 lb. The head is broad, the brow flattened, and the muzzle rapidly tapering, long, and slender; the mouth is furnished with 42 teeth. The body, though apparently thick, owing to its hairy coat, is really lank, but strong and mobile; the legs are slender. The anal glands are strongly developed, giving the animal its well-known odour. The colour above is reddish-brown; the brows, shoulders, and posterior portion of the back, as far as the root of the tail, are shot with white, the hairs in these regions having white tips. The hair on the lips, cheeks, and throat is white, and a streak of the same colour runs down the legs; the breast and belly are ashy and the flanks whitish gray, the feet red, the ears and toes black, and the tail reddish shot with black, and usually with a white tip. These various tints blend gradually into each other, and produce a *tout ensemble* which renders the animal remarkably inconspicuous.

Sportsmen have an extensive technical vocabulary for all that concerns the fox: the female is a 'vixen,' the young, 'cubs;' his head, a 'mask' or 'pate,' his feet 'pads,' and his tail a 'brush;' his dung is known as 'billet,' and his home is a 'kennel,' or, if underground, an 'earth.'

Common Fox (*Canis vulpes* or *Vulpes alopex*).

Foxes occupy burrows in the ground, generally utilising those which have been made by badgers, while occasionally they live in company with these animals. These dens are preferably on the sides of hills, the apertures leading downwards and outwards, and consist of a central chamber with several means of exit. When suitable burrows are wanting, hollows under piles of stones, or even hollow trees have been used.

The fox's food embraces a wide range of nutriment, from a fawn or a lamb to beetles, or even vegetables or fruit; nothing comes amiss. Mice form a large percentage of his diet, and when half-sated he will play for long with his food before eating it. He hunts almost exclusively by night, and in his wanderings chooses the most secluded ways and takes advantage of every particle of shelter which the nature of the ground affords when passing from one covert to another. He is fond of warmth, and if undisturbed will bask for long in the sunshine; he runs rapidly and with great endurance, swims well, and has been known to climb trees in the search after eggs. The usual cry is a short bark, most commonly heard at the pairing season; the young ones use their voices freely when hungry. The pairing takes place in February, and the period of gestation is 60–63 days. Before the birth of the young, of which there are usually 4–7, the vixen pulls out the hair from her belly, partly to provide a soft bed for her offspring and partly to expose her nipples ready for their use. When born they are very helpless (both eyes and ears being closed) and covered with smooth brown fur. At six weeks old they appear outside the burrow, and at three months go hunting either alone or with the mother, who tends them with the utmost solicitude, and will face any danger or run any risk in their defence. A vixen has more than once been caught with no more than a mouse in her own stomach carrying home a plentiful supply of larger game to her young.

The fox's mental qualities are of a very high order. His cunning is proverbial, and his knowledge of localities and ability to profit by experience

have been highly developed in an arduous struggle for existence. 'More elegant than his relatives in mien and bearing; sharper, more prudent, calculating, and adaptive; of strong memory and sense of locality, resourceful, patient, resolute; equally skilled in jumping, slinking, crawling, and swimming, he seems to unite in himself all the qualifications of a perfect highwayman, and, when his lively humour is also taken into consideration, produces the impression of a highly educated artist in his own line.' When taken very young the fox has been successfully tamed, but he does not exhibit that capability for domestication for which his congener the dog is so remarkable. With this latter, however, he agrees in the parasites by which he is infested and the diseases to which he is liable. Even hydrophobia has been known to attack him, and to have been by him communicated to human beings. He has many enemies; the wolf and dog attack and kill him even when they do not devour; the hawk and eagle take the cubs, and the latter sometimes the adults. His chief foe is man. In northern countries where he is abundant the fox is slaughtered for his fur. The skins are brought from Poland, Russia, and the whole of Siberia. The black variety is much rarer and consequently more valuable than the red.

In Britain the fox has a factitious value as the object of a time-honoured sport, which, though it leads to his being pursued to the death by horse and hound, is still the sole reason why he has not long ago shared the fate of the wolf (see FOXHUNTING). In former days many foxes were dug out of their holes in Germany for the sport of 'tossing.' Long, narrow nets were spread out in front of the holes, the opposite ends of each being held by a lady and gentleman; as soon as reynard in his attempt to escape ran upon the net this was suddenly tightened and the unfortunate creature hurled aloft like a schoolboy in a blanket; and this was repeated until he happened to fall upon solid ground and eluded his tormentors.

Several varieties of the common British form are known to sportsmen; the *Greyhound Fox*, which occurs in the mountainous parts of England and Scotland, is tall, long-limbed, and strong; the *Mastiff Fox* is shorter and stouter, whilst the *Cur Fox* is known by his black-tipped tail. In addition to these several more conspicuous variations have received names and been by some regarded as distinct species. The Coal Fox is found in Switzerland and Bavaria, and has a black-tipped tail. The Cross Fox is distinguished by a longitudinal dark line down the back and a transverse one over the shoulders. The Black-bellied Fox is restricted to the south of Europe, and is sufficiently described by its name.

The Red Fox of North America (*C. fulvus*) is very little removed from its European congener: it is not so enduring, but runs with great speed for about 100 yards. For the fur of these three varieties, especially the Silver Fox (bred on fox-farms in Prince Edward Island and elsewhere), see FURS.

(2) The Gray Fox (*Canis cinereo-argentatus, C. virginianus;* sometimes made the type of a distinct genus Urocyon) is somewhat smaller than his European relative, and has comparatively longer legs and a shorter tail; the colour is a peculiar speckled gray, due to the hairs being white at the roots and black with white rings in the distal portions. It is abundant in the southern United States, but does not occur north of Maine. It is not so swift as the red fox, but is even more cautious and timid, though its habits are in general similar. It has been seen to stalk game like a pointer.

(3) The Corsac or Steppe Fox (*Canis corsac*) is the Asiatic representative of the common fox; than this it is decidedly smaller, measuring at most 3 feet in length; it is also somewhat taller, and shorter in the tail, and has a rounder pupil. The colour in summer is reddish, but in winter it becomes paler owing to the development of a white ring round the individual hairs near their extremities. The throat, lower surface of the body, and inner surfaces of the legs are yellowish-white, and there is a three-cornered, dark-gray patch in front of each eye. The tail is dark above, and has a black tip. This species extends from the Caspian Sea to Mongolia, wherever there are extensive steppes, but it never occurs in forests or mountains. Its habits are like those of the European form. It is eagerly pursued by the Kirghiz and Turcomans for the sake of its fur: all the ordinary means are employed for its capture, and in addition eagles are trained to hunt it, and it is forcibly dragged from its earth by an apparatus resembling a magnified corkscrew. As many as 50,000 skins are said to have come into the market in some years.

(4) The South African Desert Fox (*Canis chama*) is only about half the size of the European fox, and is said to live almost entirely on ostrich eggs, which it rolls from the nest to its burrow and then breaks against a stone.

(5) The Fennec (*Canis zerda* or *V. cerdo*) is a delicately-formed little creature, remarkable for its large eyes and enormous ears, which have led some authorities to place it in a special genus (Megalotis). It is found in the deserts of northern Africa and the adjoining parts of Asia, and lives in burrows in the ground, usually near the roots of shrubs. Unlike the common fox it excavates its own home, and is able to dig so rapidly that it can often hide in this manner when pursued. Small birds are its favourite food, but it will also eat lizards, beetles, and grasshoppers, or even vegetable products such as dates or melons: fennecs have been supposed by some to be 'the little foxes that spoil the vines' of Scripture. They produce three or four young ones at a birth, which are tenderly cared for by the mother. When taken young they soon become very tame; they are captured by snares fastened at the entrance of their burrows, and, strange to say, they make no attempt to bite the nooses, though they struggle hard to break them.

(6) The Arctic Fox (*Canis lagopus*) is very well characterised by its short, blunt snout, rounded ears, short legs, and hairy covering to the soles of the feet, whence the specific name. The summer coat is brownish or gray above and on the sides, and white below; but as winter approaches the colour of the whole becomes pure white, although individuals are occasionally observed which have not changed their hue. The species is distributed over the polar regions of both the Old and New Worlds, as well on islands as on continents: it only wanders exceptionally south of the 60th parallel of latitude. The cubs are born in the latter half of June, the vixen choosing a cleft in the rock or some similar position for her nursery. Its food consists of any animals which it is strong enough to overpower, especially mice and lemmings; but in case of need it will eat creatures of any kind that may be cast up by the sea, and will even venture into the huts of the Eskimo and steal whatever it can carry away, whether edible or no. When food is abundant it will conceal it and return to its store in time of need. In character it presents a curious mixture of cunning and of impudence. Steller records that during his stay on Behring Island the foxes would come and try to take the meat from the hands of himself and his comrades, gnaw their boots, or sniff around their faces as they lay asleep; and also that in spite of numbers being slain they did not become shy. That this was not entirely due to lack of acquaintance with human beings is shown by their exhibiting the same characteristics in

Norway. When young they can be easily tamed, and as pets have the advantage of being free from the disagreeable odour associated with most foxes. The fur is a marketable article, though not so valuable as that of some of the other species. See FOXHUNTING, FURS.

Fox, CHARLES JAMES, Whig statesman, was a son of Henry Fox, first Lord Holland, by Lady Georgiana Carolina, eldest daughter of the Duke of Richmond. He was born on the 24th January 1749, and was educated at Eton and Oxford, spending part of his vacations on the Continent in the gayest and wittiest circles of the French capital, and visiting Switzerland and Italy. Notwithstanding the irregular life which he led even as a schoolboy, he was very distinguished for ability both at school and college; and so high was his father's opinion of his talents that at the age of nineteen he had him brought into parliament as member for the borough of Midhurst, a step to which he is said to have been further incited by the fact that, even at this early age, Fox's energies had found an outlet in gambling and other forms of dissipation. His precocity in vice, as well as in intellectual development, is said to have been the result of the injudicious fondness of his very unprincipled but very gifted father. Till he attained his majority Fox prudently kept silent in the House, but immediately thereafter he appeared as a supporter of the administration of Lord North, and was rewarded with the office of one of the lords of the Admiralty. In 1772 he resigned that office owing to a difference with Lord North, but the following year was named a commissioner of the Treasury. From that post he was dismissed two years afterwards, in consequence of another quarrel with Lord North, and passed over to the ranks of the opposition. During the whole course of the American war he was the most formidable opponent of the coercive measures which were adopted by the government, and the most powerful advocate of the claims of the colonists; acting, to this extent at least, in accordance with the views which for many years before had been urged upon the country by the great Lord Chatham. The difference between them was that, whereas Lord Chatham urged conciliation in order to preserve the connection between the two countries, Fox foresaw and foretold the necessity and the advantages of complete separation.

In 1782, on the downfall of Lord North, Fox was appointed one of the secretaries of state, which office he held till the death of the Marquis of Rockingham. On the dissolution of the Shelburne administration in 1783 the North and Fox coalition was formed, and Fox resumed his former office; but the rejection of his India Bill by the House of Lords soon after led to the resignation of his government. It was now that Pitt came into power, and that the long and famous contest between him and Fox, who occupied the position of leader of the opposition, commenced. In 1788 Fox enjoyed a short respite from his public labours. Accompanied by his wife, he visited the Continent, and after spending a few days at Lausanne in the company of Gibbon, who was there engaged in writing his famous history, he set out for Italy. The sudden illness of the king, however, and the necessity of constituting a regency rendered it undesirable that he should be longer absent from England, and he hastened back to his post. The regency, the trial of Warren Hastings, the French Revolution, and the events which followed it gave ample scope to the talents and energies of Fox, and on all occasions he employed his influence to modify, if not to counteract, the policy of his great rival. He was a strenuous opponent of the war with France, and an advocate of those non-intervention views which find greater favour in our day than they did in his. After the death of Pitt in January 1806, Fox was recalled to office, and endeavoured to realise his doctrines by setting on foot negotiations for a peace with France, the results of which he did not live to witness. He was on the point of introducing a bill for the abolition of the slave-trade, when he died at Chiswick, on the 13th September 1806, in his fifty-eighth year. In private life Fox was a genial companion; towards his opponents he was generous, and free from malignity or enmity; but critics like Mr Fortescue (in *British Statesmen of the Great War*, 1911) insist that he was early demoralised by self-indulgence, reckless of the interests of others as of his own, and not a little selfish. Of his oratorical powers it is enough to record that Burke called him 'the greatest debater the world ever saw,' and Sir James Mackintosh, 'the most Demosthenian speaker since Demosthenes.' His remains were interred in Westminster Abbey, near to those of Pitt.

See the *Life and Times* and *Memorials and Correspondence*, by Earl Russell; the *Character*, by Dr Parr (1809); the *Early History, The American Revolution*, and *George III. and Fox*, by Sir George Trevelyan (1880–1914); and the Lives by Wakeman (1890) and Hammond (1903).

Fox, GEORGE, the founder of the Society of Friends (q.v.), commonly called Quakers, was born in July 1624, at Fenny Drayton in the south of Leicestershire. His father, a woollen-weaver, apprenticed him at an early age to a man who combined the trades of shoemaking, wool-dealing, and farming. With him George was principally employed in tending sheep—an occupation which suited his meditative disposition. When about nineteen years of age his religious convictions deepened to such an extent as to make him believe he was the subject of a special divine call to leave his native place and his friends, 'to forsake all, young and old, to keep out of the way of all, and to be a stranger to all.' Bible in hand, he wandered about the country, spending even his nights in the open air, a small competency he had supplying his slender wants. From his clothing he became known as 'the man in the leather breeches.' He soon began to attend meetings, and often to interrupt divine services, especially when these were conducted by 'professors,' persons whom he believed to be formalists and not genuine Christians, and when held in 'steeple-houses' and called together by church-bells, to which he had a special antipathy. The church he held to be the pillar and ground of truth, made up of living stones and lively members, a spiritual house of which Christ is the head. He was not, he said, the head of a mixed multitude, or of an old house composed of lime, stone, and wood. The 'inward light,' in which all orthodox Christians now believe, though to him it seemed a special revelation which he afterwards found in the Scriptures, was the central idea of his teaching. He was not only a great religious, but a great social reformer. As the former he inveighed against everything approaching to sacerdotalism and formalism. As the latter he ran a tilt against all social conventionalism. Not only priests, but lawyers and soldiers, were obnoxious to him as the embodiment of principles which he hated. Everywhere he went he was a marked man: his dress, his mode of speech, his manners, were different from those of others. 'The Lord' forbade him 'to put off his hat to any, high or low,' and 'he was required to *thee* and *thou* all men and women, without any respect to rich or poor, high or low, great or small. And as he travelled up and down, he was not to bid people *good morning* or *good evening*, neither might he bow or scrape with his leg to any one.' He saw the evils of intemperance, and denounced all public

amusements. He thus came into collision with all sorts of people, and his life is indeed little else than a record of insults, persecutions, and imprisonments, to which his zeal and indiscretions subjected him. His experiences of prison were numerous, and of such a nature as to make him one of the earlier of prison reformers. Arrested on one occasion by Colonel Hacker, he was taken to London to be examined by the Protector, who became convinced of his sincerity and of the harmlessness of his tenets. This, however, did not prevent the continued persecution of himself and his followers, who in 1656, the year after they refused to take the oath of abjuration, had increased to such an extent that there were nearly one thousand of them in gaol. He visited Wales and Scotland, and after his marriage to the widow of Judge Fell he went to Barbadoes, Jamaica, America, Holland, and various parts of Germany. In these later wanderings he was accompanied by Penn, Barclay, Keith, and others of the more eminent of the second generation of Quaker ministers. He died 13th January 1691. Amongst his last words were : 'All is well. The seed of God reigns over all, and even over death itself.' Full of personal peculiarities, guilty of many indiscretions, he was yet an amiable and Christ-like man, with a heart full of love for his fellows, and a mind so capable and comprehensive as to enable him to institute the admirable systems of registration, poor relief, education, and self-help, which have made the sect he founded a real social power. His preaching and writings were often turgid, incoherent, and mystical. As a writer he will be always remembered by his *Journal*, full of heart and intellect, valuable as giving with extreme simplicity and an unflinching regard for truth a record of his own life, and of the manners and customs, especially of the poorer classes, in the stormy times in which he lived.

The *Journal* was not edited direct from his MS. till 1911 (by Norman Penney), earlier editions being subjected to official modifications. His works were collected in 3 vols. (1694–1706); in 1852 an edition in 8 vols. was published at Philadelphia. The list of his writings in Smith's *Catalogue of Friends' Books* (1868) occupies 53 pages. See Sewell, *History of the Quakers;* Cunningham, *The Quakers;* Neal, *Puritans;* Marsh, *Life of Fox* (1848); Lives by Janney (1853), J. S. Watson (1860), Hodgkin (1896); Bickley, *Fox and the Early Quakers* (1884); Deacon, *Fox and the Quaker Testimony* (1896).

Fox, William Johnson (1786–1864), orator and political writer, was born near Southwold, Suffolk, the son of a small farmer, who afterwards settled as a weaver at Norwich. Sent to Homerton College to be trained for the Independent ministry, he subsequently seceded to Unitarianism, and ultimately delivered a series of prelections at his chapel in South Place, Finsbury, which marked him out as the leader of English rationalism. When the Anti-corn-law League enlisted the ablest platform orators of the day in the service of free trade, his bold and impassioned rhetoric greatly contributed to arouse and intensify public feeling. M. Guizot quotes his speeches as the most finished examples of oratory which the great conflict produced. Their effect upon the vast metropolitan audiences to which they were addressed was electric. Fox also contributed by his pen to the success of free trade, and his *Letters of a Norwich Weaver Boy* were largely quoted and read. From 1847 till 1863 he sat as an advanced Liberal for Oldham in parliament, where his success was hardly equal to the oratorical promise of his platform and pulpit career. His best parliamentary speeches were upon the education of the people. One of the earliest contributors to the *Westminster Review*, he edited for many years the *Monthly Repository*, and published many lectures, &c., collected in the Memorial Edition of his works (12 vols. 1865–68). See Life by R. and E. Garnett (1910).

Fox Channel, the northern portion of Hudson Bay, washing the western shores of Baffin Land, takes its name from Luke Fox, an English navigator, who was born about 1585, explored Hudson Bay in 1631, and died subsequent to 1635.

Foxe, John, the martyrologist, was born of respectable parents in 1516, at Boston, in Lincolnshire. At sixteen a fellow of Brasenose College brought him to Oxford, apparently as a private pupil. He seems to have attended Magdalen College School, and to have become an undergraduate of Magdalen College. He took his bachelor's degree in 1537, his master's in 1543, and was elected a fellow of Magdalen in 1538. He had already acquired a reputation by his Latin verses, but soon gave himself to the study of the Fathers, and of the theology of the Reformers, with the result that he found his position among less advanced colleagues at Magdalen irksome, and voluntarily resigned his fellowship in 1545. For some time he was employed as tutor to the children of William Lucy of Charlecote, Warwickshire; there he married early in 1547, and afterwards was engaged by the Duchess of Richmond as tutor to the children of her brother, the Earl of Surrey, who had been executed, 19th January 1547. During the reign of Mary, for safety's sake he retired to the Continent, and at Strasburg, Frankfort, or Basel met all the leading Reformers, including Knox, Grindal, and Whittingham. At Basel he was employed as reader for the press in the printing-office of Oporinus. He returned on the accession of Elizabeth, was pensioned by his old pupil, now Duke of Norfolk, and received, in May 1563, a prebend in the cathedral of Salisbury. He lived chiefly in Cripplegate, London, and often preached. For a year he held a stall at Durham. But he was prevented from further preferment by his conscientious objection to wearing the surplice and other practices of the establishment. To his credit it must be said that he pleaded for religious toleration when some Dutch Anabaptists were condemned to the flames in London in 1575. He interceded for them with Queen Elizabeth and other persons in authority, but without effect. He died in 1587, and was buried in London, in the chancel of St Giles's, Cripplegate. Foxe published numerous controversial treatises and sermons, besides an apocalyptic Latin mystery play, called *Christus Triumphans* (Basel, 1556). But the work that has immortalised his name is his *History of the Acts and Monuments of the Church*, popularly known as *Foxe's Book of Martyrs*, the first part of which was published in Latin, in an octavo volume, at Strasburg in 1554, reprinted along with five other books at Basel in a folio volume in 1559. The first English edition appeared in 1563, in one volume folio. Sanctioned by the bishops, it was ordered by a canon of the Anglican Convocation meeting in 1571 to be placed in the hall of every episcopal palace in England; and it went through four editions in Foxe's lifetime, and numerous others since his death. Apart altogether from the vexed question of its historical value, it will survive as a noble monument of English. Foxe's statements cannot be accepted as trustworthy evidence, if unsupported from other sources. His story is doubtless substantially true, although his credulity and bitter prejudice hardly suggest critical capacity in the selection of his authorities.

He was warmly commended by Strype (who came into possession of Foxe's MSS.), Whitgift, Camden, Burnet, and Thomas Fuller. Apart from

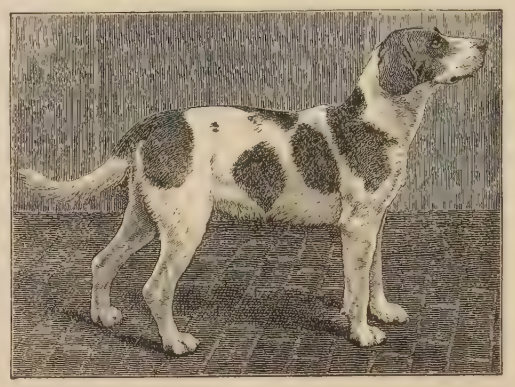
Roman Catholic critics, many of whose attacks are justifiable, Foxe's exaggerations and want of historical precision have been best exposed by the Rev. Dr S. R. Maitland, in a series of pamphlets issued between 1837 and 1842. The biography of Foxe, attributed to his son Samuel, and published in both Latin and English in the 1641 edition of the *Acts*, is certainly apocryphal, although it has formed the basis of numerous popular memoirs.

The best edition is that in the 'Reformation' series of the Ecclesiastical Historians of England, edited by R. R. Mendham and Josiah Pratt (8 vols. 1853 *et seq.*), with Canon Townsend's vindication against the attacks of Roman Catholics.

Foxglove, a species of Digitalis (q.v.). The Common Foxglove (*D. purpurea*) is a native of Britain, and a familiar and conspicuous ornament in woods and hedgerows, its flowering stem reaching a height of from 2 to 4 feet, or even more. It flowers from June to August. Both it and its white-flowered variety are frequently planted in gardens and shrubberies. Its English name, the German name Fingerhut ('thimble'), and the botanical name Digitalis (Lat. *digitale*, 'the finger of a glove') refer to the form of its flowers. The foxglove was a favourite with the fairies, and was called in Ireland Fairy-cap, and in Wales Elf-glove, elsewhere Fairy-fingers, Fairy-petticoats. But there seems no good ground for the attempt to make out that foxglove is a corruption of Folk's-glove, for Good-folk's Glove, or Fairy-glove. Another English provincial name is Fox-fingers.

Common Foxglove (*Digitalis purpurea*).

Foxhound, probably a cross between the old southern hound and the greyhound, combines the nose and tongue of the former with the speed of the latter. When the large woods began to disappear, and more 'blood' was used in our hunters, the pace of the hound was found to be still too slow. The foxhound continued to be bred for speed, until now we have a hound possessing a dash wholly unknown to the original foxhound, and capable of getting away from a large field of horses. The head of the foxhound should be large, deep through the muzzle, but without throatiness or heaviness; teeth, strong and even; shoulders, oblique and muscular; back, short and strong; legs, with great bone perfectly straight in front; hocks, well let down behind; feet, round with arched toes; ears, naturally long and graceful, but always 'rounded' or shortened to prevent tearing when working in coverts; colour, white, with black or tan markings, sometimes to a great extent; height, 22 to 24 inches. In addition to the necessary amount of speed the foxhound must possess staying powers of a high order, a good nose, and be without a tendency to 'babble' or 'run mute'—i.e. to give tongue when not on a scent, or the opposite fault, to refuse to speak to a scent.



Foxhound.

In breeding a pack of foxhounds the individual hound must not be considered, but the speed of the whole pack must be increased or reduced as necessity demands, so as to have the whole pack hunting together. Foxhounds (not bloodhounds) were till of late regularly trained—and used—to track escaped convicts at the great southern convict camps in the United States; hounds a little larger and slower than English hunting foxhounds.

Foxhunting. That foxhunting has been carried on in England for at least six hundred years is proved by a certain amount of evidence gathered from old deeds and documents. But for the first two-thirds of this period it is quite certain that the fox was only hunted to be killed, and that pursuing him in the interests of sport was quite unknown. The fox was indeed, throughout the middle ages, regarded as vermin, and was hunted for extermination, being driven into nets or dug out of the ground. Though there were many breeds of hounds in almost every part of the kingdom, none of them were then regarded as foxhounds, and practically all were kept for the chase of the wild deer and the hare. As far as is known, the earliest Anglo-Norman writing which has hunting for its subject was written by one Guillaume Twici previous to 1327, and this, though it treated of stag-hunting, hare-hunting, hawking, fishing, and other sports, made no mention of the fox as an animal who was worthy of being hunted. On the other hand, there are records of permission to hunt the fox, notably one granted by Richard II. to the Abbot of Peterborough, and another by Henry IV. to Henry de Popham, 'for taking hares and foxes in the County of Southampton.' It is sometimes asked why foxhunting, which, for at least one hundred and fifty years, has been the greatest of all English field-sports, was not practised at an earlier date than the records show, and the answer is fairly obvious, viz. that the country generally was physically unfit for what has been long known as cross-country riding. During the middle ages, and through a much later period, the land was very partially cultivated, and was covered with forests, chases, and wide open heaths or commons, all of which were strictly preserved for the chase of the stag or buck. Stag-hunting, hawking, and coursing were the sports which were followed by equestrians, and the horses used were slower and heavier than the modern hunter, and almost certainly asked to carry more weight, both in saddlery and equipment. Indeed, the saddle of the

16th century appears to have been nearly three times the weight of the modern hunting saddle, and the horses were just as frequently required to carry men in armour as to follow the chase. During the later Stuart period there was an extraordinary and very rapid improvement in the breed of horses, owing to the importation of a vast number of Eastern sires. These were Arabs, Barbs, and Turkish horses, and so thoroughly were they distributed about the country, that in a few years the light horse, as distinguished from the horse used for war, became the popular breed of the day, at a time when every one rode from place to place on business or in pursuit of pleasure, as the case might be. During the 17th and 18th centuries land was being reclaimed in almost every part of the country, and hundreds of thousands of acres of forest disappeared. The stag and the buck were also being quickly brought down in numbers, and owners of hounds were in many districts obliged to find some other quarry to hunt. It was, too, discovered some two hundred years ago that horses could travel faster than their ancestors of only two or three generations before, and that the country was gradually becoming more rideable. But who first conceived the idea of hunting the fox in the manner he has been hunted for the last two hundred years is absolutely unknown; and though there are many hunts which claim to be the oldest in the kingdom, several of these began as stag or hare hunts, and no actual date as to when they changed to fox is forthcoming.

'The Druid' in *Silk and Scarlet* states that prior to 1750 it was sound orthodoxy to hunt what came first to hand, and that it was not until some twenty years later that the line of demarcation between hare and fox began to grow sharp and clear. That many of the earlier packs hunted hares in the autumn and foxes after the turn of the year is well known, and there are at the present day old harrier packs who still turn their attention to foxes in the spring of the year. Certain it is that all the great family packs which were in existence during the first half of the 18th century had become foxhounds at some period before 1800; but in remote provincial countries the change came even later, and there are at the present day certain long-established hunts which were harriers about 1850, or even a little later. It being impossible to say definitely which is, or was, the oldest pack of foxhounds, mention may be made of some of the older packs about which definite facts are known. The Charlton Hunt went back—it no longer exists—to 1689, when, according to *Sussex Archæological Collections*, a Kentish gentleman named Roper managed a pack of hounds for the Duke of Monmouth and Earl Grey. It has always been understood locally that this pack was maintained to hunt the fox alone, but the records as to its earliest hunting are vague, and the claim with regard to foxes is mostly traditional. The country of the Charlton Hunt was hunted some years ago by the Duke of Richmond, but more recently it has formed part of Lord Leconfield's big Sussex country. Another hunt can show even stronger evidence that it has always been a fox hunt, and was not formed from a harrier pack. The hunt in question is the Quorn, one of the most important hunts in the kingdom. The evidence as to the fact that foxes were the only quarry of the Quorn Hunt is afforded by a hunting-horn which bears the following inscription: 'Thos Boothby Esq., Tooley Park, Leicester. With this horn he hunted the first pack of foxhounds then in England 55 years. Born 1677, died 1752.' The year 1698 is given by some authorities as the commencement of Mr Boothby's long mastership, and this would make his hunting period fifty-four years, presuming that he was still hunting the country at the time of his death. It should be added that in Mr Boothby's time the hunt was a private pack, and not known as the Quorn; but Mr Hugo Meynell, who followed Mr Boothby, hunting much the same country, has always been regarded as master of the Quorn. Two Yorkshire hunts can also claim great antiquity, viz. the Sinnington and the Bilsdale, but in all probability their origin is identical, both being within the district hunted by the Duke of Buckingham in '1680 or thereabouts.' The Sinnington is nearer to what used to be the Forest of Pickering, which was generally supposed to be the duke's favourite hunting ground; while in Bilsdale there is a spot known as Buckingham Stone, where tradition has it that a horse of the duke's died after a great run. Some years ago the author of a book which dealt with hunting in Dorsetshire stated that the Cranborne Chase Hunt had the distinction of being the first country in which hounds were kept to hunt fox to the exclusion of other quarry; but older authorities give the date of the establishing of this pack as 1730, which puts it many years behind the Charlton Hunt and the Quorn. As to what quarry was hunted by the Duke of Buckingham nothing can be stated with certainty, but probably bucks were hunted before the country was disafforested in the reign of Charles I., and whether foxes or hares took their place when the deer disappeared is a matter of doubt. What may be taken as certain is, that packs of hounds have been maintained in England for at least six hundred years; that for the first four of these six centuries stags or bucks were the chief quarry, though hares were hunted as well; that the early part of the 18th century was a period of transition from stag and hare to fox, and that this transition was continued for another seventy or eighty years, until the country as a whole became much what it is at the present day as regards the geographical arrangement of packs.

It should be explained, however, that the number of hunting countries has been greatly increased in quite modern times, and this increase is due to various countries having been divided, and even subdivided, so that they could be more thoroughly dealt with, or, in other words, that hounds could hunt all parts of their country regularly instead of going once or twice in a season to the outside districts, and neglecting the less desirable places altogether. In the early days of foxhunting all the packs were privately owned, and without doubt there were no very definite boundaries of country. It is said, for example, that the Berkeley country was so large as to extend from London to the estuary of the Severn, and this is confirmed by the fact that at the present day there is the Old Berkeley Hunt, in Herts, Bucks, and Middlesex, with kennels near Amersham, and the Berkeley (the Earl of Berkeley's) in Gloucestershire. The Berkeley Hunt dates from 1613; but there is nothing to show that it was a foxhunt, or even that foxes were ever hunted by this pack in its early days. The late Grantley Berkeley, however, wrote of his father, the 5th Earl of Berkeley, about 1859—that he (the 5th Earl) used to hunt all the country from Kensington Gardens to Berkeley Castle and Bristol (a distance of over a hundred miles in a straight line). His nearest covert to London was Scratch Wood, near Wormwood Scrubs, and from that covert hounds ran to Kensington Gardens about the beginning of the 19th century. The Earl of Berkeley had kennels at Cranford (Middlesex). Nettlebed, in Oxfordshire, and possibly at other places between the two extremities of the hunt; but it is not definitely decided that the pack (or packs) hunted much in the middle of the huge

district involved, and it is certain that nearly all through the 18th century the hounds of the various Dukes of Beaufort were hunting in Wilts and eastern Gloucestershire large tracts of country which are in the direct line between Cranford and Berkeley Castle. One writer has suggested that separate hunting establishments were maintained at either end of the hundred miles—that is to say, at Cranford and Berkeley Castle—and that when the Earls of Berkeley travelled between Berkeley Castle and London they took hounds with them, and hunted when opportunity offered.

To mention a few of the older and more important packs, the Belvoir, the Brocklesby, and the Badminton (the Duke of Beaufort's) rather stand out, chiefly because they are still holding their own as three of the greatest hunts in the kingdom, and also because of the blood in their kennels being of extreme value. Indeed, Belvoir blood is a by-word in hound lore, and has permeated into every modern pack in the kingdom; and it has been built up in a great measure from Brocklesby blood, and freely crossed at times with the blood of the Badminton kennel. The Brocklesby claims to date from 1700, or even a little earlier, and its hound list goes back to 1746. The Belvoir Hunt dates from 1750, and has hunted foxes exclusively since 1762. The first named of the two packs has always been owned by the Pelham (Lord Yarborough's) family, while the Belvoir hounds have always belonged to the reigning Duke of Rutland, though at times certain other gentlemen have been masters of the pack. Which of the Dukes of Beaufort first formed the Badminton pack is not clear, but it is said that there were always hounds at Badminton, and only foxes have been hunted since about 1770 in all these countries. The Southwold, in Lincolnshire, was formerly part of the Brocklesby country; while the adjoining Burton country dates back to 1774, when the third Lord Monson was master. The Blankney was taken out of the Burton country in 1871. The date of the Quorn Hunt has been given. The popular Fernie Hunt was a part of the Quorn country until 1853. The Cottesmore, which borders the Fernie and the Quorn, and is thought by many experts to contain much of the best riding country in the kingdom, is an old pack, the country having been hunted by the Noel family about 1730. Indeed, one Thomas Noel was responsible for a *Book of Hounds*, which is dated 1732, and the Noel family had the pack until 1788. Since then the Lowther family has provided many masters of the pack. The Pytchley dates from about 1750, and in 1782 the Pytchley Hunt Club was a flourishing institution, with a membership of twenty-eight. The Warwickshire is an old country, but its early history is a trifle vague, though Mr Corbet was hunting part of it in 1778, and Mr Wrightson another part two years later. As at present constituted the country dates from 1812, and the North Warwickshire—which Mr Corbet had hunted nearly fifty years before—from 1838. The Atherstone dates from 1804, and the Meynell from 1816, while the Bicester country was hunted by Mr John Warde towards the close of the 18th century, and by Sir Thomas Mostyn in 1800, since which date it has been known under its present name. All the above are important Midland packs. The countries of the Quorn, the Fernie, the Cottesmore, the Belvoir, and the Pytchley are what are frequently termed 'the shires,' and as regards grass to gallop over these are generally acknowledged to be the best riding countries in the kingdom—though the Tynedale, in Northumberland, is emphatically a grass country, and its neighbour, the Morpeth, almost equally so. There are grass countries in Ireland also, and much grass in the Warwickshire, Bicester, Atherstone, North Warwickshire, Meynell, and other countries which are not far away from the 'shires.'

There are many other countries besides those just mentioned which take high rank, and yet are not quite grass countries when compared to those of the 'shires.' Foremost among them is the Duke of Beaufort's country, the largest and most varied of any country in the kingdom. Here there are grass vales, a high-lying plateau where grass and light plough-land are in fairly equal proportions, certain hilly districts, and a good deal of woodland. Every kind of fence is to be found in the many vales of the Badminton Hunt, and stone walls on the high land. There is, in fact, great variety of country from a hunting point of view, and while the best of it is excellent, none of it is bad. To the south of the Duke of Beaufort's country lie the two divisions of the Vale of White Horse, which were formerly, together with the Old Berkshire, one single and very large hunt. The original hunt, which included the South Oxfordshire as well as the Old Berkshire and the Vale of White Horse, goes back to 1760; the Old Berkshire was taken from it in 1830, and a year later the V. W. H., which was for a season the western end of the Old Berkshire, was established, while the South Oxfordshire became a separate hunt in 1845. Both the V. W. H. and the Old Berkshire are important and very good countries; and a similar remark applies to the Avon Vale, which is for the most part in the Duke of Beaufort's original country, while some of it belongs to the South and West Wilts Hunt, and is loaned by them. Another old country is the Craven, which dates back to the Lord Craven of 1739, but has been a subscription pack for more than a hundred years; while its neighbour, the Vine, dates from 1770, and has a complete list of masters from 1790. The H. H., or Hampshire Hunt, was established about 1745, but for forty years the hounds were staghounds, and only made fox their quarry in 1791. The Garth Hunt had Sir John Cope for master more than a hundred years ago; and the Old Surrey, now joined to the more modern Burstow, has a life of over a hundred years; and the same can be said of the Surrey Union pack. The Tickham is another old pack. The East Kent dates from 1814, while the West Kent country was hunted by Mr John Warde of Squerries in 1776, since which time the country has always been hunted. The Essex Hunt was founded in 1785, the East Essex in 1820, and the Essex Union two years later; while the Puckeridge became a separate hunt in 1799, it and the Hertfordshire having been previously one hunt. These Essex and Hertfordshire packs hunt what are generally considered to be the best plough countries in the kingdom, and all draw largely upon Londoners for their subscribers—not that many people actually hunt from London in these days, but, nevertheless, all the hunts within something like a fifty-mile radius of London are to a great extent supported by professional and business Londoners who have made their residence in the country of their choice. The Cambridgeshire, in which there is as much, or perhaps more, plough than grass, was established in its present state in 1827; but a more important hunt lies north of it, this being the Fitzwilliam, often spoken of as the 'Milton,' because the kennels are at Milton Park, the residence of Mr George Fitzwilliam, who has been master, or joint-master, of the pack, except for two short intervals, since 1887. There are two other packs in the Fitzwilliam family, known as Lord Fitzwilliam's (Grove) Hunt in Notts, and Lord Fitzwilliam's (Wentworth) Hunt in South Yorkshire. The Milton pack is, however, the parent pack, and the hounds have been famous

for many generations, and the blood widely diffused through the country. The hound pedigree book of the Milton pack goes back to 1760, and it is known than an earlier book was destroyed by fire. Of the Yorkshire Hunts the Sinnington (which is mostly a grass country) has been mentioned, as also the Bilsdale. The Badsworth dates from 1730, and the Holderness from 1726. The Middleton Hunt began in 1764, and the Bramham Moor pack, of which Viscount Lascelles became master in 1922, have been in the possession of the Lane-Fox family since about 1750, while the list of masters of the York and Ainsty goes back over a hundred years. The Bedale country, as it now is, dates from 1832; but the country was hunted long before, and was, in fact, part of Lord Darlington's great country, which more than a hundred years ago extended from Sunderland Bridge, four miles south of the city of Durham, to Boroughbridge in Yorkshire. Out of this hunt came parts of the South Durham, and all of the Zetland and the Bedale. The list of dates could be extended, but the oldest and most important hunts have been mentioned, so that a general idea of the age of foxhunting can be formed. It has been shown that numerous divisions of country have been made, with the result that every part of the kingdom where hunting is possible is utilised for the purpose. Even among the mountains of the Lake District there are five packs of hounds, which are followed on foot; and there is hunting all over Wales, horses being used almost everywhere, for much of the Welsh mountain district is rideable, and in nearly all the hunts there is vale land as well as hilly country. In England the Midlands are for the most part flat, and here are most of the best countries. Farther north, in many parts of Yorkshire, Northumberland, and Durham, capital hunting countries are to be found; and Cheshire is also a good hunting country, owing to the fact that its surface is largely covered by dairy-farms. The plough countries lie chiefly in the south-east of England—in Essex, Herts, Bedford, Cambridge, Norfolk, and Suffolk; while Surrey and Sussex are for the most part hilly, with many great woodland districts. Hampshire is much more open, except in and about the New Forest—where there are foxhounds and buckhounds as well—and Dorset is the best of the southern countries from a hunting point of view, with four famous packs, the Blackmore Vale, the Cattistock, the Portman (formerly Lord Portman's), and the South Dorset to wit. In Devon there are a great number of small establishments, and every inch of the country is hunted, but the various countries are for the most part hilly, and the following almost entirely local.

As regards the *modus operandi* of hunting, the best methods were adopted more than a hundred years ago, and have hardly been changed. Time was when meets took place at a much earlier hour, very frequently at daybreak, but that was because the sportsmen of that day liked their hounds to find the drag of a fox and hunt it until they found the fox himself. Foxes in those days were much scarcer than they are now, when the time of meeting is usually from 10·30 to 11 A.M., and even later when the spring is advancing. During the cub-hunting period of the early autumn the early meet still takes place; but the reason for this is that, at daybreak in September, for example, the ground is much moister owing to dew than it is a few hours later, and this moisture enables hounds to work better than when the surface has been dried by a hot sun. From the meet hounds are taken to some woodland or gorse covert, into which they are sent, and which they go through in quest of a fox. If the fox leaves the covert hounds follow him, and run him by scent until one of three things occurs: they kill him, they run him to ground—which means that he gets into a hole, a drain-pipe or conduit, or a rocky place where hounds cannot follow—or they lose the scent and cannot follow any longer. If the fox will not leave the covert in which he is found he is either killed, or lost, or goes to ground as he would do in the open; he possibly finds a substitute in the shape of another fox, when he immediately lies down, allowing the other fox to go on in front of hounds. The 'field,' by which is meant those who follow hounds on horseback, will be outside the covert if it is a small one, but if a big woodland is drawn they will probably be allowed to follow on behind hounds as they draw, and should be able to see a good deal of woodland hunting. When a fox leaves the covert no one should move until hounds have come out, found the scent, and gone away in advance of the riders. The latter then follow as best they can, regulating their pace according to the pace at which hounds are going in front. The pace varies according to the scent. If scent is really good, horses have to gallop their hardest to keep near hounds. If scent is poor, and hounds have to seek for it all the way, then the field must go slowly, and on no account get too near the pack. Hounds must be allowed plenty of room in which to hunt on a moderate scent, and no rider except the huntsman should at such times go within at least a hundred yards of the pack. The huntsman who carries the horn is in charge of the pack, and he is the only man who is allowed to interfere with hounds in the course of a hunt. He may cast them forward, or to one side when they have lost touch of the scent. He may lift them on to what appears to be better scenting ground—out of plough-land on to grass, for example—and he may stop them altogether if he thinks that it is no longer worth while to persevere. His actions should be watched and noted by those who do not really understand hunting; but, like 'the man at the wheel,' he should never be spoken to while he is undertaking the most difficult part of all his duties, viz. trying to get his hounds to maintain the line of a fox when scent is almost non-existent. When one fox is accounted for by being killed, put to ground or lost, hounds are taken to another covert, and there is a repetition of the draw, find, and hunt, but at times many coverts—at all times of the day—are drawn and no fox found therein. Foxes live for the most part underground, but during the night, while they are out in quest of food, the holes which they are known to use are stopped, so that the foxes are outside, generally in covert, when hounds come to look for them. The holes, or 'earths' as they are always called, are opened again in the afternoon when the sport is at an end. Gamekeepers are usually paid so much a head for each fox hunted from their beat, and the amount varies according to the custom of the district, but is never less than 10s. Foxhunting begins in most countries in September, and cub-hunting continues until the end of October. The regular season opens on or about the 1st of November, and terminates at the end of March, though many packs extend their meets for a week or two of April if the season is not a very early one.

See *Thoughts on Hunting*, by Peter Beckford; Radcliffe's *Noble Science*; Vyner's *Notitia Venatica*; *Cook on Foxhunting*; the *Complete Foxhunter*, by Charles Richardson (1906); *Hunting the Fox*, by Lord Willoughby de Broke (1921).

Fox Indians, an Algonquin tribe, whose warriors sided alternately with the French and English in the wars of the 18th century, and in that of 1812–14 were allies of the English. A number now farm lands acquired by purchase in Iowa; but most of the tribe were settled, with

the kindred Sacs, on a reservation between the Canadian and Arkansas rivers.

Fox Islands. See ALEUTIAN ISLANDS.

Fox River, the name of two streams rising in Wisconsin. (1) The Fox River, or Pishtaka (220 miles), flows south to Aurora, then south-west to the Illinois, which it enters at Ottawa.—(2) The Fox River, or Neenah, after a tortuous but generally north-east course of about 250 miles, falls into Green Bay in Lake Michigan. It is divided into two sections by Lake Winnebago, the upper one being connected by a canal with the Wisconsin, so as to link together the Mississippi and the Great Lakes.

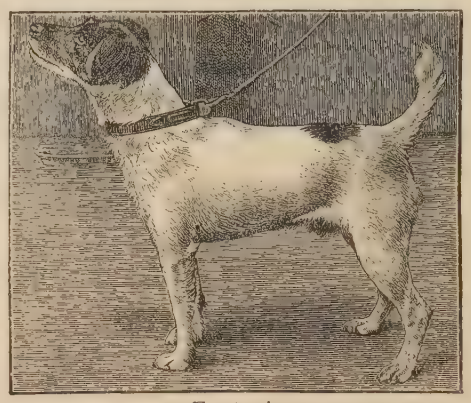
Fox-shark, or THRESHER (*Alopecias vulpes*), the commonest of the larger sharks occasionally seen off British coasts. It is the only species of its genus, and is widely distributed in the Atlantic and Mediterranean, also occurring off California and New Zealand. It is much smaller than the basking shark (*Selache maxima*), but attains a length of over 12 feet, of which half goes to the enormously elongated upper lobe of the tail, to the length and splashing activity of which the fish owes its names. The pectoral limb and the first dorsal fin are large; the snout is conical; the mouth and gill-apertures are moderately wide; the teeth are triangular and not serrated; the skin is bluish above, flesh-coloured below. The fox-shark follows

Fox-shark (*Alopecias vulpes*).

shoals of herrings, pilchards, and the like, threshing the water with its tail as it swims round its victims, which it destroys in great numbers. In spite of its size it is not dangerous to man; and though some of the stories of its attacks on large whales are exaggerated, it has been seen to punish them severely. See SHARK.

Foxtail Grass (*Alopecurus*), a genus of Grasses, of which some species are much valued, particularly the Meadow Foxtail Grass (*A. pratensis*). This is one of the best meadow and pasture grasses of Britain, but does not arrive at full perfection till the third year after it is sown. It bears mowing well, and is reckoned a good grass for lawns. This, with Sweet Vernal Grass, is the earliest of British meadow grasses; it bears drought well, and thrives under trees. The Jointed Foxtail Grass (*A. geniculatus*), with an ascending culm bent at the joints, is very common in moist places, and cattle are fond of it, but it is a small grass. The Slender Foxtail Grass (*A. agrestis*) is an annual or biennial, of little value, although occasionally sown on very light sandy soils. See GRASSES, PASTURE.

Fox-terrier. The origin of the fox-terrier is somewhat obscure. From the earliest days of hunting a small dog has been used to follow the fox to its earth, but it is difficult to say when this dog became identical with the modern fox-terrier. The terriers which ran with hounds until the middle of the 19th century were of all colours and coats; their owners, acting on the adage 'handsome is as handsome does,' bred solely for work and not for appearances. The white terrier with hound marking being found most suitable, it was bred with care, and became a distinct breed. Some smooth fox-terriers were exhibited about the year 1865, and, speedily catching the public taste because of their handy size and suitability to the house, soon became the most popular breed of the day. The wire-haired fox-terrier was not exhibited in public until



Fox-terrier.

the year 1872, the breed having a class set apart for it at Glasgow in that year. As the coat of this variety of the fox-terrier requires some attention, especially when kept for exhibition, it is not so common as the smooth section, though rapidly increasing in popularity. The chief points of the fox-terrier are: head, long, flat, rather narrow, but with powerful jaws and teeth; ears, small, V-shaped, and drooping forward; nose, black; eyes, small; back, short and strong; tail, generally cut short, set on high, carried gaily; fore-legs—an important point—must be straight, showing no ankle, good bone; hind-legs, rather straight, with long and powerful thighs; feet, round with arched toes; colour, white with black or tan markings—a point of little importance; weight, not more than 17 lb.; coat, in the smooth variety, short, hard, and dense; in the rough variety it should be half-an-inch long, but without any silkiness. The expression of the fox-terrier should be keen and hard, full of life and fire. Though the fox-terrier should not be quarrelsome, he should be ready to face anything in the way of his legitimate work. He is unequalled as a companion; and, as many fox-terriers have been kept for generations merely as companions, soft and degenerate specimens of the breed are common. But a genuine fox-terrier is of a bright and cheerful disposition, a splendid vermin-killer, fast enough to hunt, and small enough to enter an earth.

Foy. See FOWEY.

Foy, MAXIMILIEN SÉBASTIEN, French general, was born at Ham, 3d February 1775. During the early wars of the Revolutionary period he served as an artillery officer in Belgium, and on the Moselle and Rhine, till by 1800 he had risen to the rank of adjutant-general. In 1801 he commanded a brigade during the Italian campaign, and in 1805 a division of artillery in the Austrian campaign. Two years later Napoleon sent him to Turkey to assist Sultan Selim against the Russians and British, and his defence of the Dardanelles obliged Duckworth, the British admiral, to retire with loss. From 1808 to 1812 he commanded, as brigade-general, in Portugal and Spain, and was present at all the battles of the Pyrenees, being dangerously wounded at Orthez in 1814. In 1815 he was again wounded at Waterloo, where he commanded a division under Ney. In 1819 he was elected deputy by the department of Aisne. In the chamber he was the constant advocate of constitutional liberty, and distinguished himself particularly by his eloquence in opposing

the war against Spain in 1823. Foy died at Paris, November 28, 1825. The *Histoire de la Guerre de la Péninsule* appeared in 1827, and in 1828 his *Discours*, with a biography by Tissot. See his *Vie militaire*, by Girod de l'Ain (1900).

Foyers, a stream of Inverness-shire, running 9 miles northward to the east side of Loch Ness, 10½ miles NE. of Fort Augustus. During the last 1¼ mile it makes a total descent of 400 feet, and forms two magnificent cascades, 40 and 165 feet high. The lower, called specially *The Fall of Foyers*, is one of the finest in Britain. In 1895–96 works were established for manufacturing, by electricity generated by the fall, aluminium out of bauxite brought from Ireland (see the article ALUMINIUM).

Foyle, LOUGH, an Atlantic inlet on the north coast of Ireland, between Londonderry and Donegal. It is 15 miles long, 1 mile wide at its entrance, and 10 miles broad along its south side; but part is dry at low-water, and its west side alone is navigable. Vessels of 600 tons ascend the lough, and, as far as Derry, the Foyle river, which, formed by the confluence of the Finn and the Mourne, has a north-north-easterly course of 72 miles.

Fra Angelico. See ANGELICO.

Fra Bartolommeo. See BARTOLOMMEO.

Fracastoro, GIROLAMO, an Italian physician and poet, famous for the universality of his learning, was born at Verona in 1483. At the age of nineteen he was appointed professor of Logic in the university of Padua. He afterwards practised successfully as a physician, and it was by his advice that the Council of Trent moved from Trent to Bologna to avoid the plague. Some years before his death, which occurred at Casi, near Verona, on 8th August 1553, Fracastoro abandoned medicine for letters, and became intimate with some of the leading scholars of the age. The chief of his numerous writings are: *Syphilidis, sive Morbi Gallici, Libri Tres* (1530; Lond. 1720); *De Vini Temperatura* (1534); *Homocentricorum sive de Stellis Liber* (1535); and *De Sympathia et Antipathia Rerum* (1546). His collected works appeared at Venice in 1555, and his poetical works at Padua in 1728.

Fraction. In Arithmetic, when a unit of any kind is divided into any number of parts, each is termed a *fraction* of the whole unit—e.g. one foot (lineal measure) is divided into inches; one inch is thus a fraction of one foot. The usual notation employed to denote the value of a fractional quantity is to place under a horizontal line the number of equal parts into which the whole unit has been divided; above the line is placed the number of these parts actually contained by the fraction. The former number is known as the denominator, the latter as the numerator of the fraction. Thus, 7 inches is expressed as the fraction of one foot by $\frac{7}{12}$. Quantities expressed in this way are termed vulgar fractions; they are *proper* or *improper* according as the numerator is less or greater than the denominator; and when the numerator and denominator have no common factor the fraction is said to be in its lowest terms. When the denominator is 10, or a power of 10, the quantity is termed a Decimal Fraction (q.v.). In Algebra the term fraction, while including the sense of the arithmetical definition, is generally used to mean that any quantity affected by it is to be multiplied by the numerator and divided by the denominator. The addition, subtraction, multiplication, and division of fractions are performed according to rules which are practically the same both in arithmetic and algebra. Such rules will be found in any competent text-book on these subjects.

Continued Fractions.—Any expression of the form $a + \cfrac{1}{b + \cfrac{1}{c + \cfrac{1}{d + }}}$ &c. is termed a *continued fraction.* This expression is usually for convenience abbreviated to $a + \frac{1}{b +}\ \frac{1}{c +}\ \frac{1}{d +}$, &c. Such fractions may be terminating or non-terminating. A series of quantities which successively approach towards the actual value of such a quantity are termed *successive convergents* to the value of the fraction; they are alternately smaller and greater than its actual value. Such a series for the fraction above given is: a, $a + \frac{1}{b}$, $a + \cfrac{1}{b + \cfrac{1}{c}}$, &c.

Vanishing Fractions.—When, by giving to one of the terms in a fractional algebraical expression a particular value, both the numerator and denominator become zero, the expression is said to be a *vanishing fraction.* Such is the case in the quantity $\frac{x^2 - 1}{x - 1}$, when $x = 1$; and in $\frac{x}{\sqrt{a + x} - \sqrt{a - x}}$, when $x = 0$. But in the first case, by dividing both numerator and denominator by $x - 1$, the true value of the expression is $x + 1$, which is equal to 2 when $x = 1$. In the second example, by multiplying above and below by the complementary surd—viz. $\sqrt{a + x} + \sqrt{a - x}$, the fraction becomes equal to $\sqrt{a}$, when $x = 0$. Such methods for finding the true value of vanishing fractions are all more or less tentative. For a general process by which their value may be found, reference may be made to Williamson's *Differential Calculus*, chap. iv. See also article CALCULUS.

Fractures, in Surgery, are classified in several different ways. As regards the fractured bone itself, it may be merely broken across, either transversely or obliquely, the commonest injury; or broken into several pieces (*comminuted* fracture); or only cracked (*fissured* fracture, the most usual fracture of the skull); or partly broken, partly bent (*greenstick* fracture, occurring in the bones of the limbs in children); or one part of the bone may be forcibly driven into the other (*impacted* fracture). But the most important classification of fractures is concerned with their relation to the surrounding parts. In a *simple* fracture there is no wound of the skin communicating with the fracture; in a *compound* fracture there is such a wound; in a *complicated* fracture there is some other injury (e.g. a flesh-wound not communicating with the fracture, a dislocation, a rupture of a large blood-vessel). The distinction between simple and compound fractures is of special importance, as the latter are very much more serious than the former, chiefly on account of the risk of pyæmia or septicæmia, and their repair much more tedious; though the dangers attending them have much diminished since the introduction of the antiseptic method. See ANTISEPTIC SURGERY.

Fractures are most common in the long bones of the limbs, particularly the collar-bone, the radius just above the wrist, the thigh-bone, and the fibula. They are rather less frequent in children than in adults, and much less in women than in men.

Causes of Fractures.—The *predisposing* causes which render bones specially liable to fracture may be local—e.g. necrosis or tumour affecting a single bone, or general—e.g. locomotor ataxia and some other nerve diseases, the diseases called mollities and fragilitas ossium, and old age, all which render the bones generally less able to bear a strain. The

immediate cause may be either *external violence* or *muscular action*. The external violence producing a fracture may be either *direct* or *indirect*. In direct fractures the bone yields at the point where the force is applied, and there is always more or less bruising of the adjacent soft parts by the body which causes the fracture—e.g. when a limb is broken by a heavy wheel passing over it, or a stone falling upon it. In indirect fractures the bone gives way at some point between two opposing forces, and the adjacent tissues are not injured except by the broken ends of the bone—e.g. when a person falls upon his hand, and the radius or humerus gives way. The worst fractures are thus in general those produced by direct violence. Muscular action not infrequently leads to the fracture of bones into which powerful muscles are inserted, particularly the knee-cap, by simply tearing them asunder. The subject of the injury may then fall, and attribute the accident to the fall, whereas the reverse is the case. This form of accident may happen, for example, in an old person who breaks the neck of the femur by a sudden twist, and then falling down, does himself some further injury, such as impaction of the fracture, in the fall.

Symptoms of Fracture.—Fracture of a limb is attended by pain, swelling, and loss of power; but these do not suffice to distinguish it from other forms of injury. Deformity other than swelling (shortening, angling, or unnatural rotation of the injured limb), abnormal mobility at the seat of injury, and a rough grating sound and feeling (called *crepitus*) when the limb is so moved as to rub the broken surfaces together are the most satisfactory evidences of fracture. The patient, moreover, may have observed the sound of the break when the bone gave way. But in a case where fracture is suspected X-ray examination now affords an indispensable method of examination, which often reveals small fractures not otherwise discoverable. X-ray examination also gives valuable information as to the position in which the fragments lie.

Repair of a Broken Bone.—The immediate result of a fracture is considerable extravasation of blood into the tissues around it, from the blood-vessels torn across by the injury. It is not quite certain whether some of this blood takes part in the healing process; most of it at all events is simply absorbed. But during the days following the fracture inflammatory lymph, together with new formative tissue cells (here called *callus*), is thrown out between and around the broken ends of the bone. Slow organisation of the callus, with formation of fibrous tissue and blood-vessels, takes place, lime salts are deposited, and in from three to eight weeks it is usually converted into bone, firmly cementing the fragments together. In man, when the fracture is set in good position, there is generally little more lymph effused than suffices to restore the natural outline of the bone; but in animals the break is generally ensheathed in a large mass of it, called *provisional* callus, which steadies the bone till the *permanent* callus between the ends of the bones has become ossified; then the provisional callus, being no longer necessary, is absorbed.

Treatment of Fracture.—When a fracture has taken place it is important that there should be as little disturbance as possible of the injured part till it is to be finally adjusted by the surgeon. Many simple fractures, especially of the lower limb, are made compound by ignorance or carelessness on the part of the injured person or of officious onlookers. The injury should therefore be attended to first on the spot where it has been received; the limb should be fixed by handkerchiefs or strips of cloth to anything at hand firm enough to keep it temporarily steady (a walking-stick, rifle, broom-handle, &c.), or, in the case of the lower limb, to the other leg. When this has been done the patient may more safely be removed to the place where he is to remain during treatment.

The object of the surgeon in *setting* a fractured limb is to place the fragments as nearly as possible in their natural relation, and to retain them firmly in this position during healing. The first object is attained by pulling on the limb (*extension*) so that the displacement is corrected, and the limb is left in a comfortable position. Retention in this position is effected by applying some form of *splint* or external rigid apparatus to the limb, differing in material, shape, and method of application according to the seat of the fracture. Splints are usually made of wood, poroplastic felt, or metal, and fixed on by straps or bandages; but in some simple fractures, especially of the lower limb, a bandage is used impregnated with some material, like plaster of Paris or silicate of soda (water-glass), which hardens on drying and forms a case for the limb; in this way confinement to bed may be much shortened. It is necessary in some cases to continue the extension, and this may be effected by attaching weights, which act over a pulley, upon strips of plaster fixed to the broken limb.

Treatment of fractures may lead to an unsatisfactory result in either of two contrary ways: when the vitality is low, or the treatment has not secured perfect rest of the broken bone, it may become united merely by fibrous tissue instead of bone, leaving a flail-like useless limb (*ununited* fracture, or false joint); or, when rest has been too long and continuous, the healing process may not merely reunite the bone, but fix the surrounding tendons and ligaments by fibrous adhesions, leaving more or less obstinate stiffness of the neighbouring joints. The former is in general more apt to occur in the shafts of the long bones, the latter close to their ends, and the treatment must be modified accordingly.

Fractures of the bones of the head and trunk are dangerous more on account of the risk of laceration of the important organs enclosed by them than because of the injury to the bones themselves; and in general any attempt to 'set' such fractures is apt to do more harm than good. Means must simply be taken to keep them as much at rest as possible.

Fra Dia'volo, properly MICHELE PEZZA, a celebrated Italian brigand and renegade monk, born at Itri, in the Terra di Lavoro, in 1760. Of plebeian origin, he at first followed the trade of stocking-weaver, then entered the Neapolitan army, and subsequently the service of the pope; finally he abandoned military life and became a monk, but, being expelled for misconduct, withdrew to the mountains of Calabria, where he headed a band of desperadoes, whose strongholds lay chiefly along the frontier of the Terra di Lavoro. Pillage, bloodshed, and atrocious cruelties signalised his career. For years he evaded the pursuit of justice by retiring to his haunts amidst mountains and forests, and skilfully defeating, with much inferior numbers, all the armed forces despatched against him. He became at length known among the peasantry of the neighbourhood as Fra Diavolo. On the advance of the French into the Neapolitan states, along with his band he warmly espoused the royal cause, and in return they were not only pardoned and reinstated in civil rights, but promoted to the grade of officers in the royal army, Fra Diavolo himself becoming colonel. In 1806 he attempted to excite Calabria against the French, but was taken prisoner at San Severino, and was executed at Naples on the 12th November. The opera of Auber has nothing in common with Fra Diavolo but the name.

Fraga, a town of Spain, on the Cinca, 63 miles ESE. of Saragossa, the centre of a district famous for a variety of small green figs, which are dried before being consumed. Here, in 1134, the Moors defeated Alfonso I. of Aragon. Pop. 8000.

Fragaria. See STRAWBERRY.

Fragonard, JEAN HONORÉ, painter, was born at Grasse in 1732. He studied under Chardin and Boucher; and, entering the academy schools, gained the 'prix de Rome' in 1752. In Italy—which, later, he revisited—he was influenced mainly by the works of Tiepolo, the last of the great Venetians; and he executed many illustrations for Saint-Non's *Voyage de Naples et de Sicile.* Returning to France, he in 1765 received 2400 francs from Louis XV. for his 'Callirrhoé,' commissioned for reproduction in Gobelins tapestry; then he ceased to be academic, and began to be personal, to follow his true bent—helped to be most himself by the art of Venice and by the art of Rubens. He painted, with a loose touch and luscious colouring, *genre* pictures of contemporary life, or of scenes which, however titled, drew their inspiration from present actuality, from humanity seen and observed by the painter himself. To these his ardent and sensuous southern temperament gave both force and charm. He is also known by his landscapes. He is well represented in the Louvre, most typically in its La Caze collection by such works as 'Bacchante Endormie' and 'La Chemise Enlevée.' He died in Paris, 22d August 1806.

Frambœsia. See YAWS.

Frame, in Gardening, a term usually applied to movable structures used for the cultivation or the sheltering of plants. The most common form is that of the ordinary hotbed frame, which is a rectangular box of any convenient dimensions covered with glazed sashes; but they are made in many forms, according to fancy and the purpose for which they are particularly required.

Framingham, a town of Massachusetts, on the Sudbury River, 24 miles W. by S. of Boston by rail. It includes Saxonville and South Framingham, with manufactures of rubber and straw goods. Pop. 17,000.

Framlingham ('strangers' town'), a market-town of East Suffolk, 14 miles NNE. of Ipswich. It consists of a spacious market-place, with a few streets branching off irregularly. The fine flint-work church, restored in 1888–89, has a tower 90 feet high, and contains several noble altar-tombs of the Howards (the third Duke of Norfolk, the poet Earl of Surrey, &c.). Separated by the Mere from the red-brick Albert middle-class college (1864) rises the great Edwardian castle, reduced in 1650 to a mere shell, but retaining its thirteen square towers. The stronghold successively of Bigods, Mowbrays, and Howards, it was Queen Mary's refuge after Edward VI.'s death. Pop. 2090. See Hawes's *History of Framlingham* (1798).

Franc, a French silver coin which forms the unit of the French monetary system. Introduced into France 6th May 1799, it was extended to the other countries comprised in the Latin union—viz. Belgium, Italy, and Switzerland—by the convention of 1865, and has since then been adopted by Rumania (1868), Spain (1871), Serbia (1874), Bulgaria (1880), and Greece (1882). In Belgium and Switzerland it is known as the franc; in Italy, *lira;* in Greece, *drachma;* in Rumania, *lei;* in Serbia, *dinar;* in Spain, *peseta;* in Bulgaria, *leva.* The franc is coined of silver, $\frac{835}{1000}$ fine, and weighs five grammes, its value at par being about 9½d. English money, or 19 cents of United States. One pound sterling = 25·2 francs. The franc is divided into 100 centimes, but the old division into 20 sous, valued at 5 centimes each, is still made use of in common life. There are in France silver coins of $\frac{1}{5}$, $\frac{1}{2}$, 1, 2, and 5 francs; and gold pieces of 5, 10, 20, 50, and 100 francs. See DECIMAL SYSTEM.

Francatelli, CHARLES ELMÉ (1805–76), born in London of Italian family, was a famous London *chef* and writer on cookery.

Francavilla, in the Italian province of Lecce, 22 miles WSW. of Brindisi, has a pop. of 20,000.

France occupies a commanding position between the Atlantic and the Mediterranean. The civilisation developed on the coasts of the Mediterranean eventually found an easy passage towards the Atlantic and the North Sea by the broad valley of the Rhone and Saône, which communicates with the drainage areas of the Seine, the Loire, and the Garonne. The territory now occupied by France thus became the ground upon which Roman civilisation met and melted with the civilisation of the Celts and Teutons; and it gave birth to a race which assimilated a variety of ethnographical elements—Gaulish, Italian, Spanish, German, and Flemish—and developed into a powerful nationality, the French.

In its present limits, augmented in 1919 by the reacquisition of Alsace and Lorraine (5590 sq. m., 1,874,000 inhabitants), France covers just under 213,000 sq. m.—one-eighteenth part of Europe—and had in 1921 a population of 39,209,766, including Alsace-Lorraine. It is bounded on the N. by the English Channel and the Strait of Dover, which separate it from England; on the NE. by Belgium and the grand-duchy of Luxemburg; on the E. by Germany, Switzerland, and Italy; on the S. by Monaco, the Mediterranean Sea, Andorra, and Spain, from which it is separated by the Pyrenees; and on the W. by the Atlantic Ocean. Its utmost extremities are comprised between 51° 5′ and 42° 20′ N. lat., and the longitudes of 5° 9′ W. and 8° 14′ E. In shape it is a compact hexagonal mass, symmetrically distributed on both sides of the meridian of Paris, its greatest dimensions being 606 miles from N. to S., 583 miles from W. to E., and 675 miles from NW. to SE.

The areas of the different administrative subdivisions of France, and their populations, as well as the former divisions into provinces, are given in the table on the next page.

Coasts, Seaports, and Islands.—The coasts of France possess great advantages for maritime intercourse with the world. The eastern part of the Mediterranean coast, owing to its crescent-shaped indentations, has several excellent harbours which combine the advantage of being situated at, or close by, the terminus of the great commercial route connecting north-west Europe with the Mediterranean (Golfe de St Tropez, Hyères roads, Toulon, Marseilles); on the other hand, the western portion of the same coast, which describes a broad curve in the Gulf of the Lion, is flat and difficult of access, as are also the shores of the Bay of Biscay in the Atlantic. The deep estuary of the Garonne has a good port in Bordeaux; for Nantes, at the head of the estuary of the Loire, owing to the shallowness of its entrance, a deeper port has been found in St Nazaire; whilst the port of La Palisse, three miles west of La Rochelle, is steadily rising in importance. Farther north the rocky coasts of Brittany are indented with numerous narrow gulfs, and dotted with small islands; and Brest, situated on one of the gulfs, is among the best ports in Europe. On the northern coast, facing towards England, France has but few natural harbours. Cherbourg, at the extremity of the Cotentin peninsula, has been made a naval port at a heavy outlay. Le Havre, at the mouth of the Seine, also is an artificial port, whose maritime intercourse with distant lands

Old Provinces.		Departments.	Area in sq. miles.	Population in 1921.
North—	1.	Seine	184	4,411,691
Île de France	2.	Seine-et-Oise	2,185	921,673
	3.	Seine-et-Marne	2,290	349,234
	4.	Oise	2,273	387,760
	5.	Aisne	2,868	421,515
Flanders (Fr.)	6.	Nord	2,228	1,787,918
Artois	7.	Pas-de-Calais	2,607	989,967
Picardy	8.	Somme	2,424	452,624
North-east—	9.	Ardennes	2,028	277,811
Champagne	10.	Marne	3,168	366,734
	11.	Haute-Marne	2,416	198,865
	12.	Aube	2,327	227,839
	13.	Meuse	2,410	207,309
Lorraine	14.	Meurthe-et-Moselle	2,039	503,810
	15.	Moselle	2,405	589,120
	16.	Vosges	2,279	383,684
	17.	Bas-Rhin	1,848	651,686
Alsace	18.	Haut-Rhin	1,354	468,943
		Territory of Belfort	235	94,338
Franche-Comté	19.	Haute-Saône	2,075	228,348
	20.	Jura	1,952	229,062
	21.	Doubs	2,032	285,022
Burgundy	22.	Ain	2,248	315,757
	23.	Saône-et-Loire	3,331	554,816
	24.	Côte-d'Or	3,392	321,088
	25.	Yonne	2,880	271,118
North-west—	26.	Seine-Inférieure	2,448	880,671
Normandy	27.	Eure	2,331	303,159
	28.	Calvados	2,197	384,730
	29.	Manche	2,475	425,512
	30.	Orne	2,373	274,814
Brittany	31.	Finistère	2,714	762,514
	32.	Morbihan	2,734	546,047
	33.	Côtes-du-Nord	2,787	557,824
	34.	Ille-et-Vilaine	2,700	558,574
	35.	Loire-Inférieure	2,695	649,723
Poitou	36.	Vendée	2,709	397,292
	37.	Deux-Sèvres	2,338	310,060
	38.	Vienne	2,720	306,248
Anjou	39.	Maine-et-Loire	2,787	474,786
Maine	40.	Mayenne	2,043	262,447
	41.	Sarthe	2,411	389,235
Centre—				
Touraine	42.	Indre-et-Loire	2,378	327,743
Orléanais	43.	Loir-et-Cher	2,479	251,528
	44.	Eure-et-Loir	2,292	251,255
	45.	Loiret	2,630	337,224
Nivernais	46.	Nièvre	2,659	270,148
Bourbonnais	47.	Allier	2,851	370,950
Marche	48.	Creuse	2,163	228,344
Berry	49.	Cher	2,820	304,800
	50.	Indre	2,666	260,535
Limousin	51.	Haute-Vienne	2,146	350,235
	52.	Corrèze	2,273	273,808
Auvergne	53.	Cantal	2,230	199,402
	54.	Puy-de-Dôme	3,095	490,560
South-west—				
Angoumois	55.	Charente	2,306	316,279
Aunis and Saintonge	56.	Charente-Inférieure	2,792	418,310
Guienne	57.	Aveyron	3,386	332,940
	58.	Lot	2,018	176,389
	59.	Dordogne	3,561	396,742
	60.	Tarn-et-Garonne	1,440	159,559
	61.	Lot-et-Garonne	2,078	239,972
	62.	Gironde	4,141	819,404
	63.	Landes	3,615	263,937
Gascony	64.	Gers	2,429	194,406
	65.	Hautes-Pyrénées	1,751	185,760
Béarn and Navarre	66.	Basses-Pyrénées	2,978	402,981
Comté de Foix	67.	Ariège	1,893	172,851
Roussillon	68.	Pyrénées-Orientales	1,600	217,503
Languedoc	69.	Ardèche	2,146	294,308
	70.	Haute-Loire	1,931	268,910
	71.	Lozère	1,999	108,822
	72.	Gard	2,271	396,169
	73.	Hérault	2,404	488,215
	74.	Tarn	2,230	295,588
	75.	Haute-Garonne	2,457	424,582
South-east—	76.	Aude	2,448	287,052
Lyonnais	77.	Loire	1,853	637,130
	78.	Rhône	1,104	956,566
Dauphiné	79.	Isère	3,180	525,522
	80.	Drôme	2,533	263,509
	81.	Hautes-Alpes	2,179	89,275
(Savoy)	82.	Savoie	2,389	224,874
	83.	Haute-Savoie	1,776	235,668
(Venaissin)	84.	Vaucluse	1,381	219,602
Provence	85.	Bouches-du-Rhône	2,026	841,996
	86.	Basses-Alpes	2,699	91,882
	87.	Var	2,326	322,945
(Nice)	88.	Alpes-Maritimes	1,442	357,759
Corsica	89.	Corse	3,367	281,959
		Total	212,735	39,209,766

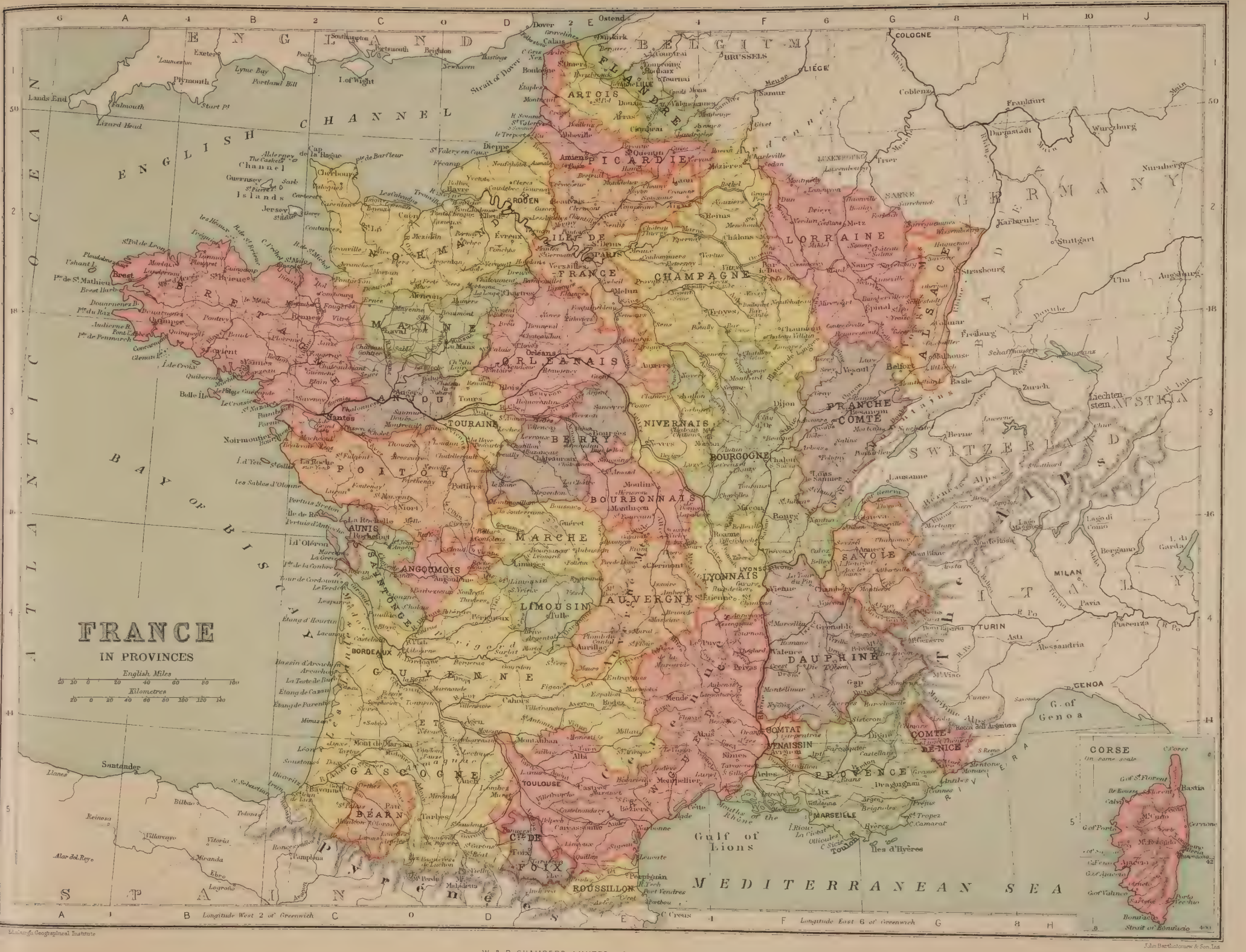
and England is very extensive—as is that of Rouen (up the Seine) and the Channel ports, Dieppe, Boulogne, Calais, and Dunkirk.

Except Corsica, which geographically belongs rather to Italy, France has no islands of consequence, the Channel Islands being British.

Colonies.—The overseas possessions of France in extent and importance are surpassed only by those of the British Empire. Canada and India were lost to France in 1759–63; Napoleon sold Louisiana to the United States of America, and his downfall in 1814 deprived his country of all but a few small islands and settlements abroad. By 1914, however, a vast new colonial empire had been built up, including North-west Africa almost *en bloc*, Madagascar, and Indo-China. Algeria, where there is most scope for European immigration, is in certain respects treated as part of France; Tunis and Morocco are protectorates; Syria, Cameroon, and Togo are territories mandated by the League of Nations; the New Hebrides (not included below) are under joint Franco-British administration.

	French Colonies.	Year of Acquisition.	Area in sq. miles.	Population.
French West Africa.	Algeria	1830	222,000	5,806,000
	Tunis	1881	48,000	2,100,000
	Morocco	1912	160,000	5,400,000
	Sahara	..	925,000	500,000
	Senegal	1635–1854	74,000	1,225,000
	French Sudan	1893	360,000	2,500,000
	Upper Volta	..	120,000	3,000,000
	Guinea	1846	90,000	1,900,000
	Ivory Coast	1883	122,000	1,550,000
	Dahomey	1892	42,000	850,000
	Mauritania	1893	155,000	260,000
	Niger Territory	1912	465,000	1,100,000
	Togo	1919	20,000	670,000
French Equatorial Africa.	Gabun	1842	120,000	1,300,000
	Middle Congo	..	150,000	1,400,000
	Ubangi-Shari	..	205,000	1,600,000
	Chad	..	490,000	2,000,000
	Cameroon	1919	165,000	2,000,000
	Somali Coast	1862–84	45,000	220,000
	Madagascar	1642–1896	228,000	3,278,000
	Mayotte and Comoro Is.	1843–1912	800	110,000
	Réunion	1649	1,000	173,000
	Total for Africa		*4,207,800*	*38,942,000*
French Indo-China.	India (Pondicherry, Karikal, Mahé, &c.)	1674	200	270,000
	Cochin-China	1862	22,000	3,800,000
	Tongking	1884	45,000	6,850,000
	Cambodia	1863	70,000	2,400,000
	Annam	1884	63,000	5,000,000
	Laos	1893	100,000	820,000
	Kwang Chau	1898	400	182,000
	Syria	1920	60,000	3,000,000
	Total for Asia		*360,600*	*22,322,000*
French Antilles.	Guiana	1626	33,000	50,000
	Guadeloupe and Dependencies	1635	700	220,000
	Martinique	1635	400	245,000
	St Pierre and Miquelon	1635	100	4,000
	Total for America		*34,200*	*519,000*
	New Caledonia and Dependencies	1853	7,700	50,000
	Society Islands (Tahiti), Marquesas, &c.	1842–80	1,600	32,000
	Total for Oceania		*9,300*	*82,000*
	Grand Total		4,612,000	61,865,000

Geographical Description.—France is mountainous only in its south-eastern half—south of a line from Biarritz to Metz. The Pyrenees form its southern border; the Alps and the Jura in the east separate it from Italy and Switzerland; farther north the Vosges run between Alsace and Lorraine. The Cévennes, west of the deep Rhone Valley, and (in the heart of France) the mountains of Auvergne



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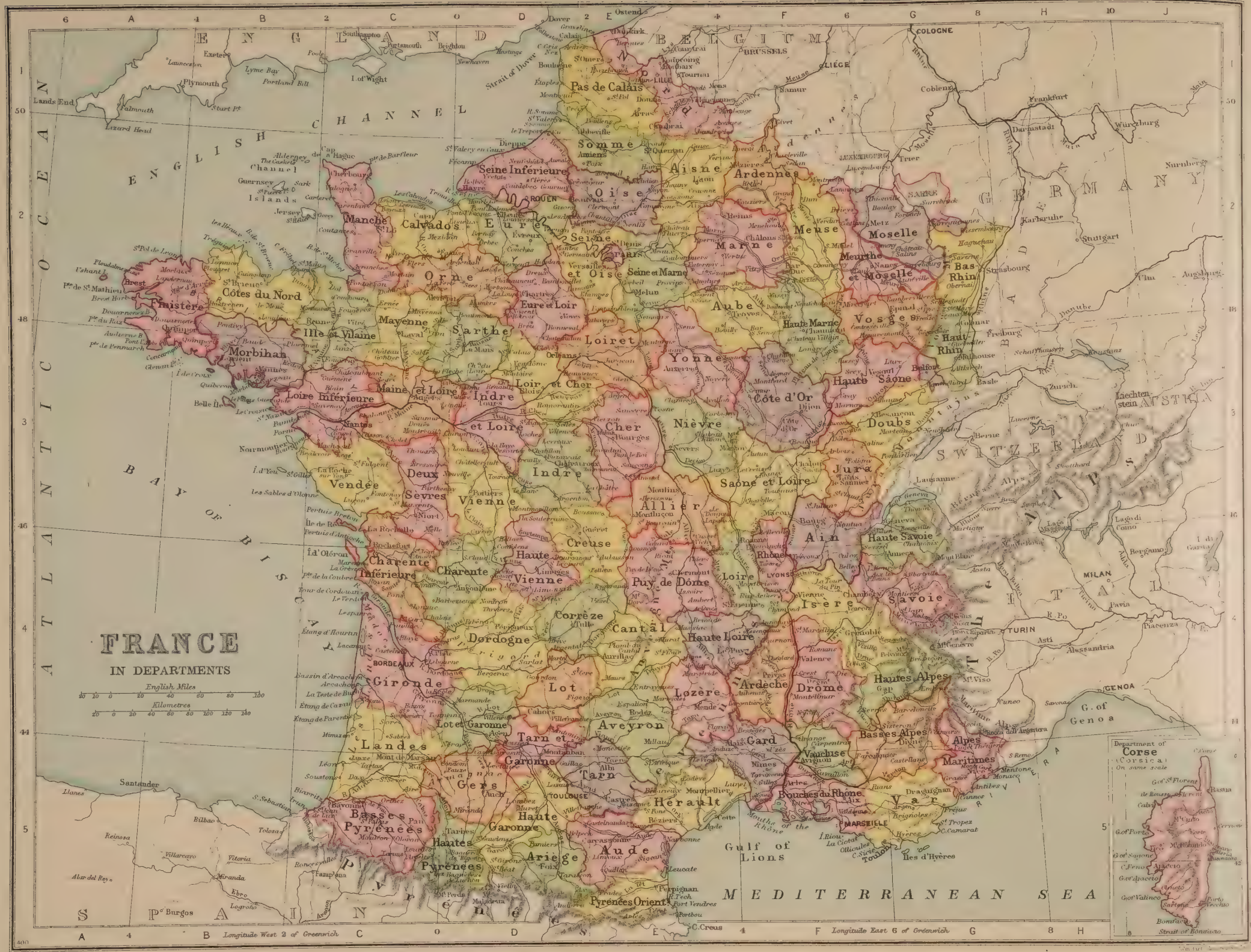

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mark the culminating points of a great central plateau. The climate of France, its vegetation, the distribution of its population, and its very history have been determined by these leading features of its orography.

The Plateau.—The extensive mass of elevated plains which rises between the lowlands of the Mediterranean coast and those sloping towards the Atlantic reaches a height of from 3000 to 4000 feet in its higher central parts only; several chains, partly of volcanic origin, piled over its surface, attain from 5000 to 6000 feet; while the river-valleys are dug so deeply into the plateau that it often assumes a hilly aspect. The whole slopes gently towards the north-west, gradually melting into the lowlands of the Garonne, the Loire, and the Seine, which would be submerged almost entirely if the level of the ocean rose 1000, or even 600 feet. In the latter case the Atlantic coast-line would run from the western Pyrenees towards the Ardennes, with detached islands to represent the highlands of Brittany and Normandy, and to the south of these two broad and deep gulfs, corresponding to what are now the upper drainage areas of the Garonne and the Loire; while the Mediterranean Sea would send into the mainland a long and wide gulf up the valley of the Rhone, with a narrow elongated lake penetrating farther north, and corresponding to what is now the valley of the Saône.

It is easy to grasp at once how such a configuration facilitated the intercourse between the Mediterranean Sea and the Atlantic Ocean. The shores of the Gulf of the Lion, which at an early period of history were dotted with Greek and Roman cities, are separated from the Garonne by only a low watershed, the Seuil-de-Naurouse (636 feet above the sea), which allows easy communication with the Bay of Biscay. Farther north the depression of the Saône, which is a natural continuation of the valley of the Rhone, is connected with the Loire by a valley of so gentle a gradient that it has been utilised for a canal (the Canal du Centre), the highest part of the watershed being but 1000 feet above the sea; and, finally, the same depression of the Saône freely communicates across the lower parts of the plateau with the tributaries of the Seine. The civilisation which developed on the littoral of the Mediterranean thus found three natural passages leading to the Atlantic Ocean and the coasts of the North Sea, without having to contend with any of the natural obstacles opposed elsewhere by the Alps.

While sloping gently towards the north-west, the plateau has a short steep slope towards the valley of the Rhone and the Mediterranean coast, and the southern part of that slope is fringed by the Cévennes Mountains, which raise their granitic and crystalline summits to more than 5000 feet above the sea (chief summit, Mont Lozère, 5584 feet). This lofty chain separates two entirely different worlds—the fertile, sunny, and warm plains of the Lower Rhone and Languedoc from the plains of the Rouergue, dreary, cold, and 3000 feet high, upon which chiefly rye is grown, and flocks of sheep find rich grazing-grounds. Farther north the mountains on the edge of the plateau become much lower. The Monts du Vivarais reach their greatest height in Mont Mézenc (5754 feet), while the Monts du Beaujolais and du Charolais as a rule do not exceed 3300 feet. The sunny slopes of the Monts du Beaujolais, turned towards the Saône, are covered with rich vineyards; while the plateau to the west of them is dotted with ironworks, coal-mines, and manufacturing cities. Still farther north the plateau, which is separated by only the narrow valleys of the Saône and the Doubs from the hills of the Jura, is fringed by the low dome-shaped hills of the Côte-d'Or (2000 feet), which connect it with the Vosges. The upper tributaries of the Seine have their source in the same wet district as those of the Saône, and both rivers are connected by the Burgundy Canal. Finally, the Vosges, although making a steep descent to the valley of the Rhine, rise but gently over the plateau, their highest points being less than 5000 feet above the sea (Ballon de Soultz, 4672 feet). Thick forests still clothe the slopes of the Vosges (and their continuation, the Hart), which are covered with morainic deposits of the glacial period, and their numberless streams are dotted with sawmills and factories.

The plateau reaches its greatest height of from 3300 to 4000 feet in central France—in the Massif Central of Auvergne, which covers fully one-seventh of France's total area, and is a region of granites, gneisses, and crystalline slates fringed by Jurassic deposits, and dotted on its surface with extinct volcanic cones surrounded by wide sheets of lava. The Massif du Cantal, connected by the Margeride chain with the Cévennes, rises nearly 2000 feet above the level of the plateau, reaching 6093 feet above the sea in its highest volcanic cone, the Plomb du Cantal. The Monts Dore, 40 miles north, have the same character; their chief summit, the Puy-de-Sancy (6188 feet), surrounded by several lower volcanic cones, being the highest mountain of central France. Finally, the Monts Dôme, a few miles farther north, consist of some fifty volcanic cones, the highest of which is Puy-de-Dôme (4806 feet). The Limousin and the Marche, to the west of the above, are granitic plateaus hardly reaching 3300 feet above the sea; while the Causses of the Rouergue, in the south, are built up of Jurassic limestones deeply cut into by rivers which flow in beautiful cañons; towards the north-east the Massif Central is continued by the Morvan, and, farther north-east, by the much lower plateaus of western Lorraine and Champagne Pouilleuse, which slope with a very easy gradient towards the plains watered by the Seine. As to the Ardennes (between the Meuse and the Moselle), which have played so important a part in military history as a bulwark against foreign invasions, they are a plateau from 1600 to 2400 feet high, still covered with wide forests, and intersected by marshy depressions, ravines, and fertile valleys. The heights of the Massif Central, suffering as they do from a protracted winter, have but a poor, rapidly-diminishing population. The forests which once covered them have mostly been destroyed, save in the picturesque Margeride chain, and only flocks of sheep graze on their meagre pasture-grounds. The Causses receive rain in abundance, but are exceedingly dry—the water rapidly disappearing in the numberless crevices of the soil. The inhabitants are thus compelled to gather rain-water in cisterns for themselves and their cattle. A few acres, cultivated here and there, bear poor crops of barley, oats, and potatoes; but hundreds of thousands of sheep are kept for the special purpose of making cheese. As a rule the plateau is thinly peopled, save in the mining and industrial regions. Farther north-east, where it is much lower, and where the broad valleys between the wooded hills have a more fertile soil, a denser population gathers in the villages and the towns, and finds the means of existence in agriculture combined with a variety of small industries.

The Jura.—A narrow passage near Belfort (la Trouée de Belfort), utilised by both the canal which connects the Saône with the Rhine and the railway which leads from Paris to Switzerland, separates the Vosges from the limestone plateaus of the Jura (Crêt de la Neige, 5653 feet). The depressions and high valleys between the forest-clad hills shelter a large and laborious population, which

is supported by a combination of agriculture and cattle-breeding with a variety of petty trades.

The Alps.—Since the annexation of Savoy in 1860 the Alps of Savoy, as well as a portion of the main chain, including the northern slopes of the chain of Mont Blanc (15,780 feet), belong to France. The pass of Little St Bernard (7190) separates the latter from the Graian Alps, which have the two passes of Mont Cenis (6883) and Mont Genèvre (6802) leading from France to Italy, and are continued to the south-west by the Oisans group, where immense glaciers rivalling those of Switzerland gather around Mont Pelvoux (13,462). The valley of the Durance separates the Graian Alps from another short parallel chain of the Cottian Alps (Monte Viso, 12,608), while the still lower Maritime Alps descend in terraces to the Mediterranean coast. The cold and snowy slopes of the Alps are but thinly peopled, especially in the dry limestone spurs of the Graian and Cottian Alps. A number of agricultural villages, however, thrive in the lower spurs of the Savoy Alps, and the city of Grenoble is an industrial centre of importance; while Chamouni at the foot of Mont Blanc is one of the chief centres for tourists.

The Pyrenees.—This wild complex of lofty chains extends for a length of 260 miles between the Atlantic Ocean and the Mediterranean Sea. In the east it is built up of three parallel chains running in a north-eastern direction: the Monts Albères, the Sierra del Cadi, which enters France from Spain and has on French territory the lofty peak Mont Canigou (9137 feet), and the chain of south-east Andorra, continued in France by the peak Puy-de-Carlitte (9583). Farther west the Pyrenees proper consist of parallel chains of wildest aspect, running west-north-west and disposed in *échelons*. Here we find the highest peaks: Néthou (11,168) in the Maladetta chain, Posets and Mont Perdu (11,000) are in Spain, but Vignemale (10,820) on the frontier is French, with other giants of over 10,000 feet. Wide *cirques*, which formerly were filled with *névés* and gave origin to vast glaciers, and arid mountains intersected by narrow and dark valleys are characteristic of that part of the Pyrenees; but the Pyrenean glaciers of our own time are much inferior to those of the Alps, and none descends lower than 7260 feet. The Pass of Roncevaux (Roncesvalles, 40 miles from the Atlantic coast), which has been the route of so many migrations, separates the Pyrenees proper from a series of much lower spurs of the Spanish coast-ridges, which, like the Mediterranean coast-ridges, also have a north-eastern direction. The passes across the Pyrenees proper are very few, very high, and difficult. The Pass of Roncevaux in the west and in the east those of La Perche and (16 miles only from the Mediterranean) Perthus lead through longitudinal valleys of the chains running north-east which enclose the Pyrenees at both ends. Of the passes through the Pyrenees proper none is lower than 5400 feet. The railways connecting France with Spain have consequently been compelled to follow the very coasts of the Atlantic Ocean and the Mediterranean, but the Central Pyrenees are to be pierced and crossed by lines up the Ariège, Salat, and Aspe valleys. A plateau, from 1600 to 2000 feet high (Lannemezan), spreads out at the northern foot of the Pyrenees. Owing to its limestone soil it is exceedingly dry, and its grazing-lands have had to be irrigated with water derived from the Neste River.

Plains and Rivers.—The whole of north-western France, with the exception of a few hilly tracts in La Vendée, Brittany, and Normandy, is occupied by wide plains which constitute the real wealth of her territory. Taking them in order from the south-west, we have first the Landes—a wide triangular space between the Bay of Biscay, the Adour, and the Loire, covered with Pliocene sands, which would be an immense marshy fever-den, bordered by shifting sands on the sea-coast, if it were not intersected by canals, and the sands were not fixed by plantations of trees. The thick growths of bushes which cover the plain are utilised as grazing-grounds for flocks of sheep, the shepherds formerly being compelled to mount upon stilts when watching their flocks. Some of the ponds—formerly bays, now separated by sand-dunes from the ocean—are valuable fishing-grounds. The Adour (187 miles long), which fringes the Landes and receives a number of tributaries (*gaves*) from the chalky plateau of Lannemezan, has but few important cities on its course—Bayonne being the chief of them. The Garonne (346 miles), which rises in Spain, and receives the Tarn and the Aveyron from the very depths of the Massif Central, is a most important channel for navigation. But the torrential rains which pour over its drainage area of 22,080 sq. m. do not always find an easy outlet in its channel, and floods are not unfrequent. The Dordogne (305 miles), which rises in the Mont Dore, has most of its course dug into the plateau. Beautiful vineyards cover the slopes of its valley, while lower down the raising of iron ore and the quarrying of grinding-stones, as also the industry of truffle-hunting in Périgord, become a source of prosperity; the old city of Périgueux is an important centre of manufactures. The Dordogne and the Garonne join to form the Gironde, which is a true marine estuary, with the left bank bordered by the low hills of Médoc, covered with vineyards yielding every year vast quantities of the finest red Bordeaux wines. The great port of Bordeaux, on the Garonne, is some 15 miles above the head of the estuary of the Gironde.

The monotony of the rich plains between the Gironde and the Loire, which include the old province of Poitou, is broken by the dreary hills of the Gâtine, a link between the chains of Margeride and Limousin and the hilly tracts of Brittany. The southern parts of the plains on the right bank of the Gironde—the Saintonge (watered by the Charente)—are among the richest districts of France. Farther north the Bocage closely reminds one of England by its meadows enclosed within rows of trees, while Le Marais, on the coasts of the Gulf of Poitou, which has the two islands of Ré and Oléron protecting the entrance to Rochefort, resembles the *polders* of the Netherlands.

Next we have the immense plains watered by the Loire, which becomes a great river after receiving the Allier, and has a drainage area covering more than one-fifth of the entire area of France (46,750 sq. m.), and a total length of 670 miles. This longest river of France rises on the plateau not far to the west of the middle of the Rhone's lower course, and describes a wide curve towards the north, approaching within 70 miles of Paris at the head of the bend at Orleans. It enters the Atlantic Ocean by a wide estuary, pouring out of its broad channel into the sea a vast or meagre volume of water in time of flood or drought. The regions along its middle course are the real heart of France. As it issues from the valleys of the plateau it waters the Sologne, formerly the chief rye-producing region; the Berry, to the south of the Sologne, a chalky plain from 350 to 700 feet high, interspersed with numerous ponds and with rich pasture-grounds; and Beauce, situated between Paris, Orleans, and Tours, quite flat and covered with cornfields and meadows. The Gâtinais, to the east of Beauce, spreads between the two great forests of middle France—the Forêt d'Orléans (which covers 84,600 acres) and the Forêt de Fontainebleau (41,700). Farther down

its course the Loire enters the lowlands of Touraine and Anjou, which are literally covered with cornfields, gardens, and vineyards, while the cities of Tours, Saumur, and Angers are centres of manufacturing industry. The beautiful meadows, cornfields, and gardens continue as far as Nantes, where the Loire enters its estuary. With the deepening of the river channel Nantes is regaining its maritime importance, vying with its *avant-port*, St Nazaire, and is, too, a busy manufacturing town.

The peninsula of Brittany is formed by two ridges of granitic hills, from 1000 to 1200 feet high, separated by a region of crystalline slates. Its scenery and moist climate, as well as those of the Cotentin peninsula, again remind one of England, with the meadows and fields fringed by trees, and the ivy-covered houses. Cattle-breeding on a large scale, poultry-farming, fruit-gardening, agriculture, and fishing are the chief riches of Brittany, as of Normandy, a land famed for its cider. The plateaus of Normandy and Maine, which rise from 1000 to 1300 feet above the surrounding plains, are covered with meadows, cornfields, and forests. The Seine separates them from the Cretaceous chalky plains of the Caux, which raise their cliffs over the Channel, and are deeply cleft by fertile valleys.

The Seine (485 miles), which rises in the hills of Morvan, and drains with its tributaries (chiefly on the right bank) an area of 30,030 sq. m., certainly is behind the Loire in length, volume, and size of drainage basin, but is far superior for navigation purposes. The wide Tertiary basin which it and its tributaries water has from remote antiquity been the dominant portion of historical France. Numerous large cities, like Auxerre, Sens, Troyes, Châlons, Reims, Laon, Rouen, which all took such an important part in the making up of France—and especially Paris, which acquired its importance owing to its most advantageous position at the intersection of all the chief routes crossing France—are situated either on the Seine, or on its right-bank tributaries which water the fertile plains of Champagne. Le Havre is the great port at the mouth of the river.

Artois and French Flanders are low tracts of land to some extent conquered from the sea. Their flourishing agriculture, vast coal-fields, and the great industry of their chief cities (Amiens, Lille, Roubaix) suffered sadly in the European War.

At the other extremity of the republic the lowlands of the south occupy the sea-coast and the broad valley of the Rhone, along which they extend between the Alps and the plateau, as far north as Lyons, to be continued farther north by the valley of the Saône.

The Rhone (507 miles) has its source in the glaciers of the St Gothard group, and of its 38,180 sq. m. drainage area—densely inhabited around Lyons—nearly one-tenth belongs to Switzerland. Below the Lake of Geneva its course is still in the mountains, and it is not far from its junction with the Saône at Lyons that it enters the plain of Dauphiné, dotted with numerous industrial cities. At Lyons the Rhone at once changes its westerly course, to flow rapidly due south in a rich valley, the slopes of which are covered with vineyards. Below Avignon the valley suddenly assumes a decidedly southern character, not unlike the driest parts of Sicily and Greece. The Isère, which rises in the Graian Alps, the Durance, which flows from the Cottian Alps, and a number of smaller streams rushing from the Cévennes join the Rhone, which bifurcates at Arles, leaving the marshy delta of the Camargue between its two main branches, and the gravelly plain of the Crau to the left. The tides being insignificant, the mouth of the Rhone is rapidly obstructed by mud and sand. A canal permits ships to enter the river at Port St Louis, and another canal now connects the Rhone with Marseilles.

The littoral of Provence has no great fertility, and, except the stony or marshy plains in the neighbourhood of the Rhone, there is but a narrow strip of land left between the mountains and the sea-coast, which is utilised for vineyards and fruit-gardens; but the remarkably well-sheltered harbours of Marseilles (q.v.), Toulon, Hyères, and St Tropez give birth to a considerable maritime commerce; and Marseilles is the chief port of France for intercourse with the South and East. The eastern part of the coast, acquired from Italy in 1860, is well known for its mild climate and rich vegetation, which render Nice, Villefranche, Cannes, and Mentone the chief resort of the invalids of Europe. As to the western part of the Mediterranean coast—Languedoc—with its cities Montpellier (and its seaport Cette), Carcassonne, Perpignan, Béziers, and Narbonne, its vineyards supply France with abundance of *vin ordinaire*. Finally, the Roussillon, which comprises the eastern outspurs of the Pyrenees, partakes of the character of the Iberian peninsula, especially of Catalonia.

Climate.—France enjoys on the whole a very fine climate; not so continental as that of central Europe, and not so maritime as that of England. Apart from the lofty tracts of the Alps and Pyrenees, the coldest region of France is evidently that of the high plateau with its severe winters, though it has hot summer days. The north-eastern part of the country (Champagne, Alsace, Lorraine, the Vosges) has a continental climate much like that of central Europe. Frosts are recorded there from seventy to ninety days per year, but the amount of snow is seldom considerable in the plains. The Paris basin has a climate transitional between the above and that of the sea-coasts. The mean temperature in December and January is not lower than 37° F.; the spring is beautiful, and excessive heat does not last long during the summer. The annual rainfall is but 21 inches (the average for France is 31·5 inches), and, though it rains on 175 days in the year, the rains usually are of short duration. The climate of Brittany is very much like that of the south-west of England; that of the plains on the Bay of Biscay is warm and dry, and Pau, on the slopes of the Pyrenees, has the deserved reputation of a sanitary station. The region about Lyons has an intermediate, rather wet climate, with cold winter and hot but humid summer; while the climate of Languedoc and Provence assumes to some extent an African character—a mild winter is succeeded by a burning hot, dry summer, moderated from time to time by the *mistral*, which blows violently from the Cévennes, throwing back to the sea the moistness which otherwise might result in rain, so that Marseilles has but fifty-five rainy days during the year. Brest, with a mean of over 44° in winter, and under 65° in summer, has the least seasonal variation of temperature in France. (The corresponding figures for Nancy in the north-east are 34° and 68°; for Perpignan in the south, 45° and 75°.)

Population, Occupations, National Character.—For origins of the French nation and the elements that compose the French population—Celtic Gauls, Belgæ, Aquitanians or Iberians, Romans, Franks and other Germanic tribes, and Normans—see the section below on the history of France, and the separate articles, such as BELGÆ, CELTS, FRANKS, &c. For the dominant language of France, see the section on French Language and Literature. For the Provençal language of the south of France, see that head. In Finistère, Morbihan, and Côtes-du-Nord the Celtic Breton is still the mother-

tongue of 1,200,000 persons, most of whom also speak French (see BRITTANY); and in the south-west the peculiar Basque language is used by 140,000 persons in two arrondissements of the Basses-Pyrénées (see BASQUES). Flemish is spoken by some 150,000 people in French Flanders; the Walloons (q.v.) have their own romance dialect in the north-east of France; and a Germanic patois is spoken in parts of Alsace and Lorraine. As to the national character, it is the sum of so many individual, provincial, and political varieties that a general judgment cannot be pronounced too cautiously. So much, however, can be said, that, like its territory, the French people is a natural transition between the inhabitants of southern Europe and those of the north. It combines the impressionability, the vivacity, the rapidity of conception, and the artistic feeling of the men of the south with the persistence, laboriousness, and rationalism of the men of the north. The sociability of the French has become proverbial.

In 1921 the population of France was 39,209,766, as compared with 39,601,509 in 1911. In the hostilities of 1914–18 France lost 1,354,000 men, and the excess of deaths over births among the civil population was even greater. But for the recovery of Alsace-Lorraine with 1,709,700 inhabitants, the inter-censal decline (1911–21) would have been over 2 millions, as against a gain of 640,000 in 1901–11. In 1866—before the Franco-Prussian war—the population was 38,067,000, so that in half a century the total crept up by little over a million, whereas it jumped from some 20 millions in 1700 to 27½ millions in 1800, and to 35,800,000 in 1851. The main cause of the practically stationary condition of the population for two generations has been the low birth-rate, which, after declining from 31 per thousand in 1800 to 26 in 1860, fell to 20 in 1900. In 1906–10 the birth-rate was 19 per thousand; the death-rate was the same (as against 24 in 1860, 28 in 1800). Of 11,697,000 families in 1911, 3,011,000 had but one child, 2,558,000 only two children, and 1,687,000 none at all. The restriction of births is most pronounced in the agricultural regions of Burgundy, Normandy, Aquitaine, least evident in the industrial centres, fishing communities, and in Savoy.

Emigration (chiefly to Algeria, U.S.A., and Argentine) is trifling—*c.* 7000 per annum in 1850–1900. Immigration, however, is considerable. In 1921 foreigners in France (mostly Italians, Belgians, Spaniards, and Swiss) numbered 1,550,000—half a million more than in 1901. Migration from country to town has marked the steady growth of industries since the coming of railways. The urban dwellers, who represented only a quarter of the entire population in 1850, accounted for about half the total by 1921. Thus while the population altered little in density in 50 years (184 per square mile in 1921), in distribution it has changed radically. The principal concentrations are in the industrial areas of the north and north-east, on the coasts of Brittany and Normandy, and round the three leading cities. Paris (2,906,000), Marseilles (586,000), and Lyons (562,000) contain over a tenth of the whole population. A dozen other towns—Bordeaux (267,000), Lille (201,000), Nantes, Toulouse, St Étienne, Strasbourg, Le Havre, Nice, Rouen, Roubaix, Nancy, Toulon—have each over 100,000 inhabitants; and there were thirty-three towns in 1921 with from 50,000 to 100,000. The sparsest areas are in the mountainous regions of the Alps, Pyrenees, Massif Central (Lozère, Cantal) and Corsica, the marshy Landes, the barren Crau and the arid Champagne Pouilleuse.

In 1911 fully 56 per cent. of the French people were classed as rural—as compared with 22 per cent. in England. Of an active population of 20,931,000 (including 7,719,000 women) enumerated in 1911, agriculture and forestry claimed 8,517,000, manufacturing industries 5,746,000, and commerce 2,053,000; transport 1,543,000, public service (army included) 1,292,000, domestic service 929,000, liberal professions 550,000, and mines and quarries 246,000.

Agriculture.—France is still pre-eminently an agricultural country. Half the nation is on the land and supplies the other half with most of its alimentary needs. Exports and imports are not the gauges of national prosperity, as in Britain; the home market is the absorbing concern of the French farmer, as it has been hitherto of the French manufacturer; luxuries—wines and *primeurs*, silks and automobiles—may be sent abroad, but the country uses itself the overwhelming mass of what it produces, normally being self-supplying to a surprising extent.

The system of small holdings, so typical of France, encourages 'Jacques Bonhomme' to work his hardest. Some 3 million people possess or cultivate tiny patches of ground or farms up to 25 acres in extent. Many peasants do not own the land they till, but are *fermiers* (tenant farmers) or *métayers* (who surrender, in lieu of rent, a proportion of the produce to the proprietor); and many are day labourers. An official inquiry made in 1908 showed that in most departments the number of small proprietors was increasing, and since the end of the European War numbers of *métayers* and *fermiers* have been able to purchase the farms they worked. The peasant may be conservative and primitive in many of his ways, but by his patient toil and sheer attachment to the soil he has made the rocky slopes of the Alps and Pyrenees, the swamps and stony deserts of the plains, yield him a livelihood where it seemed impossible for human beings to subsist. Since the Revolution and the breaking up of big estates, private enterprise and state aid have collaborated to raise the value of land; from an average of £8 per acre in 1789 it rose during the 19th century to £27. By chemical and natural manures arable land was improved and crops were doubled or trebled; marshes were drained and made habitable, as in the Landes, the Camargue, the Sologne; territory was won back from encroaching sea and sand; dry stony wastes, as in the Crau, were warped and irrigated into fruitfulness. Crises came and were overcome—phylloxera in the 80's and the slump in wine prices in the Midi at the beginning of the 20th century; the competition of grain from North and South America, which led to the introduction in 1892 of protective duties. The Great War, which called the labourer from the harvest-field to the battlefield, and fed the soil of France with hundreds of thousands of its devoted husbandmen, laid waste great areas of the richest agricultural country, maimed and ruined thousands of peasants, and forced the republic to import huge quantities of grain, sugar, and other foodstuffs.

The following table shows the distribution of French territory before and after the War:

	1911, Acres.	1920, Acres.
Agricultural and Pastoral Land	98,200,000	99,000,000
Forests	24,700,000	25,500,000
Moor and Uncultivated	9,500,000	11,500,000
Total area	132,400,000	136,000,000

The recovery of Alsace-Lorraine added 3,600,000 acres to French territory and made available as fertilisers great deposits of potash; yet the arable land fell from over 59 million acres in 1911 to under 56 millions in 1920, while 2 million acres were added to the uncultivated area. Even then the percentage of land under crops and pasturage

(72·8 of the entire country) is remarkably high. Over two-fifths of French soil is subject to the plough; forests cover nearly 19 per cent., and moor and waste 8·5 of the whole territory.

Crops.—Wheat is the chief grain crop. One-tenth of all France—a land of great white-bread eaters—is given over to wheat. Its ubiquity, however, keeps the average yield comparatively low—19 bushels per acre, as against 30 to 35 in the United Kingdom. The north shows the best results. Oats, like wheat, are grown everywhere. Rye has greatly dwindled since 1840, but persists in the Massif Central and Brittany. The area and produce of the chief crops in 1920 are shown below:

	Acres.	Metric Tons.
Wheat	12,582,000	6,448,000
Oats	8,474,000	4,230,000
Rye	2,146,000	876,000
Barley	1,640,000	836,000
Maize	847,000	387,000
Buckwheat	870,000	370,000
Potatoes	3,560,000	1,164,000

Beet-root for sugar and distillation covered 600,000 acres before 1914, but two-thirds of the sugar factories in the north were destroyed in the War, and in 1920 the acreage was only 300,000, and the yield under 3 million metric tons. Flax, which claimed 247,000 acres in 1850, dropped to 70,000 in sixty years. Hemp (in Maine, Anjou, and Brittany) is also disappearing. Hops are grown for beer in the Nord, Côte-d'Or, and Alsace. In certain departments (Dordogne, Lot-et-Garonne, Gironde especially) tobacco, a state monopoly, is authorised (25,000 metric tons before the War). Market-gardening is carried to a fine art, particularly around Paris, in the Midi, Brittany, Anjou, and Picardy. Fruit-growing is widespread, and varies with the climate: apples, pears, and cherries in Normandy and Brittany; peaches, apricots, figs, oranges, lemons, almonds, olives in the south; plums in the Vosges; prunes in Lot-et-Garonne. The central plateau has chestnuts; Dordogne produces walnuts also; Périgord is famed for truffles; Nice and Grasse for flowers.

Viticulture ranks next to wheat-growing in importance, France being the chief wine-producing country in the world. The viticulturists number over 1,500,000; their vineyards extend to nearly 4 million acres; and the yield in 1920 exceeded 1300 million gallons of wine. The Midi—Hérault, Aude, Gard, &c.—accounted for nearly half the quantity (*vin ordinaire*). Bordeaux, Burgundy, Champagne provide *vins de choix*. Only the north-western strip (part of Brittany, Normandy, Picardy, Artois, Flanders) grows no vines. The industry, which is of ancient date, established a record in 1875 with 6,300,000 acres of vines and over 1800 million gallons of wine. Phylloxera and other diseases reduced production in the next decade to a quarter of that total. Replanting with American phylloxera-resisting stocks saved the industry; the average yield was improved, and gradually production approached former figures. Whereas in 1873 fully 88 million gallons of wine were exported, and under 14½ millions imported, in 1920 exports totalled 28 million gallons (worth over 500 million francs), and imports 117 million gallons (valued at under 600 million francs). France imports cheap wine from Algeria, Spain, and Italy, and exports choice wines. Brandy is distilled from wine in many districts—5 million gallons in 1920; the Cognac (q.v.) of the Charentes is world-famed; Armagnac eau-de-vie, produced in Gers and round about, is not so strong. American prohibition, collapse of the German, Russian, and other markets, and high British excise duties told on the wine-grower after the War. See VINE, WINE, BRANDY.

Cider (q.v.) and perry take the place of wine in Normandy, Brittany, and Maine. In good years, like 1913 and 1915, from 600 to 700 million gallons have been produced in France, the north-west contributing over two-thirds.

Live-stock.—The numbers of farm animals before and after the European War were:

	1913.	1920.
Horses	3,231,000	2,635,000
Mules	193,000	181,000
Asses	360,000	298,000
Cattle	14,807,000	13,217,000
Sheep	16,213,000	9,406,000
Pigs	7,048,000	4,942,000
Goats	1,453,000	1,341,000

Thus, despite the addition of Alsace-Lorraine, the totals two years after the armistice were in every case still well below the figures for 1913, when the pastoral industries were flourishing and France was exporting horses, cattle, and pigs. Horses are reared especially in the west, among the best-known breeds being the Percheron—sturdy, but far from slow; the heavy draught Boulonnais, the cross-bred Anglo-Norman, and the little Tarbes steed with Arab blood. Poitou is noted for donkeys and mules. Cattle find good pasturage throughout the north-west, in the Auvergne plateau, Burgundy, Jura, among other parts. The chief race is the Norman, both its milk and its meat being excellent. Among draught oxen the white Charolais is in high repute. The dairy industry is most developed in Normandy, Brittany, and the north. Cheese, a *sine qua non* in France, is of infinite variety. Camembert (Normandy), Gruyère (Jura), and delicate Brie are made from cow's milk; Roquefort from ewe's milk (west of the Cévennes and from Corsica). See CHEESE. Unlike cattle, sheep fell in numbers during last century, foreign competition being too strong. The flocks in 1840 were almost double the 1913 total. The best mutton—*pré salé*—comes from the coast of Brittany and Poitou. The largest flocks are in the centre, south, and west, where the pasturage is inadequate for bigger stock, and the climate not too cold and damp—Cévennes, Corsica, Basses-Pyrénées, Aveyron, Bouches-du-Rhône, Berry, and Champagne.

Forests.—Forests and woods extended over 10,328,000 hectares in 1920 (about a third belonging to the state or local authorities), Alsace-Lorraine having added 440,000 hectares. The public forests are subject to a provident régime; but reckless cutting, disastrous fires, and the wholesale destruction and demands of war have made great gaps in many forested regions, and 550,000 hectares were rendered unproductive for years. The greatest forests are in the departments of Landes (516,000 hectares) and Gironde (462,000 hectares), where a wilderness of sand and stagnant pools has been transformed by drainage and pine plantations. The Ardennes, Argonne, and Vosges forests were in the war zone. Round Paris are the fine forests of Fontainebleau, Rambouillet, Orléans, &c. Many slopes of the Alps, Jura, and Pyrenees are pine-clad, and there are large forest areas between Toulon and Cannes (Monts des Maures and Esterel), in the Morvan (Côte-d'Or, Nièvre, &c.), and Dordogne (chestnuts). Mulberries are grown in the lower Rhone valley, where some 50,000 sericiculturists (90,000 in 1913) rear silkworms, producing 2000 to 3000 metric tons of cocoons. See FORESTRY.

Mining.—Before the War of 1914–18 France was relatively poor in minerals. Two-thirds of the country's coal and nine-tenths of its iron were produced in the area overrun by the Germans, and the invaders temporarily or permanently put out of service many mines and works. In the centre and other regions the metallurgical industry was, however, greatly stimulated; the restoration of Alsace-Lorraine made France the leading iron-producing country in Europe; and fuel difficulties were met by the exploitation of the Saar coal-mines (see

Saar), and by the rapid development of hydro-electric power. The production of coal in 1913 was 40 million metric tons, and the consumption over 60 million. The Nord and Pas-de-Calais mines contributed two-thirds of the production. Other coal-fields are in the Loire (St Étienne), Saône-et-Loire (Blanzy), Gard (Alais), Tarn, and Aveyron departments; in Bouches-du-Rhône lignite is worked. Between 1873 and 1913 the production of iron ore was raised from 3 to 22 million tons, all but 2 millions from Meurthe-et-Moselle (Briey, Longwy, Nancy). The rest of Lorraine, lost to France in 1871–1918, gave in 1913 over 21 million tons, so that its recovery instantly doubled the iron resources of the republic, and opened up great possibilities for the metallurgical industry (given an adequate supply of fuel). Lorraine ore yields 33 to 40 per cent. of iron; rich deposits, exploited since 1900 in Normandy, Brittany, and Anjou, yield 40 to 60 per cent.; and 'pure' mineral has long been worked in the Pyrenees.

There are valuable antimony mines in Vendée, and aluminium is extracted from the bauxite plentiful in Provence. Small quantities of gold, silver, zinc, lead, copper, manganese, and wolfram are obtained. France is rich in building materials (stone, gravel, slate, cement), witness her cities and roads. Asphalt, bituminous schists, petrol (Alsace), graphite (Hautes-Alpes), and kaolin are also worked. Rock-salt is exploited in Lorraine and elsewhere, and sea-salt in the marshes of the Midi. The unrivalled potash beds (discovered in 1904) in Alsace are invaluable alike to the chemical and agricultural industries. Mineral springs of great variety and fame abound—at Aix-les-Bains, Vichy, Évian and other resorts.

Manufactures.—Industrial development was later and slower in asserting itself than in England, handicaps being shortage of labour and fuel, dearness of machinery and transport. The War of 1914–18, which played havoc with France's main industrial areas, the north and north-east, led to the establishment of new industries (chemical, for instance), and the extension of old ones (especially metallurgy), the expansion of other industrial centres in the heart of the country, and the exploitation of vast resources of neglected water-power; and it gave valuable lessons in mass production and combination. French manufactures, as a rule, have been noted abroad for their artistic taste, novelty, and skilled workmanship, their quality rather than their quantity. The chief industry in France is the manufacture of *textiles*—silks, cotton, wool, linen—which before the War gave employment to about a million workers. Lyons (q.v.) is the centre of the silk industry, but hand-looms in the city itself have given way to power-looms in factories scattered over the Rhône, Isère, and adjoining departments. St Étienne specialises in silk ribbon. Artificial silk is made at Besançon and elsewhere. In 1913, an exceptionally good year, France imported 7½ million kilos of raw silk (from Japan, China, Italy, &c.), and herself produced half a million; she exported silk and silk thread to the value of over £25,000,000 (Britain taking more than a third), and kept £10,000,000 worth for the home market. See Silk.

Before the War France imported 330,000 metric tons of raw cotton, and, with over 7½ million spindles and 167,000 hands, exported 64,000 tons of cotton material and thread. Most of the cotton spinning and weaving towns (Lille, Amiens, Roubaix, St Quentin, among others) were in the invaded area, and the industry suffered accordingly. The restoration of Alsace made the Vosges region the principal centre, others being Rouen and Roanne. See Cotton.

The flourishing wool industry quartered in the north (Roubaix, Tourcoing, Fourmies, Avesnes, Cambrai, Reims, &c.) was almost wiped out during hostilities. In 1913, over 268,000 metric tons of wool were imported from Australia, Argentine, and other countries, and added to 35,000 tons of French wool; and 38,000 tons of woollen manufactures were exported. The destruction and stripping of the wool factories in the north gave an impetus to those in Normandy (Elbeuf, Louviers), Languedoc (Mazamet, Castres), Vienne, and round Lyons. Alsace added half a million spindles to the three millions already engaged in wool-spinning. See Wool.

Linen was made at Lille, Cambrai, Armentières, and other parts of the invaded area, mostly from Russian flax, and the industry was therefore very severely hit by the War, the more so as over half the home-grown flax came from the Lys region. Spindles, which numbered 570,000 in 1913, were reduced to one-tenth of that number by 1918. Other industries of the kind are hemp (rope-walks at Angers), jute (Dunkirk), and lace (Caudry, Calais, Le Puy, Luxeuil, Alençon, &c.).

Notwithstanding the destruction of furnaces in the devastated north and north-east, France after the War had over 100,000 men employed in *iron and steel* foundries, and the annual output of cast-iron and steel by 1920–21 was two-thirds of the 1913 totals of 5,207,000 and 4,687,000 metric tons respectively. The foundries are mostly situated beside the Lorraine iron mines, and where coal or water-power is available—in the Nord, St Étienne (Loire), and Le Creusot (Saône-et-Loire), Dauphiné, and Savoy. Alpine streams are also harnessed for the extraction of aluminium, of which France is one of the leading producers. The electrical industry (dynamos, electric fittings, telephones, &c.) has advanced rapidly during the present century. Subsidiary industries of ever-growing importance are the manufacture of automobiles (over 500 factories, 100,000 hands, and 50,000 cars in 1913), and aeroplane-building.

The chemical industry in all its branches—from picric acid to perfumery—was suddenly stimulated when the War cut off German supplies and created an unprecedented demand for explosives, &c. This industry has greatly profited by the development of hydro-electric power in the Alps, Pyrenees, and Rhone valley. Lyons (artificial dyes) and Marseilles (sulphur, soap) are among the chemical centres. Alimentary industries—besides those already mentioned under agriculture—include macaroni and farinaceous pastes, biscuits, chocolate, coffee, confectionery, olive oil, and liqueurs. Among a host of secondary manufactures may be mentioned clothing and underclothing (Paris fashions), furs, gloves (Grenoble); paper, rubber, glass, porcelain (Limoges, Sèvres), clocks, jewellery, carpets, fans, feathers, and *articles de Paris*.

Fisheries.—Both the deep sea and coast fisheries are valuable, the principal catches being cod (Newfoundland and Iceland), herring and mackerel (North Sea and coast), sardines and tunny (coast). In 1913 there were 28,000 fishing-boats and 160,000 fishermen; the War halved these figures, but recovery was rapid after 1918, sails giving way to steam and motors. The chief fishery port is Boulogne; others are St Malo (for Newfoundland), La Rochelle, Fécamp (cod and herring), Arcachon (oysters), Douarnenez and adjacent Breton coast towns (sardines). See Fisheries.

Merchant Shipping.—Thanks to new construction, purchases, and taking over of ex-enemy ships, the mercantile marine quickly made good war losses of over a million tons and, with a gross tonnage of 3,300,000 tons in 1922 (as compared with under 2,000,000 in 1914), ranked next to Britain in European steam shipping. (The tonnage of sailing ships was over 500,000.) This still left room for

great expansion, as over 70 per cent. of the 35½ million tons entered and of the 26¾ millions cleared at French ports in 1922 was under the British or other foreign flag. The lack of bulky exports for outward cargo has long hampered French shipping. The leading commercial ports are Marseilles, Le Havre, Rouen, and Bordeaux; Cherbourg and Boulogne are the outstanding passenger ports.

Foreign Trade.—France's *commerce extérieur* is, according to British standards, small, considering her internal trade, wealth, and population. Between 1870 and 1900 it stagnated, imports (for home consumption) totalling from £150,000,000 to £200,000,000 per annum, and exports (of home origin) seldom reaching the former figure. A high protective tariff was introduced in 1892. The 20th century witnessed a marked improvement, and by 1913 imports reached 336 millions, exports 275 millions sterling. The War naturally inflated imports and restricted exports. In 1915–20 imports averaged 28 milliards (i.e. 28,000 millions) of francs, and exports only 10 milliards. By 1921, however, allowance being made for depreciation of the franc, the values of French imports (23½ milliards) and exports (21½ milliards) were approaching the 1913 standard. In 1913 the tonnage of imports was 44 million metric tons, of exports 22 millions; in 1921 the corresponding figures were 38 millions and 16 millions. The chief exports are mostly manufactured articles—silks, cottons, woollens, clothing, automobiles, chemicals, and wines. Imports are mainly raw materials and foodstuffs—wool, cotton, silk, coal, oil seeds, skins, timber, petroleum, rubber, copper, machinery, cereals, wines, and coffee. Britain, U.S.A., Belgium, Germany, and Switzerland are, with the French colonies, France's principal customers and sources of supply. The United Kingdom has long been the foremost participator in French foreign trade, *inter alia* selling coal, machinery, metals, woollens, cotton yarn, and buying silk, gloves and clothing, woollen goods, wine, motor-cars. Our exports to and imports from France in 1922 both totalled about 48½ millions sterling.

Communications.—French highways are particularly good, road material being plentiful and geographical conditions favourable. *Routes nationales* of remarkable straightness (over 24,000 miles in length) link Paris, the chief centres, and the frontiers. The state maintains them. About 337,000 miles of district roads are controlled by local authorities. Apart from the state railway (including the old Ouest line), the railways are privately owned; the great companies, whose concessions expire in 1950–60, are the Paris-Lyon-Méditerrannée or P.L.M. (the biggest), Orléans, Est, Nord (the richest), Midi, and Alsace-Lorraine; these seven systems total over 25,000 miles. About 7000 miles of inland waterways are utilised; the navigable rivers—Seine, Loire, Saône, Rhone, Rhine, &c.—are joined by canals, as are the Mediterranean and Atlantic; the canal system of the north and north-east is the most highly developed. Air lines connect Paris with London and other capitals, and France with Algeria.—See RAILWAYS, CANALS.

Government and Administration.—Since the overthrow of Napoleon III. on 4th September 1870 France has been under a republican form of government, sanctioned in February 1875 by a constitutional law, which has undergone since but slight modifications. The present constitution remains a mixture of monarchical and republican institutions, and it has steadily maintained its strong and long-established centralisation.

The Revolution abolished the thirty-three *gouvernements* which corresponded in the main with the old provinces of France, and substituted therefor divisions known as *départements*. These take their names generally from some local river or mountain range, their boundaries being largely artificial; more uniform and manageable in size, and making for national unification, they have yet failed to obliterate provincial traditions. There are 89 such departments (86 in 1871–1918) besides the Territory of Belfort; they are subdivided (1921) into 385 *arrondissements*, 3019 *cantons*, and 37,963 *communes*. Over each department the president appoints a *préfet*, over each arrondissement a *sous-préfet*. The prefects are powerful political agents and administrative officers. They represent the government generally within their departments, see to the execution of laws and decrees, exercise surveillance over local authorities and public servants, appoint teachers and many minor functionaries, through their subordinates influence the elections, and in many capacities serve the central power which nominates—and may at pleasure cashier—them. Each department has (besides a consultative nominated *conseil de préfecture*) a general council (*conseil général*), a deliberative body, with at least one member per canton, elected for six years. The general council votes the local budget, levies departmental taxes, and has charge of local roads, public buildings, health and charitable institutions. *Conseils d'arrondissement* are likewise elected by manhood suffrage, but are of little importance. The cantons have no councils of their own, and are merely territorial subdivisions for electoral, judicial, military, and other administrative purposes. The communes (or parishes) range in size from a score of acres to over 300,000 (Arles), in population from 30 to nearly 3,000,000 (Paris); more than half have less than 500 inhabitants. Each elects a *conseil municipal*, which chooses a mayor; he is the mouthpiece of the commune, and also the local agent of the state, which can suspend or dismiss him. Decentralisation is more restricted in the largest cities. Thus Paris has no elected mayor; each of its 20 arrondissements has a government nominee as mayor; police matters are under control of a Préfet de Police; other municipal matters are subject to the Préfet de la Seine—which department extends beyond the city. Both prefects are appointed by government.

Parliament consists of a Chamber of Deputies and a Senate. These unite in *Congrès* every seven years to elect a President of the Republic, whose powers are very wide. As head of the executive he signs treaties, declares war, promulgates laws passed by both houses, appoints functionaries and, with the Senate's consent, can dissolve the Chamber. He chooses the Président du Conseil or Premier, who, with his ministry, is responsible before parliament. The Chamber of Deputies meets in the Palais Bourbon, and consists of 584 members (including 6 for Algeria and 10 for the colonies). Aged 25 or over, these are elected for four years by manhood suffrage, in the proportion of one deputy per 75,000 inhabitants. Every male citizen of 21 or more has a vote, unless serving in the army. A law of 1919 combined proportional representation with relics of the old majority system. The constituencies are the departments (the Seine and a few others are subdivided), the old single-member constituencies—the arrondissements—having been abandoned, the *scrutin de liste* reintroduced, and the necessity of second ballots minimised. Deputies and senators are paid—15,000 fr. annually, plus 1000 fr. *per mensem* added in 1920. The Senate (which sits in the Palais du Luxembourg) under the Constitution of 1875 contained 300 members, of whom 75 were nominated for life. The last of these life senators died in 1918. A law of 1884 substituted an elected senator for each life senator deceased. The restoration of Alsace-Lorraine added 14 new senators. Three senators represent Algeria and 4 the colonies.

Senators must be at least 40 years of age, and are elected for nine years, one-third of the house retiring every three years. They are elected by indirect 'universal' suffrage, the college of electors consisting in each constituency (department) of the deputies, members of the general council and conseils d'arrondissement, and delegates from the municipal councils of the department.

Justice.—The judicial organisation maintains many traces of its ancient character, and remains a powerful instrument in the hands of the government in political matters. In each canton a justice of the peace (*juge de paix*) decides small civil cases, and, in the *tribunal de simple police*, petty offences or 'contraventions.' More important civil cases go before the *tribunal de première instance* (3 judges) for the department, which, sitting as the *tribunal correctionnel*, also punishes more serious infractions of the law (*délits*). Cases of crime proper are tried by a *cour d'assises* (3 judges and a jury of 12 citizens) in the capital of the department. There are 26 appeal courts in Paris and the provinces. In the larger centres commercial disputes are settled by a *tribunal de commerce;* labour disputes are referred to *conseils de prud'hommes*, on which employers and workmen are represented. The Court of Cassation (q.v.) in Paris, on appeal, can quash the judgments of the civil and criminal courts. The *Conseil d'État*, a consultative body of life-members who give the government advice on questions of legislation and administration, is also the supreme tribunal for administrative suits, and judges cases between private citizens and the state. The Senate sits as a High Court of Justice to try a president or a minister impeached by the Chamber of Deputies (e.g. M. Malvy in 1918) or any one charged with an attempt against the security of the state (e.g. Boulanger, Déroulède, Caillaux). A distinctive feature of the procedure in criminal cases is the secret and sometimes protracted preliminary investigation by an examining magistrate (*juge d'instruction*), who dismisses the case or sends it to the competent court, where the *procureur* prosecutes for the state. Besides the departmental prisons there are nine central *maisons de force* for prisoners serving over a year, a convict depot at St Martin de Ré, and penal stations in New Caledonia (where deportation ceased in 1896) and French Guiana, for forçats condemned to hard labour or solitary confinement. For French Law, see CODE.

Religion.—Save 1,000,000 Protestants and 100,000 Jews, the French are (in practice or in name) Roman Catholics. The Concordat of 1801, whereby Napoleon fixed the relations between France, the Gallican Church, and the Papal See, was ended in 1903. A law of 1905 separated church and state, which till then had supported financially, in proportion to their numbers, the Roman Catholic, Protestant, Jewish, and (in North Africa) Muslim faiths. The republic ceased to pay salaries to priests and pastors (except army padres) and to recognise or subsidise any form of worship. Churches and religious brotherhoods and sisterhoods were called on to form themselves into *associations cultuelles* (subject to the common law regulating all kinds of associations) in order to retain ecclesiastical property. The Roman Catholic Church refused, Pius X. condemning such associations (in 1924 Pius XI. withdrew the papal prohibition); the Protestant and Jewish Churches complied. Many religious orders had already, by the Associations Law of 1901, been dissolved or exiled, failing state authorisation. Public worship, however, was not interfered with; the same *curés* officiate as before in the parish churches. There are some 31,500 *curés*, assisted by 9000 *vicaires;* 8 cardinals, 17 archbishops, and 70 bishops. Lyons is the metropolis of Catholic France, its archbishop being 'Primate of the Gauls.' The Protestants belong mostly to Calvinistic or Reformed Churches, especially in the Cévennes and between Nantes and Bordeaux, those in Alsace, Doubs, and Haute-Saône being Lutherans.

Education.—The present system is the outcome of a long struggle between the state and the church for the right of using education as a means for promoting each its own ends. The National Convention in 1794–95 drew up a scheme of public education under state control, to the exclusion of the clergy, but it was never carried out, and under Napoleon education was subjected to the combined influence of church and state. In 1833 the church secured certain privileges, which were extended by the republican governments of 1850 and 1875; thus it had primary and secondary schools of its own, and could confer university degrees. In 1881–82 primary education was made free and compulsory for children of 6 to 13, and in 1886 it was laicised. Church privileges were abolished, and in 1901 convent schools were suppressed.

The Minister of Public Instruction is aided by a Conseil Supérieur. The whole state-aided teaching organisation—primary, secondary, and higher or university—forms the 'University of France.' The country is divided into 16 educational districts called *académies*—viz. Paris, Aix, Besançon, Bordeaux, Caen, Clermont, Dijon, Grenoble (incorporating Chambéry since 1920), Lille, Lyons, Montpellier, Nancy, Poitiers, Rennes, Toulouse, Strasbourg. Each *académie* is administered by a rector, assisted by inspectors (one for each *département*) and an academic council, on which teachers, professors, general and municipal councils are represented. Every commune has at least one elementary primary school. Higher primary schools provide a further three years' course. For infants (up to 6) there are *écoles maternelles*. Secondary education is given in state *lycées*, in communal *collèges*, and in private establishments; *enseignement supérieur* in universities and special colleges, many of which are of high reputation—the Collège de France, Museum of Natural History, École des Hautes Études, École des Chartes, École Normale Supérieure, École Polytechnique and St Cyr (military), Institut Pasteur, Beaux Arts, &c. In 1920 there were 4,690,000 pupils enrolled in elementary schools (19 per cent. in private schools) and 264,000 in *écoles maternelles*. Public secondary schools had 105,000 boys (at 120 *lycées* and 234 *collèges*) and 42,000 girls (64 *lycées*, 83 *collèges*). There are besides many private schools, some taking the place of suppressed clerical institutions. In 1919 only 2 per cent. of conscripts were illiterate. The 16 universities vary greatly in size and in number of faculties, among the most important being Paris; Lyons and Bordeaux (especially medicine); Grenoble and Toulouse (science); Montpellier, Strasbourg, and Nancy. There were 50,000 students in 1921, Paris alone having 21,000. The clergy have their own 'free faculties,' but these cannot confer degrees. See also UNIVERSITY and ACADEMY.

Army.—The army is recruited by compulsory military service. The law of 1872 imposed 5 years with the colours; this was altered to 3 in 1889, 2 in 1905, 3 again in 1913, and 1½ in 1923. All Frenchmen become liable to serve at 20, and remain so for 28 years, active service being followed by 2 years' *disponibilité*, 16½ years in the first reserve and 8 in the second. In 1913 674,000 officers and men were serving; in August 1914 3,781,000 were mobilised; by 1917 over 3 millions were on the western and Macedonian fronts, 1½ millions elsewhere in France or North Africa, besides 1¼ million conscripts at munitions, railways, land work, &c. Nearly 10,000,000 men were mobilised in 1914–18 and 1,400,000 killed. After the War the

French army was the most powerful in the world. The peace establishment of the active metropolitan army was 335,000 in 1922, exclusive of 160,000 in the armies of occupation. The Colonial army and North African troops added other 250,000, including 50,000 whites (Foreign Legion, Zouaves, &c.). The native troops (Algerians, Moroccans, Senegalese, &c.) have been greatly increased since 1914. The infantry rifle is the Lebel; the favourite field-gun is the quick-firing '75' (3-inch bore). Uniforms are horizon blue, except for Chasseurs (dark blue) and Colonial troops (khaki). The Gendarmerie is a military police force; the Garde Républicaine a similar body in Paris. See ARMY.

Navy.—The French navy, second only to the British in the 19th century, was outstripped in the 20th by America, Germany, and Japan, and by the Treaty of Washington (1922) was put on an equal footing with Italy in tonnage of capital ships, its replacement tonnage being fixed at 175,000 tons. France had then 10 battleships (7 of them Dreadnoughts). After the War the fleet was strongly reinforced by light vessels for defence purposes. (See NAVY.) The navy is recruited partly by voluntary enlistment, partly by conscription. The coasts are divided into five maritime arrondissements, under *préfets maritimes*, with headquarters at the chief naval ports, viz. Brest, Cherbourg, Toulon, Lorient, Rochefort.

Finances.—The Constituante in 1790 abolished the old one-sided oppressive taxation and levied various *contributions*, relying disproportionately on indirect taxation for revenue purposes. This régime held till the European War, on the eve of which an income-tax act was passed (July 1914). Before then the direct contributions were on (1) land (built and unbuilt); (2) personal property (based on rent); (3) doors and windows; and (4) *patentes* or trade licences—the state taking about half the proceeds and the departments and communes the rest. The last three were abolished, so far as the state was concerned, in 1917, when the income-tax was extended. Commercial and industrial profits are now taxed, as also turnover. Indirect taxation includes registration, stamp, customs and excise duties. A municipal indirect tax, the Octroi (q.v.) also brings in large sums. Other rich sources of revenue are state monopolies (tobacco, matches, gunpowder), posts and telegraphs, and state domains (forests, &c.). In 1913 direct taxation accounted for 11 per cent. of the 5100 million francs collected (expenditure being 6000 millions); in 1919 it contributed 2253 million francs—about 20 per cent. of the total receipts. The 1923 budget calculated revenue at 19,285 million francs, and expenditure nearly 4000 millions more.

The French national debt rose from £51,000,000 in 1815 to £498,000,000 in 1870, when war expenses and indemnity added 40 millions sterling. In July 1914 it was 34,188 million francs; by the end of hostilities (January 1919) it was 151,100 millions; and by 1922, thanks to reparations of the devastated areas, &c., 317,000 million francs (£12,679,000,000 at par of exchange, or over £323 per head of the population). Of this total, foreign debt (nil in July 1914) represented 75,000 million francs.

For further information see (in addition to the modern histories mentioned on a later page) geographical works by E. and O. Reclus, Vidal de la Blache, Ardouin-Dumazet and Joanne; Fallex and Mairey, *La France et ses Colonies* (1922); *Un Demi-Siècle de Civilisation Française* (1916) by various hands; E. Saillens, *Facts about France* (1918); Poincaré, *How France is Governed* (1915), and J. Barthélemy, *Le Gouvernement de la France* (1919); the *Annuaire Statistique* and the *Annuaire Général de la France et de l'Étranger;* books on the Colonies by H. Lorin, P. Gafferel, and M. Petit, and *L'Annuaire Colonial;* Bodley's *France*, and volumes by Miss Betham Edwards and A. J. C. Hare. See also EUROPE (for geology); BRITTANY, NORMANDY, and other provinces; PARIS, LYONS, MARSEILLES; SEINE, RHONE, LOIRE; ALPS, PYRENEES; and for French money, weights and measures, FRANC, METRE, LITRE, GRAMME, DECIMAL SYSTEM.

HISTORY.—At the dawn of history what is now France was occupied by a multiplicity of tribes, belonging to several different races; but the Celtic Gauls were the dominant people, and held the greater part of the country. The Ligurians occupied the Mediterranean shores; the Iberians or Basques held the south-west; and in the north-east were the Belgæ, Germanic immigrants who had adopted a Celtic tongue, or Celts who had been in some respects Germanised or mixed with Germans. The Gauls were sufficiently energetic to have conquered North Italy and terrorised Rome from the 5th century B.C. to the middle of the 3d century B.C., and even pushed victorious armies into Thrace and Galatia. But the Romans conquered the Cisalpine Gauls about 225 B.C., and by 150 had conquered the south of Transalpine Gaul (Provence); in 58–50 B.C. Julius Cæsar conquered the sixty-four different states in Gaul, and from that time the Gauls rapidly adopted the Roman polity, the Latin speech, and Roman manners. Greek civilisation had ere this gained a footing at Massilia (Marseilles), but history for France, as for Great Britain and Spain, began with the Roman Conquest. Protected against Teutonic invasion by military posts on the Rhine, subjected for the first time to legislation and administration, the Gallic tribes, who had risen before their conquest to the height of civilisation attainable by them without foreign aid, turned to peaceful pursuits, such as agriculture and commerce, and built for their governors amphitheatres, public baths, aqueducts, military roads. Lugdunum (Lyons) became a Transalpine Rome. In the 2d century A.D. Gaul was the most populous, in the 4th it was one of the most civilised Roman provinces. Its schools were so famous that Roman-born students went to learn there the art of eloquence. Its nobles and cultured classes supplied the empire with more than one general and with more than one poet or prose-writer. It became the home of an enlightened Christianity, but did not escape the rebellions of slaves and land-labourers which broke out now and then in the empire, and bore witness to aristocratic and ecclesiastic oppression. Thus, by the engrafting of Roman civilisation upon the old Celtic stock, there grew between the Alps, the Mediterranean, the Pyrenees, the Atlantic, and the Rhine a Gallo-Roman state, with a culture free from the Hellenistic stamp peculiar to the eastern provinces of the empire, and more akin in many respects to our modern circumstances than to those of the ancient world. Indeed, Gaul was fast being elaborated into a pure neo-Latin nationality, when, from the year 395 onward, the Teutonic tribes, pent up to the east of the Rhine, and pressed from behind by Slavonic hordes, burst upon the scene and acted as a dissolvent upon Roman civilisation. Beaten in Tuscany in 406, bands of Vandals, Burgundians, Suevi, and Alemanni, falling back upon Gaul left bare of troops, destroyed the forts on the Rhine and in the interior of the country. After long wanderings the Burgundians settled in the fruitful plains of the Rhone valley, and founded the kingdom of Burgundy from the Mediterranean border to the Vosges. A few years later the Goths, also retreating from Italy, occupied both sides of the Pyrenees, founding the kingdom of the Visigoths, from the Garonne in the north to the Ebro in the south, with its capital at Toulouse. In 451 a Roman general of barbarian birth, Aetius (q.v.), fighting at the head of an army in which Romans, Burgundians, and Visigoths stood

side by side, defeated in the Catalaunian fields (Châlons-sur-Marne) the hordes of Attila. This was Rome's last deed of war in Gaul.

The staff of military supremacy fell from the hands of the Romans into those of the Franks. These were a confederacy of the Germanic tribes between the Rhine and the Harz Mountains, whom the Romans had attacked in vain, and to whose persistent invasions they had to sacrifice Belgium. Once in possession of the banks of the Meuse and of the Sambre, they advanced under their king Clovis (481–511) towards the Seine and the Loire, and made at first Soissons and then Paris their capital. Clovis became a Christian. Carving out for himself a realm abutting to the south upon the Visigoths, and to the east and south-east upon the Burgundians, he laid, from the Rhone and Garonne to Brittany, foundations for the future kingdom of France. Clovis, through his zeal in the interests of the Catholic Church, earned the title of 'most Christian king,' which passed from the Frankish chiefs to the kings of France. The emperor at Constantinople gave him the Roman title of patrician and consul. The Franks remained subject to their own 'Salic law,' but they maintained in Gaul Roman law, Roman state and church organisation. Thus a Germanic tribe became the leading military and political agent in the plains of northern Gaul, and gave to France its name and its first dynasty of kings, the Merovingians (q.v.); but it adopted the Romance tongue of the conquered. Charles Martel, *maire du palais* to the 'Rois Fainéants,' defeated Arab invaders at Poitiers (732) and drove them south.

In 752 the Karlings or Carlovingians (q.v.), in the person of Pepin the Short, superseded the Merovingian dynasty, and laid the foundation of the temporal power of the popes. Pepin's son, Charlemagne (768–814), raised to its zenith the supremacy of the Franks in western Europe, by uniting under his hegemony the Germanic states hewn out of the Roman provinces. Coming at a time when the Germanic ruling classes were no longer separable from the conquered masses, the formal centralisation of power in his hands, ratified by his coronation in 800 as Roman emperor by the pope Leo III., could not long stem the forces at work for the splitting up of western Europe into a number of small states; neither could this result be accomplished by the building up of a military monarchy extending from the Ebro in Spain, and from the Apennines in Italy, to the North Sea, and from the Atlantic to the Elbe in Germany, the establishment of a code of imperial law and of a system of imperial government, the encouragement of learning and commerce. The Frankish military hegemony fell to the ground under the reign of his weak successors. The next step towards the formation of France was the Treaty of Verdun (843), by which the localisation of the Germans became final; their former racial unity sank in an awakening sense of different nationalities.

Feudal Monarchy.—Though Charles the Simple was politic enough to put an end to the incursions of the Normans by making their leader Rollo Duke of Normandy, the unchecked development of a hereditary aristocracy had reduced the royal power to a shadow, when in 987 Hugh Capet, Count of Paris and of Orleans, was made king by the feudal chiefs. He was the real founder of the French monarchy as distinct from the extinguished Frankish kingship, and from the imperial dignity which was vested after Charlemagne in the ruling house of Germany. While the Roman emperors of the German nation often took up their abode at Aix-la-Chapelle, Charlemagne's residence, the Capetian kings, residing in Paris and crowned in Rheims, became an outward sign that the Rhine divided races again, as in the days of Varus and Arminius (q.v.). Louis *le Gros* (1108–37) regulated the feudal system, abolished serfdom on his own estates, secured corporate rights to the cities under his jurisdiction, while a new element in the state was generated by the foundation of a free burgher class. At this juncture the policy of the Plantagenets forced England into hostility with France. Henry of Anjou, already Duke of Normandy, suzerain lord of Brittany, Count of Maine and Touraine, had married Eleanor of Aquitaine, who brought him the provinces of Guienne, Poitou, and Gascony; and when in 1124 he became king of England as Henry II. (q.v.), his prestige outshone utterly the French court. The kings of England laid claim to the crown of France; the French kings demanded obedience from their too powerful vassals. Hence an enmity so persistent, and fed subsequently from so many sources, that the Crusades, of which the Normans were the most zealous promoters, offer the only instances of military fellowship between England and France till the days of the Crimean war. Philippe Auguste (1180–1223) recovered Normandy, Maine, Touraine, and Poitou from John of England. He took an active personal share in the Crusades, and permitted the pope to organise a cruel persecution against the Albigenses in the southern parts of the country. Philippe was the first to levy a tax for the maintenance of a standing army, and in his reign a chamber of peers, of six secular and six ecclesiastical members, was instituted to act as a council of state. Many noble institutions date their origin from this reign, as the university of Paris, the Louvre, &c. A right of appeal to the royal courts was established, and the arbitrary power of the great vassals crippled. Improvements in the mode of administering the law were continued under his son, and his grandson, Louis IX. (1226–70), who, before his departure for the Crusades, secured the rights of the Gallican Church by a special statute, in order to counteract the constant encroachments of the papal power. Under his son, Philippe III. (1270–85), titles of nobility were first conferred by letters-patent. He added Valois and the *comtés* of Toulouse and Venaissin to the crown. Philippe IV. (1285–1314), surnamed *le Bel*, acquired Navarre, Champagne, and Brie by marriage. With the object of securing support against the secular and ecclesiastical nobility, Philippe gave prominence to the burgher element in the nation, and for the first time called together the *États Généraux*, or States General, at which the *tiers état*, or burgher class, appeared together with the nobles and clergy. With the view of securing to the crown the great fiefs, he abrogated the right of females to succeed to landed property. His tyrannical persecution of the Templars showed his abuse of the regal power, while the transference of the holy see to Avignon brought the popes for seventy years under the influence of the French court. Under his three sons and successors, Louis X. (1314–16), Philippe V. (1316–22), and Charles IV., *le Bel* (1322–28), the rule of the kings of France was strengthened and extended.

House of Valois.—Philippe VI. (1328–50), the first of the House of Valois, succeeded in right of the Salic law. His reign, and those of his successors, John (1350–64) and Charles V., *le Sage* (1364–80), were disturbed by constant wars with Edward III. of England, who laid claim to the throne in right of his mother, a daughter of Philippe *le Bel*. The war began in 1339; in 1346 the battle of Crécy was fought; at the battle of Poitiers (1356) John was made captive; and before its final close, after the death of Edward (1377), the state was reduced to bankruptcy, the nobility excited to rebellion, and the mass of the people sunk in barbarism. Debasement of the coinage,

onerous taxation, and arbitrary conscriptions brought the country to the verge of irretrievable ruin, while the victories of England humbled the sovereign, annihilated the French armies, and cut down the flower of the nation. The long and weak minority of Richard II. diverted the English from the prosecution of their groundless claims to the kingdom of France; but during the minority of Charles VI., *le Bien Aimé* (1380–1422), the war was renewed with increased vigour on the part of the English nation, who were stimulated by the daring valour of Henry V. The signal victory won by the English at Agincourt in 1415; the treason and rebellion of the French princes of the blood, who governed the larger provinces; the ambition of the several regents, the ultimate imbecility of the king, the profligacy of his queen, and the love of pleasure early evinced by the dauphin; all combined to aid Henry in his attempts upon the throne. But the premature death of Henry, the persevering spirit of the people, and the extraordinary influence exercised over her countrymen by the Maid of Orleans concurred in bringing about a thorough reaction, and, after a period of murder, rapine, and anarchy, Charles VII., *le Victorieux* (1422–61), was crowned at Rheims. He obtained from the States General a regular tax (*taille*) for the maintenance of paid soldiers, to keep in check the mercenaries and marauders who pillaged the country. The policy of his successor, Louis XI. (1461–83), favoured the burgher and trading classes at the expense of the nobles, while he humbled the power of the vassal princes. He was a crafty ruler, who managed the finances well, and succeeded in recovering for the crown the territories of Maine, Anjou, and Provence; while he made himself master of some portions of the territories of Charles the Bold, Duke of Burgundy. Charles VIII. (1483–98), by his marriage with Anne of Brittany, secured that powerful state, and consolidated the increasing power of the crown. With him ended the direct male succession of the House of Valois.

Louis XII., *le Père du Peuple* (1498–1515), was the only representative of the *Valois-Orléans* family. The tendency of his reign was to confirm the regal supremacy, while the general condition of the people was ameliorated. He and his successor, Francis I. (1515–47) of the *Valois-Angoulême* branch, wasted their resources in futile attempts to establish their hereditary claims to Lombardy. Francis I.'s rivalry with the Emperor Charles V. of Spain gave itself vent in four wars for the possession of Burgundy and Italy. Knighted by Bayard (q.v.) after the victory of Marignan (1515), but defeated and taken prisoner at Pavia (1525), Francis ultimately had to renounce Italy, though he made good his title to Burgundy (1544). His reign is marked by the flowering of the Renaissance, by the beginning of the Protestant Reformation and work of Calvin (q.v.), by the further strengthening of the absolute power of the monarchy, and by the subordination of the clergy to the crown in terms of the 'Concordat' signed with the pope. An ally of the Protestant princes in Germany, and of the schismatic king of England, Henry VIII., he yet remained in his home policy an adherent of the Roman Catholic religion. He and his immediate successors were concerned mainly with the political aspects of the Reformation, which recruited its upholders from the aristocratic and enlightened classes. Henri II. (1547–59) recovered Calais for France. Under Francis II. (1559–60) the Roman Catholic House of Guise obtained possession of the effective power in the state. Their adversaries, the House of Bourbon, headed the movement of the 'Réforme.' Under the weak kings Charles IX. (1560–74) and Henri III. (1574–89), who were under the influence of their mother, Catharine de' Medici, this division in the French nobility resulted in wars of religion and the war of the League. The massacre of Protestants on the night of St Bartholomew (1572) so raised the pride of the House of Guise that eventually Henri III. fled to the Bourbon camp, where, in 1589, he was murdered by a fanatical monk. The name of Charles IX. remains associated with the horrors of the St Bartholomew's night, which witnessed the striking of a blow at the very heart of the nation; the first step in a periodical recourse to murder, persecution, and proscription. Such horrors, renewed by Louis XIV. against the Protestants, and applied by the Revolution to a different class, have, with the triumphant campaigns of Napoleon, done more to weaken France than the worst blows of its enemies.

Bourbon Line.—The accession of the Bourbon prince, Henri IV. of Navarre (1589–1610), allayed the fury of religious wars, but his recantation of Protestantism in favour of Catholicism disappointed his own party, to which, however, he granted the free exercise of their religion and ecclesiastic autonomy by the Edict of Nantes (1598). By degrees Henri, through the counsels of his minister Sully, and by his own personal popularity, raised the power of the crown higher than ever, while he began a system of thorough administrative reform, which was arrested only by his assassination by the fanatic Ravaillac. During the reign of his son, Louis XIII. (1610–43), Cardinal Richelieu, one of the greatest statesmen of modern Europe, resumed the policy of Francis I. against the House of Hapsburg by entering into a compact with the Protestant princes engaged in the Thirty Years' War, raised higher the authority of the crown at home, and humbled the Huguenots, who in the south and west of France had established almost a state within the state. Cardinal Mazarin, under the regency of the queen-mother, Anne of Austria, governed during the minority of Louis XIV. His continuation of Richelieu's policy roused the parliament of Paris to a last effort in favour of its ancient political liberties, systematically cut down or ignored by the kings; the nobility also made a last stand for their feudal rights. The civil war of the Fronde ensued (1648–53). Its termination put all classes under the heel of the young king, Louis XIV. (1643–1715), who could justly say, with local parliaments reduced to judicial and administrative bodies, with aristocrats demeaned into courtiers, 'L'état, c'est moi.' During his reign the French monarchy culminated. But under a cloak of magnificence, sores gathered sufficient to effect its ruin less than seventy-five years after his death. He continued the policy of Richelieu and Mazarin. The successes of his armies under Condé, Turenne, Vauban, Luxembourg, Catinat, Vendôme, Boufflers, and Créqui extended the boundaries of France to the Rhine, and to Flanders in the north; this was mainly due to the talent of Louvois in developing the military and naval resources of France, and to the financial skill of Colbert. But the war of the Spanish Succession (1701–14), though confirming a prince of the House of Bourbon upon the Spanish throne, ended disastrously for the French, repeatedly defeated by Prince Eugene of Savoy and Marlborough. At home the greatest splendour and luxury were displayed; art, literature, and science flourished to a degree unknown before. The proud king compelled the pope to restore to the Gallican Church some of its privileges, but he fell under the influence of Jesuit advisers, and dealt his country a baneful blow by the revocation of the Edict of Nantes (1685), causing 400,000 Protestants to emigrate. At the close of his rule, his absolutism and

bigotry, the oppressive war-taxes, the prodigality of the court, and the luxurious lives of the clergy bore their fruit.

His youthful heir, Louis XV. (1715–74), succeeded to a heritage whose glory was tarnished, and whose stability was shaken to its very foundations. The long reign of Louis XV. presents nothing worthy of notice except the gradual rise of those modern philosophical and political sentiments which prepared the overthrow of all the ancient institutions of the country. The regency of the profligate Orleans paved the way for the miseries which followed, while his corrupt financial administration brought the nation into the most overwhelming financial embarrassments. In this reign Corsica was added to France. The state was thoroughly disorganised, the fleet and army neglected. The colonies fell a prey to foreign attacks; the work of Champlain in Canada (1608–35), of Dupleix in India (1730–53), was undone; while the capricious change of policy which the king's mistress, Madame de Pompadour, forced upon the government brought contempt on the country. The Peace of Paris (1763), by which the greater portion of the colonial possessions of France were given up to England, terminated an inglorious war, in which the French had expended 1350 millions of francs. The close of this unhappy reign was still further disturbed by the cabals of the Jesuits, but their banishment in 1764 marked the triumph of the philosophic movement over the Roman Catholic Church. In 1774 Louis XVI., a well-meaning, weak prince, succeeded to the throne. His first ministers, Maurepas, Turgot, and Malesherbes, had not the vigour to carry out reforms. They were succeeded by the financier Necker, who endeavoured, by economy and method, to arrest the impending bankruptcy of the state. The influence of Voltaire, Rousseau, Montesquieu, and a host of other writers imbued with the modern democratic spirit, the sufferings of the masses, the importation of English political ideas, the American war of independence, in which the French took an important part (in pursuance of a deliberate design in this way most effectually to weaken England), the restoration to the Paris and provincial parliaments of some of their long-lost privileges, conspired together to sound the death-knell of monarchical absolutism. After much opposition on the part of the king and court, the States General, which had not met since 1614, assembled at Versailles on the 5th of May 1789. They formed themselves into a *National Assembly*, thereby commencing the Revolution, and undertaking to make a new constitution, they presently called themselves the *Constituent Assembly*.

The Revolution.—Under the 'ancien régime' thus abruptly brought to an end the grades of nobility had become so numerous that their members stood in the ratio of 1 to 250 of the entire population. Nevertheless, every grade of nobility exempted its holder from the payment of the ordinary land-tax or *taille*, from the charge of maintaining the public roads (*corvée*), from military conscription, from receiving billets of soldiers, &c. The nobles paid the *capitation* tax, but in a very unequal proportion, although the landed property was vested almost entirely in their hands. They, in fact, together with the clergy, monopolised the principal share of the national revenues, and left to the lower classes the burden of labour and of paying the taxes. At the outbreak of the Revolution the French nobility were sunk in profligacy and fallen to the lowest stage of demoralisation. The clergy kept pace with the nobles in general depravity, and while their aggregate revenues amounted, according to Necker, to 130,000,000 of livres, and their landed property stood in the relation of 1 to 5¾ of that of all other proprietors, their contributions towards the maintenance of the state were inadequate and irregular. The *tiers état* were crushed by the weight of an unjust taxation, which was rendered more obnoxious by the system of farming out some of the taxes. The most tyrannical of these was the tax (*gabelle*) on salt. The municipal institutions which had been permitted to flourish under some of the Valois princes in the middle ages were almost entirely abolished, and the offices of towns, like those of the state and the courts of justice, were either hereditary or open to purchase. The *tiers état*, which included professional men and all who were not members of either the noble or the clerical order, saw themselves utterly excluded from all participation in the privileges and duties of free citizens at the very time when their minds were drawn to the discussion of questions of political independence, equal rights, and universal freedom.

The resistance made by Louis and his advisers to the reasonable demands of the Deputies led to their declaration of inviolability. The king retaliated by ordering a large body of troops under arms, dissolving his ministry, and banishing Necker, whom he had shortly before recalled under the pressure of public opinion. The consequence was the outbreak of insurrectionary movements at Paris, where blood was shed on the 12th July 1789. On the following day the National Guard of Paris, and a new civic militia under the authority of the municipality were convoked; and on the 14th the people stormed the Bastille. The provinces repeated the acts of Paris, and everywhere national guards and revolutionary municipal councils were called together. On the 4th of August feudal and manorial rights were abrogated by the Assembly, which made a solemn declaration of the equality of human rights. The royal princes and all the nobles who could escape sought safety in flight. The royal family, having attempted in vain to follow their example, tried to conciliate the people by the feigned assumption of republican sentiments; but on the 5th of October the rabble, followed by numbers of the National Guard, attacked Versailles, and compelled the king and his family to remove to Paris, whither the Assembly also moved. The next two years witnessed the solemn inauguration and the subsequent withdrawal of various constitutional schemes. The princes of the blood and the ancient noblesse raised corps of émigrés, but their efforts could not arrest the spread of republicanism. The king alternately made concessions to the republicans, and cherished schemes for escaping from their surveillance; but each month added to his humiliations and to the audacity of those surrounding him. With the death in 1791 of Mirabeau, the champion of the National Assembly, all chance of the establishment of constitutional monarchy perished. The Constituent Assembly was succeeded in 1791 by the *Legislative Assembly*. The king was compelled by the Girondists to a war with Austria in April 1792; and the early defeats of the French were visited on Louis, who was confined in August with his family in the Temple. The advance of the Prussians into Champagne threw Paris into the wildest excitement. The Assembly dissolved itself in September, the *National Convention* took its place, and the republic was proclaimed. In December the king was brought to trial, and called upon to answer for repeated acts of treason against the republic. On the 20th January 1793 sentence of death was passed upon him; and on the following day he was beheaded. Revolts burst out in every part of France. England, Holland, Spain, Naples, and the German states combined together against the republic. Christianity was now formally repudiated, and

the sacredness of the republic and the worship of Reason solemnised. Marie Antoinette, the widowed queen, was guillotined; the dauphin and his surviving relatives suffered every indignity. A reign of blood and terror succeeded. Danton and Robespierre, after having condemned countless numbers to the guillotine, suffered each in turn a similar fate. After the destruction of the Terrorists a reaction gradually set in; the people were wearied of bloodshed and anxious for peace and order at any price. In 1793, 1795, and later, insurrections took place in La Vendée on behalf of the white flag, but were quenched in blood. The brilliant exploits of the young general Napoleon Bonaparte in Italy turned men's thoughts into fresh channels. In 1795 a general amnesty was declared, peace was concluded with Prussia and Spain, and the war was carried on with redoubled vigour against Austria. The Revolution had reached a turning-point.

A *Directory* was formed to administer the government, which was now conducted in a spirit of order and conciliation. In 1797 Bonaparte and his brother-commanders were omnipotent in Italy; Austria was compelled to give up Belgium and recognise the Cisalpine Republic. The glory of the French arms was re-established abroad, but at home the nation was still suffering from the shock of the Revolution. The Directory repudiated two-thirds of the national debt, and thus almost ruined the commerce and credit of France. Under the pretext of attacking England, a fleet of 400 ships and an army of 36,000 picked men were equipped; their destination proved, however, to be Egypt, whither the Directory sent Bonaparte; but the young general, resigning the command to Kléber, landed in France in 1799. The Directory fell on the famous '18th Brumaire' (9th November 1799); under the constitution of Sieyès the state was put under consuls, who, unlike those of Rome, were three in number, with different degrees of authority; Napoleon secured supreme power as First Consul. In 1800 a new constitution was promulgated, vesting the sole executive power in Bonaparte, who showed consummate skill in reorganising the government, to which he imparted a systematic efficiency and a spirit of centralisation that secured a thoroughly practical administration. Having resumed his command, he marched an army over the Alps, attacked the Austrians unawares, and decided the fate of Italy by his victory at Marengo. In 1801 the Peace of Lunéville was concluded, and the boundaries of France were once more extended to the Rhine. England was the only country which refused to recognise the various Italian and German conquests of France; and, with the exception of a brief period of peace, England remained the implacable foe of Bonaparte from the days of the consulate to his defeat at Waterloo. Every period of respite from war was employed by the First Consul in fostering trade and industry, and in obliterating both in private and public life the stains left by the Reign of Terror.

The Empire.—In 1804, on an appeal by universal suffrage to the nation, Bonaparte was proclaimed emperor. The pope came to Paris to crown him and his wife Josephine; a new nobility was rapidly created, and the relatives and favourites of the emperor received vanquished kingdoms and principalities at his hands. For a time Napoleon's influence with the weakened powers of the Continent succeeded in maintaining an injurious system of blockade against England; and, except in the Peninsula, his arms were everywhere victorious. His marriage, too, with the Archduchess Maria Louisa, a direct descendant of the ancient House of Hapsburg (1810), seemed to give to his throne the prestige of birth, which alone it had lacked. He kept up the democratic impulse of the Revolution as much as was wanted to drive his engine of war. His tactics would have availed him little against the successive European coalitions had he not adopted the principle of national armies, general conscription, and forced requisition introduced by Carnot, the 'organiser' of revolutionary France's victorious resistance against foreign aggression. This principle has since become the outstanding feature of continental warfare. It gave Napoleon an empire including practically the whole of Europe, except Russia, Turkey, and Great Britain; when it was quietly introduced by Prussia, it assisted effectually in bringing to a close the emperor's career, but not until he had made himself king of Italy (1805), made of Holland and Naples vassal kingdoms (1806), set up in Germany the Confederation of the Rhine, conquered Prussia (1806–7), occupied Portugal, deposed the Bourbons in Spain (1808), reduced the Hapsburgs after four campaigns from their medieval title of Roman emperors to the status of emperors of Austria, made of Rome a French town, and carried off Pope Pius VII. to Fontainebleau. In the long run, the evils attending his high-handed policy both in France and out of it undermined his position. The French navy was destroyed by Nelson at Trafalgar (1805), and the sea-trade of France much injured. His despotism, the unceasing strain of war, the burden of conscription, the estrangement between emperor and pope combined to cause disaffection among the French people.

From 1811 to his final defeat in 1815 the emperor rapidly lost ground. The disastrous Russian campaign, in which his enormous army of 400,000 men was lost amid the rigours of a northern winter, was soon followed by the falling away of his allies and feudatories. Napoleon himself was still victorious wherever he appeared in person, but his generals were beaten in numerous engagements; and the great defeat of Leipzig (1813) compelled the French to retreat beyond the Rhine. The Swedes brought reinforcements to swell the ranks of his enemies on the east frontier, while the English pressed on from the south; the senate and his ministry betrayed his cause, and the allies marched on Paris, which, in the absence of the emperor, capitulated after a short resistance, March 30, 1814. Napoleon now abdicated in favour of his young son, and retired to the island of Elba, the sovereignty of which had been granted to him. His wife and son removed to Vienna; his family were declared to have forfeited the throne; France was reduced to her former limits, and the provinces she had acquired were restored to their national rulers.

The Restoration.—On the 3d May Louis XVIII. (the brother of Louis XVI.) made his entry into Paris. The conduct of the Bourbons did not conciliate the nation; they returned loaded with debts, and surrounded by the old nobility and clergy, who had not renounced their former privileges, and who looked upon the generation of Frenchmen that had arisen since the Revolution as their natural enemies. A narrow spirit influenced the weak policy of the king, which led to the establishment of a strict censorship, the extension of the powers of the police, and the persecution of the adherents of the Empire; while the lower classes and the army, who alike resented the humiliating reaction that had followed the former excitement of war and conquest, were treated with an indifference, and even contempt, by the returned émigrés, to which they were wholly unaccustomed. On the 1st March 1815 Napoleon left Elba and landed in France. The soldiers flocked around his standard; the Bourbons fled, and he took possession of their palaces. The news of his landing spread terror

through Europe; and on the 25th March a treaty of alliance was signed at Vienna between Austria, Russia, Prussia, and England, and preparations were at once made to put down the movement in his favour and restore the Bourbon dynasty. At first the old prestige of success seemed to attend Napoleon; but on the 18th June he was defeated at Waterloo; and, having placed himself under the safeguard of the English, he was sent to the island of St Helena, in conformity with the generally acknowledged sentiment that it was necessary to the peace of Europe to remove him finally and definitely from the scene of his former power.

The second restoration gave occasion to many pledges of a more liberal policy on the part of Louis, but few of them were fulfilled, and a general and sullen discontent reigned among the people, who were again deprived of all voice in the administration or in the election to offices, and were harassed by the petty tyranny of the priests, who were the favourite advisers of the crown. In 1821 Napoleon breathed his last at St Helena; and in 1824 Louis XVIII. died without direct heirs, when his brother, the Duc d'Artois, succeeded as Charles X. The same ministerial incapacity, want of good faith, general discontent, and excessive priestly influence characterised this reign, which was abruptly brought to a close by the revolution of 1830, and the election to the throne of Louis-Philippe, Duke of Orleans, as king by the will of the people. Progress in material prosperity made his government popular with the *bourgeoisie*, and for a time he held his ground. The capture of Algiers (1830) and war with Abd-el-Kader laid the foundation of France's great North African empire.

The Second Republic.—But the determined resistance of the king to the growing desire for electoral reform led at last to open insurrection in Paris; and, Louis-Philippe having abdicated (February 24, 1848), a republic was proclaimed under a provisional government. An insurrection of the Red Republicans in Paris (June 1848) was only put down after great slaughter. Louis Napoleon was elected President of the Republic in December 1848; but by the famous *coup d'état* of December 2, 1851, he violently set aside the constitution and assumed dictatorial powers; and a year after (2d December 1852) he was raised by the almost unanimous voice of the nation to the dignity of emperor, as Napoleon III.

The Second Empire.—The constitution of this second empire was the same as that of the first. A senate and a legislative body, shorn of all effectual parliamentary rights, screened badly the emperor's complete absolutism, under which, however, France made great advances in the development of her natural resources and in manufactures. Assuming the character of an adjuster of the wrongs of nations, Napoleon proclaimed himself a mediator in the Danish and Austro-Prussian wars, and the defender of the Italians against Austria, of the pope against the people of Italy, and of the Mexicans against the government of the United States of America. By his help the Italians were relieved from the Austrian yoke, and the pope was left master of Rome; Savoy and Nice were gained for France (1860); but in Mexico the emperor's intervention only led to greater bloodshed, and ended fatally for his protégé, the Austrian Prince Maximilian. He co-operated with Britain in the Crimean war (1854–56), and signed with that country a treaty of commerce (1860) on free-trade lines. Colonial expansion in Asia was begun by the acquisition of Cochin-China and Cambodia. Although the brilliant success of the Paris Exhibition of 1867 seemed to mark the consideration in which the emperor was held, his political credit had already then lost its importance. At home the great financial embarrassments of his government were arousing the discontent of the people; and to avert the growing disaffection Napoleon offered (1869) to adopt a constitutional form of government, and to make some concessions in regard to freedom of the press. It was soon found that the responsibility of the ministry was fictitious, and that the emperor availed himself of its protection to cloak his own acts of personal government. The result of the appeal made to the nation in 1870, on the plea of securing their sanction for his policy, was not what he had anticipated; and the 50,000 dissentient votes given by the troops in this plebiscite revealed a hitherto unsuspected source of danger. Confident in the efficiency of the army, and anxious to rekindle its ardour, he availed himself of a pretext to declare war against Prussia.

The course of events in the short but terrible Franco-German conflict of 1870–71 astonished Europe by its unexpected character, revealing at once the solidity of Prussian strength and the hollowness of imperial power in France. War was declared on the 15th July, and it had been the intention of the French emperor to cross the Rhine at Maxau and push his armies between the North and South German States so as to force the latter into neutrality. Such action required superiority in numbers and mobility at the very outset, besides good generalship. These advantages were soon found to be all on the side of the Germans, whose perfect organisation enabled every detail of mobilisation to be completed by the 30th July. Their troops, 518,800 men, with 1584 guns, were then formed into three armies—the first under General Steinmetz, the second under Prince Frederick Charles, and the third under the Crown Prince.

The French had with difficulty collected 270,000 men with 925 guns by the beginning of August, and these were deficient in transport and equipment. The emperor assumed the chief command, and had 128,000 men between Metz and the frontier at Saarbruck, some 47,000 under Marshal MacMahon on the eastern slopes of the Vosges Mountains, and 35,000 in reserve at Châlons. The first engagement took place on 2d August, when General Frossard's corps drove out the weak German detachment in Saarbruck, but did not push its success, and the Germans took the offensive next day. On the 4th the third army (130,000) on the German left met General Douay's advanced brigade (5000 men) near Wissembourg (Ger. Weissenburg), defeated him, and pressed on to Wörth, where MacMahon had taken up a strong position with his main body (45,000). The battle fought here on the 6th was disastrous to the French, who fled in confusion through the Vosges Mountains. On the same day the battle of Spicheren was fought between 67,000 of the first German army and 32,000 of Frossard's corps, and ended in the orderly retreat of the latter. As a result of these disasters the emperor found it necessary to retire towards Metz, and, after the fierce and undecided rearguard action at Borny on the 14th, entered that fortress on the following day with 176,000 men and 540 guns. He then abandoned the chief command to Marshal Bazaine. Meanwhile the second German army had reached the Moselle, and was threatening with its advanced troops the roads to Paris. This was unknown to Marshal Bazaine, although he had a large force of cavalry which should have kept him informed of the enemy's movements. He ordered the retreat westward to continue, and his staff made the great error of directing the bulk of the troops to use only one, and that the southernmost, of the two broad chaussées available. At least seventy-two hours would have been necessary to complete the with-

drawal from Metz under these circumstances, and the Germans had already placed some cavalry across the road near Mars-la-Tour. On the 16th they were vigorously supported (as was invariably the case in this campaign) by other troops, and succeeded in stopping the westward movement of the French. Next day the latter concentrated on the Gravelotte position, eleven miles in extent. On the 18th the pitched battle of Gravelotte was fought, and resulted in the French being driven back on Metz. Here they were surrounded, and, after several gallant but unsuccessful attempts to break out, surrendered on 27th October.

Thus within a month the regular armies of France had been rendered powerless to oppose the German advance. But in the meantime the Gardes Mobiles had been called out, and, with the remains of MacMahon's army, formed at Châlons a body of 120,000 men, with 324 guns, much disorganised, and almost entirely without discipline. With these it was determined to attempt to join hands with Bazaine by a northerly march, which was commenced on 21st August, without intelligence reaching the Germans, part of whose second army was again in motion towards Paris. On the 25th the Germans learned, it is said through a telegram in a foreign newspaper, of MacMahon's movements, and at once changed the direction of their march so as to intercept him. The effects of want of discipline and contradictory orders had greatly delayed his march, and he was much harassed by the enemy, till finally on the 30th the 5th corps under De Failly, having encamped near Beaumont without taking the precaution of protecting themselves by a chain of outposts, though it had been engaged the previous day, was surprised and driven northwards on Sedan. Here MacMahon collected his dispirited troops, but only to find that the enemy had surrounded him, and by vigorous forward movements had captured the bridges over the Meuse and the commanding positions round the town. A fierce battle commenced early on the 1st September by the attack on Bazeilles. This village was captured by the Bavarians and recaptured by the French, and ultimately burned. By noon MacMahon had been wounded, and General Wimpffen as senior officer had taken command, only to find further resistance hopeless, in spite of the gallant charges of the French cavalry under General Marguérite, who fell at their head. Nearly 500 guns were playing upon the French, who were crowded into Sedan and under its walls, and at 5 P.M. the white flag was hoisted on the citadel. Next day the emperor, who was with the army, surrendered with 83,000 men.

On the 4th Paris was in rebellion, the senate dissolved, the empress-regent a fugitive on her way to England, and France proclaimed a republic amid tumultuous excitement. Before the close of September, Strasburg, one of the last hopes of France, had capitulated, and Paris was completely invested by German troops; and on the 5th October the Prussian king had taken up his headquarters at Versailles. Gigantic efforts were made to raise armies in the provinces for the relief of Paris. Gambetta, escaping from the city in a balloon, joined the government at Tours, and by his energy got together many thousand armed men. These under the successive command of Generals D'Aurelles de Paladine, Chanzy, and Bourbaki fought stubbornly on the Loire, and with some slight success, threatening at one time to cut the German line of communications, at another to raise the siege of Belfort. But the surrender of Metz by Bazaine, and consequent reinforcement of the German armies round Paris, frustrated the first, and the masterly tactics of General von Werder on the Lisaine not only prevented the second, but drove the French troops into Switzerland, where they were disarmed and interned. Whilst these events were occurring in the south and south-east, the Germans were overrunning the north as far as Dieppe, and fought a drawn battle with the French levies under General Faidherbe, who perhaps displayed more talent than any other French leader during the campaign. From Paris, where almost every able-bodied man was enrolled in the ranks, frequent sorties were made, and bloody battles fought in the villages to the east and south, Le Bourget, Champigny, Le Hay, Bougival, Raincy, &c., several of which were taken and retaken more than once. The city also underwent a bombardment for several days, from which, however, it suffered little, and it was not till hunger left no option, in January 1871, after a four months' investment, that negotiations were opened with the enemy at Versailles. The united efforts of the different branches of 'the Provisional Government of Defence,' respectively installed at Paris and Tours, then succeeded in bringing about an armistice, and a portion of the investing army entered the city, which had been till then cut off from all communication with the outer world, except by balloons and carrier-pigeons, and finally threatened by famine. They remained but a few hours, and with the concurrence of Germany the French nation now proceeded by a general election of representatives to provide for the exigencies of the country.

The Third Republic.—The First National Assembly of the French Republic met at Bordeaux in February. After receiving from the Provisional Government of Defence the resignation of the powers confided to them in September 1870, the Assembly undertook to organise the government, and nominated M. Thiers chief of the executive power of the state, with the title of President of the French Republic, but with the condition of responsibility to the National Assembly. On the 1st of March the preliminaries of peace were finally ratified at Bordeaux, the chief conditions being that the province of Alsace (except Belfort) and part of Lorraine, including Metz, should be ceded to the German empire, and that France should pay a war indemnity of 5000 millions of francs, and continue to be occupied by German troops till the money was all paid. This enormous obligation was discharged in September 1873, and during the same month France, after an occupation of three years, was finally relieved from the presence of foreign troops. In the spring of 1871 the peace of France was seriously threatened by a successful outbreak at Paris on the part of the Communists; but, after great bloodshed and grievous damage to public and private property, they were quelled by the regular army, and on 20th May order was restored in Paris.

The ex-Emperor Napoleon died in exile at Chislehurst in 1873. His son was killed in the Zulu war (1879). In 1873 M. Thiers resigned the office of President of the French Republic, and was succeeded by Marshal MacMahon, who appointed ministers willing to pave the way for the reinstatement of the Bourbon dynasty. But the plan of a fusion between the two branches of the family failed through the action of the Comte de Chambord, whom it was intended to make king under the title of Henri V.; whereupon the monarchical majority in the National Assembly, in spite of the growth of republican feeling in the country, confirmed for seven years MacMahon's tenure of the presidentship. Matters thus remained in suspense between a return to the monarchical principle and a thorough acceptance of the republic till 1875, when, by the accession of some Orleanists to the moderate republican parliamentary party,

it became possible to pass constitutional laws for the republic. A senate and chamber of deputies represented the people; a president elected for seven years stood at the head of the government. The general election held in virtue of the constitution showed that France, under universal manhood suffrage, was now in favour of a parliamentary republic. A last attempt made in 1877 by the 'reactionary' parties to stem the tide of popular feeling met with a decided rebuff at the polling-stations. In presence of a republican majority both in the House of Deputies and in the senate Marshal MacMahon resigned his office (1879), and an out-and-out republican, M. Grévy, was appointed in his stead. Gambetta, the eloquent orator and leader of the republicans, became after the death of Thiers the paramount political power in France. After Thiers's death first Gambetta, then Jules Ferry, led the republicans. Public liberties (freedom of the press, of meetings, of professional syndicates) and municipal rights were secured; primary education was reorganised, being made free and compulsory and secularised. Protectorates were established in Tunisia, Annam and Tongking, and Madagascar, but costly colonial expeditions and the loss of French influence in Egypt led to Ferry's fall in 1885. Under Sadi Carnot's presidency (1887–94) parliamentary institutions were endangered by General Boulanger and Boulangism; Free Trade was abandoned in favour of Protection (1892); the Panamá scandal, economic crises, and anarchist outrages fomented unrest; and the Franco-Russian alliance was announced (1891). Carnot's popularity and tragic end rallied republican sympathies; monarchist power dwindled, and socialist representation in the Chamber grew apace. Casimir Périer resigned the presidential chair after but six months' tenure, and Félix Faure succeeded him (1895–99). His term of office witnessed the beginning of the Dreyfus case, the threat of an Anglo-French rupture over the Fashoda incident (1898), and the installation of Delcassé, Foreign Secretary from 1898 to 1905.

The presidency of Loubet (1899–1906) was notable for a Nationalist outburst under Déroulède; the *Entente Cordiale* (1904) with Britain—following on an arbitration treaty, the recognition of British predominance in Egypt and French interests in Morocco, and the settlement of the Newfoundland fishery dispute; friction with Germany over Morocco, temporarily allayed by the Algeçiras Conference (1906) and the dropping of Delcassé; the reduction of military service from three years to two (1905); and a series of anti-clerical measures by strong Radical-Socialist ministries (Waldeck-Rousseau, Combes, Rouvier), including the suppression of unauthorised religious orders and schools (1901), the annulling of the Concordat, and the separation of church and state (1905).

While Fallières was president (1906–13), syndicalism, strikes, and labour troubles were much in evidence, and socialists were conspicuous in parliament and in ministries of the day. The Triple Entente (Britain, France, Russia) was consolidated (1907) to counterbalance the Triple Alliance (Germany, Austria, Italy). The Casablanca affair again provoked Franco-German tension during Clemenceau's premiership (1906–9), and the Agadir incident in 1911 almost led to war, Caillaux being obliged to cede part of French Congo to Germany in return for concessions in Morocco, which Lyautey now proceeded to organise as a protectorate. Poincaré was elected president in 1913, and Barthou, alarmed by German army increases, restored the three years' military service. Viviani carried another highly controversial measure, the income-tax law, in July 1914; and on the eve of the Great War (q.v.) Poincairé hurried back from a Russian visit, and Jaurès, the Socialist leader, was assassinated. The Great War welded all parties in an *Union Sacrée* to defend their invaded country. Briand, Ribot, and Painlevé in turn formed cabinets; then the veteran Clemenceau saw the War to a successful finish, and represented France in the Versailles treaty discussions. An eight hours' day act and electoral reform were adopted in 1919, and at the November elections the Radical-Socialist majority in the Chamber melted away, power passed from 'Left' to 'Centre,' and the 'Right' was greatly reinforced. The health of Deschanel (president from February to September 1920) breaking down, Millerand, premier at the time, was elected in his place. The restoration of the devastated areas, reincorporation of Alsace-Lorraine, and organisation of ex-German colonies in Africa, support of Poland, crises with Germany, Greece, Turkey, &c., financial needs, Reparations, and a host of baffling post-war problems, continued to tax the energies and ingenuity of successive governments; and when Poincaré, who held office in 1922–24, occupied the Ruhr, the Entente Cordiale was severely strained by France's nationalist policy. In 1920 the *cinquantenaire* of the Third Republic was celebrated with great fervour, the firm establishment of the constitution contrasting profoundly with the instability (thanks to manifold group coalitions) of French ministries, whereof over sixty held office in the first fifty years of the republic.

See the histories of France by Michelet, Guizot, Duruy, Lavisse, and Rambaud; the *National History of France*, ed. by Funck-Brentano (6 vols. 1915); *Cambridge Modern History; Mediæval France* and *Modern France*, ed. by A. Tilley (1922); Hassall's *France, Mediæval and Modern* (1918); Mme. Duclaux's *Short History of France* (1918). For the Revolution, see the works of Thiers, Mignet, and Aulard (1901), Taine's *Origines de la France Contemporaine* (trans. 1878–85); Carlyle's *French Revolution* (1837), and books by J. H. McCarthy (1891–96) and J. H. Rose (1894). For the Second Republic and Second Empire, see works by P. la Gorce; for the Third Republic, by E. Zévort; also for contemporary France, E. Bourgeois' *Modern France* (1919) and the histories of Hanotaux and Seignobos.

See also the articles on FRANKS; BURGUNDY, NORMANDY, and other old Provinces of France; MEROVINGIANS and CARLOVINGIANS; VALOIS, BOURBON, and other royal houses; CAPET, CHARLEMAGNE, LOUIS XIV., NAPOLEON, and other great rulers; JOAN OF ARC, CALVIN, RICHELIEU, ROBESPIERRE, and outstanding historical figures; HUGUENOTS, GIRONDISTS, CORDELIERS, JACOBINS, and leading parties; and GALLICAN CHURCH.

LANGUAGE AND LITERATURE.—The French language belongs to a family which offers unusual interest and exceptional facilities for philological and literary study. It is the best specimen of its kind, because the decomposed soil from which it springs—Latin—is school property; because the successive states it has gone through are visibly marked on its material and in its significance; because its line of development lies across the richest and most accessible historical ground. Long before the Romans conquered Gaul their speech was already undergoing certain specific changes, whence in due course and in the proper places the modern languages of Italy, Rumania, Spain, Portugal, and France would take their rise. These changes consisted principally in the weakening or dropping off of primitive elaborate case inflexions, the suppression of short vowels between consonants that could with ease be pronounced together, a gradual increase in the stress laid in pronunciation upon the accented syllable, the use among the Roman plebs of forms and words not accepted in the polished classes of society, and the tendency to depart from the earlier and synthetic modes of expression in order to introduce into the mechanism of speech a new class of words, which slowly took the place of perishing case and verb inflexions.

Through Latin, its ancestor, French belongs to the

Aryan stock of languages. Along with its sister-languages, Roumanian, Italian, Spanish, and Portuguese, it sprang into being when soldiers, colonists, and merchants, in the course of several centuries of Roman domination, had saturated western and southern Europe with their *lingua romana rustica*, or common Latin speech, an essentially popular and unliterary form of utterance, but forcible and instinct with an irrepressible vitality. This Latin of the Roman people and of their European possessions is known to philologists in the shape it received after the invasion of the barbarians and through the admixture of Teutonic elements, under the name of Romance. It is as it were a vegetable mould, spread to a great depth over the surface of western and southern Europe; and from its common properties were formed, by a process of differentiation, the special and localised soils suited to bring forth ultimately the distinct literatures of Italy, France, Spain, and Portugal. In France Romance gave birth to Old French, which can be divided into three successive periods—the period of formation, the flourishing period, and the period of decay. The first is contemporaneous with the earliest middle ages, and its origin, like that of French history, dates back to the conquest of Gaul by Rome. The Celtic dialects were overpowered by the *lingua romana rustica*. While the masses spoke popular Latin, the literary dialect of Cicero was written and spoken by the educated and governing class: it was a class language, and continued so till the church was left alone in possession of this effete legacy of ancient Rome.

The *lingua romana*, according to a law inherent in every language, was already assuming local peculiarities in different parts of Gaul when the first move towards the formation of a French language, the campaigns of Julius Cæsar, was completed by a second, the settlement in Gaul of the Frankish, Burgundian, Saxon, and Gothic tribes from beyond the Rhine. The formation of different dialects received fresh impetus from the complete disruption of the Roman power in the West. From that day, the processes of decay, which till then might be considered as modifications within the *lingua romana*, assumed a regenerative character and became the starting-point of a new language. To the Franks has fallen the honour of having their name attached to it. This Germanic title has by no means affected the inner construction of the language. Teutonic influences can be traced in goodly number in the vocabulary and phonetics of Old French; but the grammatical framework and the syntax, which developed only in the late stages of Old French, are wholly and absolutely Latin in origin and Latin in spirit. Language in Gaul, as elsewhere, ran into types: dialects, whose primary causes are obscure, were formed. In the valleys of the Rhone and of the Garonne, in the whole country (very nearly the half of modern France) verging to the Bay of Biscay, from the mountains of Auvergne southwards, early French was not French; it inclined to the Italian and Spanish modifications of Romance on which it bordered. These southern dialects, known under the collective name of *langue d'oc*, fell out of the race for supremacy when the centre of political and military power in Paris became strong enough to absorb the Mediterranean border in its circle of influence. By degrees inner troubles and invasion from without deprived the southern speech of its national significance as a body of language. Nowadays Provençal (q.v.) is for the people a patois, for literary antiquaries and philologists a curious study. Its victor, the *langue d'oïl*, the parent of modern French, has had a triumphant career. Geographically, to it belonged the valleys of the Saône, Loire, Seine, Scheldt, and Meuse. Scholars distinguish four dialects in it. The dialect of Paris became paramount after the building up in Paris under the Capetian kings of a natural centre for the gradual nationalisation of France. The culminating point of Old French was reached when it had evolved fully its 'half synthetic system' in the 12th century.

The language thus shaped brought forth a stupendous amount of literature. For two centuries medieval French was the polite language of Europe, more so than modern French has ever been; for after the early but transient literary outburst of the *langue d'oc*, and before the dawn of the Italian Renaissance, French had no rivalry to fear from still shapeless contemporaries. It was currently held till well into last century that French literature had its roots in the Augustan age of Latin culture, and that the Hellenism of the Renaissance was the first air in which it flourished. The mythological apparel of French poetry and the classical rhetoric do admittedly proceed from that source. But hearts beat and imagination wove its webs of fancy in France ages before scholars imported the literary finery of Greece and of Rome. The natural trunk of French literature, if not of French letters, casts its roots in the same soil whence the language sprang. Language, nationality, and society are even in the middle ages the constituent elements of history, and the true nature of the times is better elicited from them than from the records of military violence.

In the flourishing period of Old French, society is feudal, its character is the division of men into four sharply defined classes: the nobility, whose occupations were mainly martial, and who in consequence fostered an epic literature; the burghers, among whom are first found the more strikingly national points—common sense, wit, good-humoured satire, gracefulness, a fresh and nimble style; the villeins, affording to the burgher plentiful material for jest; the clerics, including the clergy and all professional men, who spoke and wrote Latin, and who when they took to writing in French brought to it the older language's historical and philosophical qualities. Those four classes had their being between the four walls of medieval immutability—the Catholic religion, feudalism, monarchy, and the grossness of their world-conceptions. Thus rough-hewn, French society, from the 11th to well into the 14th century, assumed and preserved throughout the Crusades, throughout the struggle between emperor and pope, in spite of the annexation to England for a time of a large portion of France, the proud position of master and arbiter in matters of the intellect and of social commerce. The deeds of war of the Frankish kings of the Merovingian and Carlovingian dynasties called forth French epic poetry. The appearance of Clovis as the champion of the Catholic faith against the Arian heresy, of Charles Martel as the protagonist of Christendom against the Moslem Arabs from Spain, of Charlemagne as conqueror of the heathen Saxons in Germany and of the Mohammedans on the banks of the Ebro, fed an ever-swelling strain of song till it rang its loudest in the *Chanson de Roland* (11th century). Round this epic poem, struck up by the Norman *trouvère* at the battle of Hastings, further royal, feudal, and biographical epics ranged themselves, almost all grounded on fact, some borrowed from antiquity, some suggested by the Crusades, some imported from Brittany. The last class may be claimed by Great Britain as derived from the literary fund of its oldest inhabitants; for, when the Celts of Britain had been driven from the east coast by the Angles and the Saxons, a part of them crossed the sea to French Brittany, taking with them the

legend of King Arthur. Those who remained in Wales, after charming their Teutonic conquerors by their gift of song and poetry, fascinated with still greater ease the Normans romanised by their long stay in France. The *Round Table*, *Perceval*, *Tristan*, *Lancelot* were incorporated in Anglo-Norman literature, till they won for French in their continental form the prize of narrative poetry. From France those romantic stories passed into the Netherlands, Germany, Italy, and the Spanish peninsula, carrying everywhere that air of chivalry and gallantry which in matters of the imagination gave an ideal to society and constituted its moral unity. In the middle of the 13th century the purely epic cycle and the romantic cycle engrafted upon it were complete. Then came in verse the opportunity of the story-teller and in prose that of the chronicler. The French fabliau or tale is unequalled for wit, humour, alertness, good-tempered malice, and refined mockery, with a strong dash of the salt of coarseness. The Voltairian spirit already tripped lightly about, and the fabliau writer, in his swift, pointed treatment of social matters, is the forerunner of the *esprit Gaulois* and Parisian vivacity which feed a distinct current in the stream of French literature. Boccaccio and Chaucer drew much material from the French elaboration of tales hailing from all quarters of the globe.

Whole collections of fables were fathered upon Æsop, dubbed to that purpose with the familiar name of Isopet. By degrees the short fable was succeeded by long semi-epic, semi-satirical compositions, in which a moral was aimed at man by the transference of social relations to the animal world. The *Roman de Renart*, the most representative and most comprehensive of these productions, was imitated and translated everywhere, and its more interesting parts have remained a common possession of all literature, suggesting for instance the Flemish *Reynaert de Vos*, and finally appearing as Goethe's *Reineke Fuchs* in modern literature. In the 14th century the latest French compilation of Mr Reynard's exploits throws a deal of light on the society of the time. It expresses the ideas of the comparatively wakeful and wealthy middle class then occupying the large towns, their hatred of the landed aristocracy, and indifference to the villein's lot. The French have to thank the Crusades for their first histories. Some of these belong to Anglo-Norman literature, and recount the deeds of France's ally, Richard Cœur-de-Lion. But they are outshone by Villehardouin's *Conquête de Constantinople*, the masterpiece of historical composition in the middle ages proper. He reminds us of Herodotus as the *Chanson de Roland* reminds us of Homer. The sixth crusade and the life of Louis IX. are the subject of Joinville's *Mémoires*, while various causes resulted in an outburst of French or rather Anglo-Norman historical productions in England which did not extend beyond the beginning of the 14th century. History in the middle ages being heroic, epic, and chivalrous rather than didactic and philosophical, the aristocrats provided the clerics with the material and spirit of its treatment. But as time wore on the latter in their turn enriched French literature with branches that are entirely their own. They began to write in the character of students and scholars, of moralists, caricaturists, educators, dramatists, and professors of religion. Their most important contribution to general literature is the *Roman de la Rose*, a vast allegorical treatment of the lover's woes and the lover's bliss in the pursuit of the object of his passion. Begun by Guillaume de Lorris, the poem was continued and diverted from its original purpose by Jean de Meun; it became popular throughout Europe in the multitudinous artificially-cultured court circles of the 14th century. It passed into the Dutch, Italian, and English languages. It imparted its character to French literature till the end of the 15th century, was transcribed and printed during 300 years, and stands in an indirect relation to the 'romans' and 'précieux' works of the 17th century. Lyrical poetry has, properly speaking, no cradle of its own within the strict limits of French medieval literature, for it was brought thither from a sunnier, warmer, and softer southern air. Italian, Spanish, and the *langue d'oc* were the natural and early vehicles of lyricism in Europe. Of these three languages the last named was the first to bear fruit. There prevailed in Provence some particular rules of etiquette and of good breeding, upheld by a brilliant society in which women held the foremost place. The troubadours in their lyrics held up the mirror to that society and reflected its tastes. When the south had fallen a victim to the bane of persecution and military supremacy extended upon it from the sterner north, the art of the troubadours found in the 13th century a temporary abode in Champagne, Picardy, Flanders, and Artois, whence it passed to Germany, to Italy, to Sicily, to Spain, to Portugal, inspiring everywhere the first lisping attempts of nationalities whose languages have since proved themselves to be, as lyrical instruments, superior to the French.

The 15th century witnesses the linguistic transformation of Old French into Modern French. The last traces of case inflection disappear, the analytic form of language supersedes in all essential parts the half-synthetic system. The French mind acquires these qualities of reflection, French thought takes that philosophic turn which distinguishes the idealism of the intellect from the idealism of the imagination. Froissart, in his Histories, wields an inquiring as well as a picturesque pen. His successor, Philippe de Comines, the historian of Louis XI., is still more of a moralist and of a politician. Charles d'Orléans, snatching from the perishing troubadours the thread of lyrical poetry, passed it to Villon, who wove into its silk many a coarse hempen filament, till Clément Marot raised French verse to religious solemnity in his translation of the Psalms, preserved its grace in his epistles, and gave it a pathetic ring in his elegies. In the meanwhile the Italian Renaissance was filling with its glory the world of art and of literature. Native and spontaneous literary activity was paling before the light of the revival of learning. With the accession of the House of Valois to the throne we find at once that the spirit of France has passed away from the old into a new society and a new literature. France will now receive the lessons of ancient Rome, ancient Greece, and modern Italy before it does again original work and resumes its supremacy in Europe. French society becomes polished, its local provincial centres die out, and culture flourishes in the court of the king. Francis I. is proclaimed the father of letters. The state is organised, there is a general intellectual impulse, women are promoted to the place of honour in social and court life. French officers, sent year after year at the head of French troops to Italy by Charles VIII. and Louis XII., brought back a knowledge and a love of art and letters. Italian architects built mansions for them and palaces for the royal family. Italian painters and sculptors hung pictures and set up statues in their halls. Italian scholars interpreted for them the masterpieces of Roman and Greek literature. No longer mere power or physical prowess, but mind was the object of a gentleman's ambition. It became the fashion at court to show enlightenment by attending the preachings of the Reformers. Francis I. laid the foundation of the Bibliothèque

Nationale and of the Collège de France. He, and his sons after him, encouraged artists and scholars. Paris numbered then 500,000 inhabitants, of whom 15,000 were students.

In the general excitement of the Renaissance and the Reformation, literature could not but move in the same direction as society at large. Italian comedy ousted the *mystères, sotties,* and *farces;* the imitation of Greek and Latin authors reduced the flow of inspiration in poetry, and burdened it with artificial rhetorical rules and with a mass of ill-advised borrowings from the Latin vocabulary and from the Latin syntax. Ronsard and his *Pléiade* stood in the van of this movement, which Régnier endeavoured to stem, while Rabelais, mixing the new material with the old in an ill-assorted, stupendous mass of cumbersome learning, low jesting, high thinking, and word-rioting, came near being the burlesque Shakespeare of his age, whose energies are best represented in we know not which of the numerous veins running through *Gargantua* and *Pantagruel.* No two minds could be more different than those of Rabelais and Montaigne, the great prose-writers of the 16th century, yet only the Renaissance could produce either; the first, with his reason driven wild in pursuit of the visions of his imagination; the second, a blithe Greek sage, carrying his wisdom lightly and discoursing as if arm in arm with Plutarch, his model. Rabelais, Montaigne, Calvin, and Descartes, by setting French prose on the basis afforded by the revival of learning, drew to themselves some of the attention then given to Italy. Poetry was rescued from Ronsard's exaggerations by Malherbe only to be tapered down almost out of existence by over-much attention to elegance, refinement, lightness, and style. Looking forward through the spans of time, we find that, divorced from nature and limited to the expression of the social emotions, poetry is poetical with Lafontaine only in his *Élégie aux Nymphes de Vaux,* with Racine only in the choruses of his tragedies. As for the professed lyric poets of the 17th and 18th centuries, their performance bears the impress of the sterility and rhetoric of their Latin models. J. B. Rousseau, Lefranc de Pompignan, Lebrun, and Pindare are worse sinners in this respect than Racan, Chaulieu, and Parny. Lyricism finds better interpreters in church orators, such as Bossuet (*Oraisons Funèbres*), Bourdaloue, Massillon, and Fléchier, all of the 17th century. It pervades the glowing pages which love of nature and effusion of sentiment dictated to J. J. Rousseau and Bernardin de St Pierre in the later part of the 18th; it dwells in the religious fervour of Chateaubriand and in the passionate enthusiasm of Madame de Staël on the threshold of the 19th. André Chénier was the first to restore some soul to poetry, in the pure Greek note which he sang during the horrors of the Revolution.

Such a long eclipse is partly explained by the premature application to literature of standards of taste and of formal criticism. Malherbe subjected his talent to a personal discipline which Boileau consolidated into a set of rules enforced with the lash of satire. Corneille wrote his tragedies early enough to remain comparatively free from this rod, but Racine acknowledged Boileau as his master. The 17th century is in France the age of authority in literature as in everything else. The French Academy, founded by Richelieu in 1635, to establish positive rules for the French language and to render French speech not only elegant, but also fit to present all arts and all sciences, gave an earnest of its future labours by an endeavour to curb Corneille's waywardness in composition. Public opinion at court and public opinion in town circles —for Paris was becoming a centre of culture and thought, forming together with the court the whole of French society—fell by degrees into line with the Academy and with Boileau. Thus was formed, along with French unity, the unity of French literature, and to this period is ascribed the name *classical period,* to distinguish it from the period of liberty and individualism ushered in after the Revolution and the Empire, by the rise of liberalism in politics and the return to freedom in the matter of prose and verse composition. As long as town and court moved together in the same direction, the unity of French thought, of French literature, and of French political development remained unimpaired and produced its fruits good and bad. After Corneille's sublimity and his representation, not without some Spanish staginess, of the conflict of duty and passion in heroic human breasts, came Racine's polished and courtly expression of the agitations of the heart. Molière, the greatest French painter of men from life, showed himself in his *Tartufe* the scourge of hypocrisy; in his *Misanthrope* he was austere and touching; in the *Femmes Savantes* and in the *Précieuses Ridicules* he exposed the false and pedantic erudition of the woman of the period; in the *Avare* he related the plight of an unconscious miser; playful withal, castigating with sobriety, ruthlessly just and gently forgiving, uproariously funny and immensely suggestive, acting his parts himself in the happiest fashion, using the sharpest, tersest, and brightest French. Regnard followed him, but far behind. Then came Destouches, Le Sage, Piron, Gresset, Sedaine, without Molière ever having a rival, except perhaps Lafontaine, whose fables, conceived in the same inimitable French vein, are one and all natural or comic little dramas in which an apparently artless exhibition of the ways of animals and things leads to a neat moral applicable to man. Florian followed in his footsteps at a respectful distance. Madame de Sévigné gained a place for letter-writing as a distinctly French art, an accomplishment in which many Frenchwomen have excelled after her. In contrast to Bossuet's Hebrew-like eloquence and militant ecclesiasticism stood Fénelon, gentle, suave, and versatile, ever healing wounds and pointing a warning finger to dangers ahead. Totally different from either of them had been Pascal, an introspective pessimist oddly placed in the vestibule of an impersonal age, wrestling with doubt, bending the language to his intellectual agony, and planting upon the Jesuits the stigma of his honest, piercing satire. La Rochefoucauld, who wrote his contribution to moral philosophy before La Bruyère, was also a memoir-writer, a gift in which Cardinal de Retz, the naturalised Scotsman Hamilton, and the Duc de St Simon all excelled.

Amidst the mistaken foreign and home policy which was striking at the very roots of the nation, French literature offered towards the end of the long reign of Louis XIV. a spectacle of imposing intellectual force. France established thereby so well its claim to the leadership of society and literature in Europe that, thanks to a lull in native literary production, as in England, or to a comparatively backward state of culture, as in Germany, or to a paralysis of the national vigour, as in Italy, the French 17th century might seem to protract itself in all these countries even at a time when a total change was passing over French society, and pointing its literature in a new direction. The age of Louis XIV. was, above all things, that of a well-balanced literature, the work of men whose nerves are not upset, who are fully satisfied with the work suggested by their situation. Their stock of ideas was adequate to their power of treatment, and nothing came to mar the dignity and gravity with which they approached their subjects. There is a wholesome moral tone underlying their performance, and the

kind of repose bred from the illusion that one's work is final. But Louis XIV.'s senility and fanaticism, and after him the license and unscrupulousness of the regent, disorganised the court; a larger number of thinking and able men collected in Paris than the service of the state and of the church could occupy. Parisian society, once educated by the court and long led by it, broke away, and violently rebelled against an irksome tutelage. It returned to freedom first, then it welcomed adventurous minds which abandoned troublesome spiritual and moral loyalties to swell the ranks of drawing-room malcontents, while below them seethed a large class of *intrigants* and schemers recruited in the overgrown establishments of noblemen and courtiers. Literature, from being an art in itself, became subordinate to ideas; by an enormous influx of ripening thought it became a vehicle for hitherto unexpressed political, moral, religious and scientific matter. Till 1750 the disintegration of the old social body remained latent. Still, Montesquieu's *Lettres Persanes* and his *Considérations sur la Grandeur et la Décadence des Romains* announced plainly enough the advent of social satire, and the application of philosophic method to the study of political history. But his *Esprit des Lois*, by showing the interdependence of physical and moral laws and the conditions to which is subjected the legislator's apparent liberty, marks a clear departure from the traditional theories of government.

The great mouthpiece of the spirit of the age, Voltaire, belongs still in pure literature to the times of Louis XIV. His tragedies are classical, his literary criticism is that of Boileau, his poetry is an academic display of wit and sociability; but the remainder of his works form a complete battery in which his tales represent the light artillery and his histories the heavy guns. Combining passion with philosophic acumen, strangely divided between vanity and generosity, the personal friend of kings and the advocate of individual and popular rights, preaching tolerance and openly undermining public respect, deep in prejudice and the enemy of superstition, he showered upon the tottering edifice of French society pamphlets, treatises, letters, discourses, epistles—all of them shafts pointed with sarcasm, finely weighted with a touch of plausible learning, and feathered from the wing of his sparkling imagination. He was assisted in his incessant warfare by a host of talented and original thinkers. Sensualistic followers of Locke, like Condillac and Condorcet; combative materialists, like Helvetius and D'Holbach; encyclopædists, headed by Diderot and D'Alembert; earnest moralists like Vauvenargues; writers of novels and plays with a purpose, such as Le Sage and Beaumarchais, or with the object of minute psychological analysis, such as Marivaux and l'Abbé Prévost; naturalists, like Buffon and Bernardin de St Pierre, showed each in his own department of letters, art, or science, many even in several departments at once, one common spirit and an identical zeal by which all thinkers and writers, often unknown to themselves, worked in concert as if holding of malice prepense an intellectual Pentecost. The age was too much in earnest for plain comedy; it was too bitter for poetry; Gilbert almost alone wrung a true cry from his heart; Crébillon writes some overwrought tragedies, and Laharpe stands forth as the last critic of the Boileau school.

At this juncture J. J. Rousseau appeared to complete Voltaire. Born in Geneva, where the political institutions towards which France was moving were partly in existence, early weaned from an atmosphere still nominally Calvinistic, professedly at war with the philosophers, he gave them the support of his persuasive eloquence, passion, imagination, inspiration, enthusiasm, heating in fact their cold intellectualism with an emotional fire that quickened the seed of mischief, and raised the nation's pulse to fever-heat, till even Rousseau's voice was lost in the clamour of the Revolution. He broke fresh ground in the science of politics by his *Contrat Social*, in the art of education by his *Émile*, in pure literature by his *Nouvelle Héloïse*, painting a picture of more natural morals, often greatly at variance with morality. An unworthy son of the society of his day, he passed condemnation upon it. In the year after his death the political assemblies began the realisation of his ideas. Thus literature, at work among other causes, led straight to the Revolution. The ring of Mirabeau's oratory was heard for a few years above the turmoil in which perished the poet André Chénier.

As long as the axe did execution in France, and as long as Napoleon's sword held sway in Europe, literature did not raise its voice. Madame de Staël drew her inspiration from without, though mentally and emotionally in touch with J. J. Rousseau. She called the attention of France to the benefit it could derive from the study of independent foreign literature, such as the nascent literature of Germany and the established literature of England. She showed that the poetry of the Renaissance, derived from the ancients, elaborated into formal classicism, burdened with pagan associations, and modernised in Italy and Spain, could not be compared with the hidden bubbling springs welling forth in the chivalry and cathedrals of the land, and flowing from the lips of the greatest poets out of France.

By doing away with every sort of restriction and privilege the Revolution imparted a new unity to the French nation, immensely developed the function of the middle class, and threw open vast prospects to its hopes and ambitions. Becoming the centre of gravity of the nation, and holding in its hands the reality of power, it re-echoed the ideas of Madame de Staël. Chateaubriand, finding in a return to medieval ideals the proper food for his imagination and the right colours for his style, unwittingly favoured her liberalism. Then Lamartine stepped forth as the lyrical poet long looked for in vain, revealing in his reposeful, tuneful lines, often sad, and ever bathed in a dim religious earnestness, a beautiful and sympathetic side of French poetic sentiment which had never yet found a mouth able to utter it. A whole school of lyric poets followed in Lamartine's footsteps—Alfred de Vigny and Victor de Laprade being among the greatest. Casimir Delavigne is not free from the besetting sin of rhetoric, and Victor Hugo was master of too many instruments besides the lyre to be classed here. His position is that of founder and head of the French romantic school, as the men called themselves who threw off all allegiance to the classical traditions. He philosophised for his followers on romantic æsthetics, explaining what relation ugliness bears in art to beauty. He applied his doctrine in a series of dramas, to one of which, *Hernani*, the romanticists nailed their colours and compelled the public to bow. From 1830 to 1885 Victor Hugo was in all kinds of literature, at first an initiator, then a revered and victorious chief, and during his old age an idolised master. Under his leadership formalism was excluded from the technique of poetry; ingenuity and a free adaptation of rhetorical means to poetical ends taking the place of compulsory standards. In prose style was left similarly to individual initiative; the language being boldly bent to the purpose of the writer, and receiving its moulding from the originality and character of his mind. There was no longer a question of imitating set

models and complying with fixed precepts. Expression received its form from within. Hence a new, multiple, and often eccentric art, seeking too much after the pictorial and sensational significance of words, a general strain on the resources of language and of literary expression, but a profusion of striking effects, and the transference to the pen of many capabilities belonging properly to the brush, the pencil, or the chisel. Victor Hugo inaugurated thus a new method in literary composition. Taste and wit became of less moment, because literature no longer rested upon society as a whole, but upon the nature of each individual writer.

Romanticism represented three things: a return to ideals medieval, a recoil from ideals classical, and the awakening of modern France to its own ideals. Victor Hugo embodied all this in his long career. Royalist and Catholic at first, he sang odes to the past; adversary of the Academy and of the Théâtre Français, he gained seats in the first for his followers and the boards of the second for his and their dramas. Then, interpreting the inner life of the bourgeoisie, he wrote for them the poetry of their daily musings, of their affections, of their children. Next, led on to liberalism and to the breadth of human charity, he with one hand branded Napoleon III., with the other revealed what gleams of spiritual beauty shine unknown in the hearts of the lowest and poorest, while his imagination wrought into epic poems the history of the world and the destiny of man. Nobody ever did so much with words, and words never did so much for any one. The æsthetics of romanticism bore fruit in the transformation of dogmatic criticism into literary history. Sainte-Beuve applied the theory of the new practice with so much success that the critique of art and literature, always a favourite pursuit with the French, but long a cause of weakness, became one of their strongest points, and most beneficial to all literature. With him, Villemain, and Scherer, literary history became comparative as well as personal. To attempt an enumeration of Victor Hugo's followers, or of the writers in any given field, would break the proportions of this general survey, besides conveying a wrong impression, for it is a feature of this century that the activity of talent pervades several fields, and expresses itself in verse and in prose almost indifferently. Lamartine, for instance, was an orator and a historian as well as a poet. Victor Hugo was still more discursive. Few men sat down to their work with the intention of deriving their inspiration from the nature of their subject only. Subjects were rather chosen as themes, and their treatment showed a complicated compromise between man and thing. Michelet's history, for instance, is not separable from Michelet. After the first ado of the romantic movement, which immensely broadened the stream of French literature, the old and new flood mixed their waters and ran as it were into four principal masses. Poetry became more and more of an art and less and less of a substance, except in Alfred de Musset, who rivalled the finest performance of Lamartine and Victor Hugo without sacrificing his originality to either, sometimes toying with life, sometimes sneering at it, sometimes uttering the cry of man unredeemed from vice, crushed in sorrow, and bound in weakness, in a voice so true, in so sweet a melody, that he is the most loved of French poets. Below him stand the Parnassian poets, Leconte de Lisle, Baudelaire, Sully-Prudhomme, François Coppée, Catulle Mendès, and José Maria de Heredia; and conspicuous among his minor contemporaries are the ultra-romanticists Gérard de Nerval and Théophile Gautier.

The drama, to which Casimir Delavigne, Alfred de Vigny, and Alexandre Dumas laid stepping-stones for Victor Hugo, fell after him into the hands of the semi-classicist Ponsard, of Augier, Feuillet, Alexandre Dumas fils, and Sardou. The comic stage, occupied by the rapidly-constructed and rapidly-vanishing productions of Scribe, only seldom saw a real comedy. But as a set-off some of the old comic force entered now and then into the romantic drama, and trickled into many novels and romances. These were a genuine growth of the times, and, for variety, artistic treatment, psychological analysis, they rank high above every novel published before, with the exception of but a few to which they are historically affiliated. Novels are fantastic with Ch. Nodier, historical with Alfred de Vigny, realistic with Mérimée, Balzac, Flaubert, and Daudet, panoramic with Alexandre Dumas the elder, homely with Sandeau. George Sand, possessed like Madame de Staël of almost masculine gifts, and, like her, one of Rousseau's disordered kindred, exhibited in herself and in her books the play of the passions in their natural state, till she poured forth her mellowed ardour in pure idyls of country life. There is but a distant affinity between the 'realism' of some of the preceding writers, the 'naturalism' of Zola and Maupassant, and the 'impressionism' of the De Goncourts. A wave of liberalism in the Roman Catholic Church bore Lamennais, Lacordaire, and Montalembert to oratorical fame, while Renan shone in church history, Cousin and Auguste Comte in philosophy, Taine in scientific psychology. Béranger stood almost alone in having but one specialty. A liberal, though under the spell of the Napoleonic military glory, he raised to an art his turn for penning popular songs. The analytical qualities of the French mind and its power of constructive writing were nowhere better displayed than in the department of history. A. Thierry with fidelity and picturesqueness, Guizot with some heaviness, Thiers with patriotic complacency, Quinet and L. Blanc with too much passion, Michelet with an excess of the poetical faculty, De Tocqueville with breadth and insight, attached their names to some masterly work.

The end of the 19th and beginning of the 20th century found French literature in vigorous if somewhat distracted condition. Old schools still lingered, but reaction was strongly marked in every field. Groups or *chapelles* formed—and reformed—by the score. In poetry the Symbolist school, ci-devant 'Decadents'—Verlaine and Mallarmé at their head—rebelled against the lapidary Parnassian style, and began the cult of vagueness and obscurity, *vers libre* and word-music, which was taken up among others by Vielé-Griffin, Henri de Régnier, and the Belgians Verhaeren and Maeterlinck. The romantic tradition was upheld by Richepin and the Comtesse de Noailles; the classical by Jean Moréas and Charles Maurras. But the most remarkable development was the neo-Catholic nationalist school, represented in verse by Guérin, Claudel, Francis Jammes, and Péguy, the poet critic who fell in the Great War, which gave fresh impulse to this *traditionniste* movement. In drama the same *macédoine:* naturalist plays from Henri Becque, symbolist from Maeterlinck, romantic (verse) from Rostand; above all *pièces à thèse*, psychological, physiological, sociological—sensuous with G. de Porto-Riche, censorious with Brieux, pungently witty with Donnay, tense with Hervieu, violent with Bernstein, elevated with F. de Curel, to name no more of a brilliant band. Antoine's Théâtre Libre fostered individuality and audacity. In the novel these found still freer scope. Anatole France, foremost French man-of-letters of his age, linguist, historian, archæologist, artist, philosopher, and what not, has a

place apart. That master-analyst, Paul Bourget, helped to give naturalism its quietus, and following the psychological novel of Stendhal, showed new possibilities in realism. The *roman social* quickly took root. While Pierre Loti and the Tharaud brothers go abroad for their vivid pages, Bazin, Bordeaux, Boylesve depict French provincial life. While André Gide and Marcel Proust plunge ever farther into the dark unfathomed depths of the human soul, Pierre Benoit disports in romantic adventure. While Romain Rolland prides himself on his serene internationalism, Maurice Barrès, apostle of nationalism, waxes lyrical over his native soil. With Jules Lemaître, Brunetière, Faguet, Lanson, Doumic, Sarcey, there was no lack of critics to direct, dote, damn, and disagree. Bergson and Boutroux showed that philosophy was still a form of literature distinct from fiction. Henri Fabre, the naturalist, won the title of the Insects' Homer. Lavisse, Sorel, Hanotaux, the historians, Berthelot the chemist, and other savants took their seats among the 'Immortals.' Vigour and variety marked every department of letters at the dawning of the new century, and the War which ravaged and welded France brought no unity and no devastation to its rich perennial literature.

In France more than in any other country mental power is accompanied by the literary faculty. Hence all science and all manner of erudition claim a place in literature. An inquirer going the round of the interests of civilised man would with difficulty find an object of study or a branch of culture in which the French could not offer a model of presentment. Their literature is marked by symmetry and fullness in its successive periods, by continuity in its unity and variety, by evenness in its distribution over the pursuits of man, by regularity in its function towards society, by the amenableness of the people to its influence. Literature is a mightier instrument with them than elsewhere. They quickly respond to it. The susceptibility of the national character, its somewhat feminine eagerness and quickness of perception, which keeps society as it were in a continual whirl of integration and disintegration, and ideas in perpetual revolution, are the very endowments which make their literature the most uniformly readable of all. With a little less of the mind-quality about them, they would be happier and wiser, perhaps, but Europe would be duller and poorer.

The history of the French language may be studied in the dictionaries of Diez, Brachet, Littré, and Clédat, and in Brunot's *Histoire* (1905 *et seq.*); its grammar in such books as those by Diez, Bartsch, Brachet, and Gaston Paris. The serial *Romania* (since 1872), the *Zeitschrift für Romanische Philologie* (since 1877), *Romanische Forschungen* (from 1883), Dr Wendelin Förster's *Altfranzösische Bibliothek*, and Suchier's *Bibliotheca Normannica* may also be consulted.

For the history of the literature, see the monumental *Histoire littéraire de la France*, begun by the Benedictines and continued by members of the Institute (i.–xxxv. 1733–1915), but reaching only to the 14th century; Petit de Julleville's ample *Histoire de la Langue et de la Littérature française* (1897–99); and for early texts the works of J. J. Ampère, Léon Gautier, Aubertin, Gaston Paris, P. Meyer, and J. Bédier. For the 16th century Darmesteter and Hatzfeld; for the 17th, Voltaire, Demogeot, Laharpe, Sainte-Beuve, V. Cousin, Fournel, and Dupuy; for the 18th, Barante, Villemain, Bersot, Albert, Lord Morley, E. and J. de Goncourt; for the Revolution, J. Chénier, Géruzez, Maron, G. Merlet, and the De Goncourts. For the 19th century and contemporary literature, books by Charpentier, Merlet, Le Goffic, Mme. Duclaux, and critical essays on individual writers by Vinet, Sainte-Beuve, Villemain, Montégut, Prévost-Paradol, A. Pontmartin, Caro, Taine, Scherer, Paul de St Victor, G. Planche, H. Étienne, St René Taillandier, Janin, Saint-Marc-Girardin, Lemaître, Bourget, Brunetière, Faguet, Pollock, Saintsbury, and Henry James.

There are manuals covering the whole ground by Lanson, Brunetière, and Faguet, and in English by Saintsbury, C. H. C. Wright, Dowden, and K. T. Butler (1923). See also the *Grands Écrivains* series; editions by the societies of *Anciens Textes* and *Textes Modernes*; and the articles on the chief French writers in this Encyclopædia, as well as CHANSONS DE GESTE, DRAMA, FABLIAUX, NOVELS, PROVENÇAL, ROMANCE LANGUAGES, ROMANCES, ARCHITECTURE, MUSIC, PAINTING, SCULPTURE.

France, ANATOLE (pseudonym of Jacques Anatole Thibault), French man of letters, and the foremost writer of his time in France, was born in Paris, 16th April 1844. From his father, a bookseller and bibliographer of the Quai Malaquais, he inherited gifts of scholarship, while from his mother, a woman of religion and a lover of beauty, there came to him faculties of fancy and imagination. Outwardly the circumstances of his life were uneventful. Educated for a short time at a school in the Faubourg St Germain, and later at the Jesuit Collège Stanislas the chief influences which went to the moulding of his mind were the classics of Greece and Rome, and the spirit of the 18th century in France, while scarcely less important was the environment of his earliest years—old Paris, with its historical associations, with its book-stalls and curiosity-shops, with the microcosmic life of its quays. On the completion of his education there followed a period of teaching and also of desultory journalism, when work in verse but also in prose was contributed, mostly to the pages of ephemeral reviews devoted to furthering the aims of the Parnassian poets. To these activities the appearance in 1868 of *Alfred de Vigny*, a study of the great precursor of the Parnassians, was a natural sequel, and this was followed in 1873 by the publication of *Les Poèmes dorés*, a first volume of verse in the Parnassian style. In 1874 France was on the staff of the Senate Library, but soon resigning that position, returned to literature, edited a series of French classics for Alphonse Lemerre, the publisher of the contemporary poets, and became for a time a reader with that house. His work during this period, consisting of monographs on the classic writers of France, was collected and published as *Le Génie latin* (1913). In 1876, with *Les Noces corinthiennes*, came a second volume of verse, which revealed, like its predecessor, elegance without originality, a certain deftness of touch, a wide range of reading and interests, but little poetic inspiration. It was in prose, indeed, that France, as heir to the ironic tradition of Montaigne, Voltaire, Renan, was to find his true form of expression; in that medium, charged with satire, yet relieved throughout with pity and sympathy, was henceforward to be developed a philosophy of almost unrelieved scepticism. In 1879, as first attempts at fiction, appeared *Jocaste* and *Le Chat Maigre*, two short naturalistic novels, much inferior to later work, especially to their immediate successor, *Le Crime de Sylvestre Bonnard* (1881), which, crowned by the Academy, must be considered the first of France's masterpieces. Here, as in most of his stories, there is no continuous narrative, but a series rather of loosely connected sketches, essays, and meditations; through these, in a style charming as always in its harmony, grace, and rhythm, and in its studied simplicity and lucidity, is recorded with gentle irony the tale of Bonnard, the unworldly antiquarian, the earliest and certainly one of the most delightful of France's avatars. *Les Désirs de Jean Servien*, which followed in 1882, a novel of the naturalistic type, is one of the weakest of France's works, but *Abeille* (1883) is a pleasing fairy tale. *Le Livre de mon ami* (1885), an autobiographical account of early days, is an undoubted masterpiece in its kind, a

perfect fusion being contrived between the genuine impressions of childhood and the more critical reflections of maturity; hardly so successful in this manner were the sequels, *Pierre Nozière* (1899) and *Le Petit Pierre* (1918). In 1886 appeared *Les Enfants*, a collection of nursery stories, and for some years thereafter France's production was limited to short stories and to journalistic work in literary criticism. In the short story, as represented in the series *Balthasar* (1890), and in the later series *L'Étui de nacre* (1892), *Le Puits de Sainte-Claire* (1895), *Crainquebille, Putois, Riquet* (1904), *Les Contes de Jacques Tournebroche* (1909), and *Les sept femmes de la Barbe-Bleue* (1909), France cannot compare with the great masters in that craft, though even the most indifferent are models in style. In literary criticism, however, his name ranks high, although he represents the type of critic who, maintaining the essential subjectivity of criticism, does not criticise, so universal is his curiosity, so catholic his taste, so absolute his scepticism as to rules, canons, and principles of literature. In *La Vie littéraire* (4 vols. 1888–92), a collection of his work in literary criticism, contributed to *Le Temps*, France appears as an unrivalled *causeur*, as a trained and erudite historian, as in part a gifted moral philosopher, while in these four volumes, perhaps better than in more formal works, are reflected the essential convictions of the author—his universal scepticism and irony; his purely human and naturalistic conception of the world; his code of ethics (later beautifully expressed in *Le Jardin d'Épicure*, 1894), based exclusively on freedom, sympathy, and pity; his hostility to the traditions and institutions which support supernaturalism, asceticism, and dogmatism; his open advocacy of the thought and even of the ethics of the 18th century. After 1892 France forsook literary criticism for fiction, and in *Thaïs* (1890), *La Rôtisserie de la reine Pédauque* (1893)—the sequel, *Les Opinions de M. Jérôme Coignard* (1893), is in important respects inferior—and *Le Lys rouge* (1894), embarked on the period of his greatest artistic achievement, a period which ended in his election to the Academy in 1896. *Thaïs*, the tale of an early Christian hermit, who in saving a courtesan lost his own soul, is written in the tone of the Lives of the Saints, and is the most carefully finished of his works; *La Rôtisserie de la reine Pédauque*, a pastiche perfect in its sustained imitation of 18th-century style, has no plot, though there is a connecting interest centring round the epicurean Abbé Coignard, who, in his delight in confounding human reason by the spectacle of its infirmities and contradictions, may be taken as a projection of France himself. In both works, only more openly in the second than in the first, superstition and asceticism are made the sport of destructive irony. *Le Lys rouge*, a novel of contemporary life, reveals France's style in unmatched pellucidity; here, as always, conversations are of the very essence of the story, and from the point of view of art, if not from that of ethics, universal tribute has been rendered to this work. To the literary life of France in the period following 1897, the Dreyfus case must be taken as the key. Under the influence of that crisis, sceptic though he was, and as a result, one must suppose, of the ascendancy of the pity and sympathy which had always tinged his scepticism, France became, from what might be termed a conservative anarchist, an open champion of free-thought and socialism. In the four volumes of *Histoire contemporaine—L'Orme du mail* (1897), *Le Mannequin d'osier* (1897), *L'Anneau d'améthyste* (1899), *Monsieur Bergeret à Paris* (1901)—the course of this evolution in his thought is to be traced. These volumes consist of a series of articles originally contributed to *Le Figaro*, but they are articles of a kind which almost defy definition; sometimes they consist of a descriptive sketch with some of the elements of a short story, more often they are a commentary and mostly a satire on current events; in so far as a certain thread of narrative connects the whole, the various instalments may really be regarded as the chapters of a loose and rambling novel; thus *L'Orme du mail* is unique as a description of provincial life, *Le Mannequin d'osier* is a living picture of shabby gentility, while *L'Anneau d'améthyste* and its almost purely political sequel, *Monsieur Bergeret à Paris*, together form a bitter satire against the worldliness of the established church. Throughout the whole of the *Histoire contemporaine* it is in the life, character, and opinions of Professor Lucien Bergeret, a picture of France himself, that chief interest lies. In *Monsieur Bergeret à Paris* there are no more than hints of France's sympathy towards socialism, but shortly thereafter he definitely espoused that cause, and subsequently wrote and spoke much in its furtherance; *Opinions sociales* (1902) is an assemblage of his written views on questions social and economic; while *Vers les temps meilleurs* (1906) is a collection of his speeches on similar topics. Of the two stories in *Sur la pierre blanche* (1905), the second represents France's conception of a Utopia, but it is a Utopia essentially disappointing. Equally disappointing were the times in which the work appeared—no real political purification had followed from the Dreyfus case, the promises held out by socialism continued unfulfilled. In these circumstances disillusionment came to France. It was then that *La Vie de Jeanne d'Arc* (1909), an elaborate anti-clerical work, appeared, but more typical products of discouragement and cynicism were *L'Île des Pingouins* (1908), a pungent political satire on the vanity of human endeavour; *Les Dieux ont soif* (1912), an historical novel reflecting through Brotteaux des Islettes antagonism, on the part of the author, to the French Revolution, and *La Révolte des Anges* (1914), a novel chaotic in construction and anarchistic in philosophy. A pacificist prior to 1914, France nevertheless actively supported his country during the Great War with his pen, as in *Sur la voie glorieuse* (1915) and *Ce que disent nos Morts* (1916). Later he appeared as a somewhat sceptical apologist of bolshevism. In 1921 he was awarded the Nobel Prize in literature, and in 1922 appeared *La Vie en fleur*. He died 12th October 1924. The chief characteristics of France as a writer and his merits as a stylist have been indicated. Among his limitations are to be noted the essential formlessness of his longer works, a tendency to repetition, and a subjectivity which hampers his creative imagination, making his best characters no more than portraits of himself.

See works by G. M. C. Brandes (1908), G. Michaut (1913), V. Giraud (1914), W. L. George (1915), and L. P. Shanks (1919); also A. L. Guérard in *Five Masters of French Romance* (1916). Most of France's works have been translated into English; his table-talk, collected and recorded by P. Gsell, appeared in translation as *Anatole France and his Circle* (1922).

France, ISLE DE. See MAURITIUS.

Francesca da Rimini, the beautiful daughter of Giovanni da Polenta, lord of Ravenna, was given in marriage to Giovanni the Lame, son of Malatesta, lord of Rimini, on the conclusion of peace between the two houses. But her heart was already given to Paolo, Giovanni's brother; and in 1285 Giovanni, surprising the two lovers together, slew them both. The incident is woven into the *Inferno* of Dante. See Leigh Hunt's poem, D'Annunzio's tragedy, and Yriarte, *Françoise de Rimini dans la Légende et dans l'Histoire* (Paris, 1882).

Francesco di Paula, or ST FRANCIS OF PAOLA, founder of the order of the Minims, was born in 1416 at Paula or Paola, a village of Calabria. At the age of thirteen he was the inmate of a Franciscan convent; and at nineteen he retired to a cave where he inflicted on himself every species of self-mortification. The fame of his piety having attracted to his cell several emulators of his austere life, he obtained permission to erect a convent, and the new community received from Pope Sixtus IV. the title of the Hermits of St Francis of Assisi; but the title was changed by Alexander VI. to Minim-Hermits of St Francis of Paola. The founder established numerous communities in Italy, Sicily, France, Spain, and Germany, but the Minims were never settled in Great Britain or Ireland. To the usual conventual vows, Francesco added one of the most rigorous abstinence—flesh, eggs, cheese, and milk being strictly forbidden the entire year, except in illness. Popular report having attributed to Francesco several wonderful cures, Louis XI. of France, being ill, summoned him to his presence. Francesco was received with the highest honour, and attended the king on his death-bed. Charles VIII. and Louis XII. induced him to settle in France, and built him convents at Plessis-les-Tours and Amboise. Francesco died at Plessis on Good Friday 1507, and was canonised in 1519.

Franceville, a military station in French Congo or Gabun (q.v.), founded by De Brazza in 1881 on the Ogowé, near where the Passa enters it.

Franche-Comté, province of E. France, in the Rhone basin, corresponded to the former County of Burgundy, and comprised Doubs, Haute-Saône, and Jura departments. Capital, Besançon.

Franchise. See CONGRESS, PARLIAMENT, REFORM, REPRESENTATION, WOMEN'S RIGHTS, and the sections on the government in the articles on the various countries.

Francia (1450–1517), a Bolognese painter whose real name was Francesco Raibolini. Originally a goldsmith, medallist, and artist in niello-work, he became famous as a religious painter, influenced mainly by Perugino and Raphael. See C. G. Williamson, *Francia* (1900).

Francia, JOSÉ GASPAR RODRIGUEZ, usually called Dr Francia, Dictator of Paraguay, was the son of a small landed proprietor, of French or Portuguese origin, and was born near the town of Asuncion about 1757. He studied theology at the university of Córdoba, took his degree as doctor of theology, and was for some time a professor in that faculty. Next he adopted the profession of law, and practised for thirty years, earning a high reputation. He was past fifty when the revolution which shattered the Spanish yoke in South America broke out in Buenos Aires. Paraguay at first offered active opposition to the revolutionists, but ultimately sought to obtain independence for itself. Francia took a leading part in the movement, and on the declaration of independence in 1811 was appointed secretary of the first national junta. Two years later, under a new constitution, he was elected one of the two supreme consuls. Francia was himself virtually sole ruler from the first, and in 1814 was appointed dictator for three years. At the expiry of that time the dictatorship was given him for life, and the absolute control so conferred he exercised until his death in 1840. Under Francia's firm rule the condition of Paraguay rapidly improved, but the country went to ruin after his death. One characteristic of his government was a system of non-intercourse, political or commercial, with other nations. So strict were the regulations against foreign intercourse that ingress to or egress from Paraguay was next to impossible; and Francia's treatment of some foreigners who did get in, among them the famous savant Bonpland, was harsh and barbarous. He was a complete despot throughout, but his aims were not purely selfish. He was unscrupulous in his choice of means, and became more violent as he grew older and as the east wind blew. Yet he improved agriculture, promoted education, repressed superstition as well as religion, and enforced strict justice between man and man in his law-courts, however little he regarded it for himself. And it is said that his death was regretted by the people as a public calamity. Francia is a solitary figure full of interest of a kind, but is after all a very mean example of the old Greek tyrant, and becomes absurd when posed as a great hero and patriot.

See Rengger and Longchamp's *Essai Historique*, &c. (Paris, 1827); Spanish Life by Bazán (1887); and *Francia's Reign of Terror* (Lond. 1839), by J. P. and W. P. Robertson, two young Scotsmen whom Francia turned out of the country. Carlyle's interesting *Edinburgh* essay (1843) must be read with caution, in view of its bias favourable to the dictator.

Francillon, ROBERT EDWARD (1841–1919), novelist, was born at Gloucester. Educated at Cheltenham and Cambridge, and called to the bar in 1864, he was on the *Globe* newspaper from 1872 to 1894. *Grace Owen's Engagement*, a first novel, appeared in *Blackwood's Magazine* in 1868. Among later works were *Olympia* (1874), *A Dog and his Shadow* (1876), *King or Knave* (1888), *Jack Doyle's Daughter* (1894), *Mid-Victorian Memories* (1913).

Francis, SAINT. See FRANCIS OF ASSISI.

Francis I., king of France, son of Charles, Comte d'Angoulême, was born at Cognac, September 12, 1494, and succeeded Louis XII., his uncle and father-in-law, January 1, 1515. His first act as king was to reconquer Milan, which had been wrested from his predecessor two years before. Crossing the Alps by an unguarded pass, he attacked the Swiss mercenaries in the Milanese at Marignano (13th September 1515), and obtained a complete victory—the Swiss losing 12,000 men. In December 1516 he signed a concordat with the pope, which virtually broke down the independence of the French national church. On the death of Maximilian, emperor of Germany, in January 1519, Francis became a candidate for the imperial crown. But the election of Charles of Spain (henceforward known as Charles V., q.v.) provoked Francis to a declaration of war against him, though, in spite of all the splendours of the 'Field of the Cloth of Gold' near Calais (1520), the French king had failed to secure for an ally Henry VIII. of England, who afterwards joined the pope and the emperor. The papal troops drove the French out of Italy; the soldiers of Henry and the emperor invaded France on the north; the Constable Bourbon deserted to the enemies of Francis; and the principal Italian republics declared against him. The French king, after presenting for some time a bold and successful front to his many adversaries, was totally defeated and taken prisoner at the battle of Pavia, 24th February 1525. Charles carried his captive to Madrid, and only granted him his liberty a year later, Francis being compelled to renounce the suzerainty of Flanders and Artois, the duchy of Burgundy, and all his Italian possessions and claims, to promise the restoration of Bourbon to his former dignities, and to surrender his two sons as hostages. No sooner, however, did he regain his freedom than he induced Pope Clement VII. to absolve him from his oath; and England, Rome, Venice, Florence, and Genoa—all of whom were growing alarmed at the immense power of Charles—withdrawing from their alliance with the latter, and siding with his antagonist, the war in Italy

recommenced. On 5th May 1527 Bourbon's 'black banditti' stormed and sacked the Eternal City, and captured the pope. On the other side a French army was frittered away before Naples, having accomplished nothing. At last a peace was concluded at Cambrai, in July 1529, by which Francis retained Burgundy, but lost the Milanese, Flanders, and Artois. Hostilities were again renewed in 1534; yet, as before, only little was accomplished. The war was, however, marked by an alliance between Francis and the Turks, a proceeding which excited the indignation of Christendom. By the efforts of Pope Paul III., another treaty was concluded for ten years at Nice between Charles and Francis, 18th June 1538. Charles V.'s unfortunate expedition against Algiers once more stirred up the French king to renew the quarrel (1542), and he launched five different armies against the emperor. In spite of the battle of Cérisolles (14th April 1544), in which the French were completely victorious, Charles and his ally, Henry of England, marched upon Paris, and Francis was compelled to make peace at Crespy (18th September 1544), matters being left *in statu quo*. Francis died at Rambouillet, March 31, 1547. Superficially a man of brilliant parts, Francis had in reality at bottom a frivolous, changeable, licentious nature. Nevertheless he greatly fostered learning and art, inviting painters and scholars to his kingdom, founding libraries, opening schools, and building several of the finest palaces in France; but his persecution of the Vaudois and other Protestant sects has left a dark stain on his memory which all his patronage of artists and men of letters will not efface. See FRANCE; Cochrane, *Francis I. and other Studies*; Pardoe, *Court and Reign of Francis I.* (new ed. 3 vols. 1887); G. Paris, *François I.* (1888); Coignet, *Francis I.* (trans. 1889); H. Hauser, *Les Sources de l'histoire de France* (ii. 1909); also CHARLES V., and works there cited.

Francis I. (1708–65), emperor of Germany, was the eldest son of Leopold, Duke of Lorraine, and Grand-duke of Tuscany. In 1736 he married Maria Theresa (q.v.) of Austria. See AUSTRIA.

Francis II., emperor of Germany, and I. of Austria, was born at Florence, 12th February 1768, and in 1792 succeeded his father, Leopold II. The reign of Francis may be summarised as a series of wars against Napoleon, in which, except in the last, he was worsted. The first contest was that terminated by the Peace of Campo Formio in 1797, when Austria lost the Netherlands and Lombardy, receiving in return Venice, Dalmatia, and Istria; the next that in which Austria, after the great reverses of Marengo and Hohenlinden, was compelled to sign the Treaty of Lunéville in 1801. Then followed the short campaign of 1805, in which the defeat of the Russians at Austerlitz left Austria no alternative but to purchase peace at Presburg by the cession of Venetia, Tyrol, and Vorarlberg. In the following year, on the foundation of the Confederation of the Rhine, Francis renounced the title of German-Roman emperor, and contented himself with that of emperor of Austria, which he had already assumed in 1804. In 1809 another futile attempt to break the power of Napoleon again ended in disaster, Austria losing by the Treaty of Vienna (1809) the provinces of Salzburg and Carinthia, also Villach, Görz, Trieste, and a part of Croatia, Dalmatia, and Galicia. Then, after a short alliance with France, the emperor once more assailed his western antagonist; and this time, in conjunction with the Russians and Prussians, Austria won the battle of Leipzig (1813), and helped to complete the first overthrow of Napoleon. By the Treaty of Vienna (1815) Francis recovered his possessions in Lombardy and Venetia and Galicia. This success was probably due almost entirely to Metternich, who became virtual ruler of Austria in 1809. Francis was a type of the absolute despot who rules in such a way as to promote what he conceives to be the welfare of his subjects. His internal policy was, however, marked by the suppression of all liberal views in politics and in intellectual life, by a jealous concentration of political power in the hands of the emperor and his minister, and by a rigid adherence to the conservatism of the past. Although narrow in both mind and sympathy, Francis was a popular ruler, owing to his urbanity of manner and the simplicity of his courtly life. He died on 2d March 1835, and was succeeded by his son Ferdinand I. See Meynert, *Franz I.* (2 vols. Vienna, 1871–73).

Francis, JOHN, publisher of the *Athenæum* for half a century, was born in 1811. In August 1831 he entered the *Athenæum* office as a clerk, and two months later became its publisher, a position he held till his death, 6th April 1882. Francis took an active part in the movement for the repeal of advertisement duty on newspapers, as also the compulsory stamp and paper duty. The 'John Francis Pensions' were established by the Newsvendors' Benevolent Institute, as a memorial of him. See *John Francis, publisher of the Athenæum*, by J. C. Francis (2 vols. 1888).

Francis, SIR PHILIP (1740–1818), son of the Rev. Dr Francis, was born in Dublin. Leaving Ireland at twelve, he entered St Paul's School in London about the same time as Woodfall, afterwards editor and printer of the *Public Advertiser*. At sixteen Francis was appointed a junior clerk in the secretary of state's office, of which Henry Fox was the head, to whose family Dr Francis had acted as tutor. In 1758 Francis was secretary to General Bligh on his expedition against Cherbourg; in 1760 he was Lord Kinnoul's secretary during a mission to Portugal; in 1761 he acted as amanuensis to the elder Pitt, and in 1762 he was made first-clerk in the War Office by Welbore Ellis, then secretary at war. In December 1771 Francis was offered the post of deputy-secretary by Lord Barrington, which he declined, resigning his clerkship in the following March. In June 1773 he was nominated by Lord North, on Lord Barrington's recommendation, a member of the Council of Bengal. Always at enmity with Warren Hastings, he fought a duel with him on the 17th of August 1780, and was seriously wounded. In 1781 he returned home with a fortune largely acquired by playing whist with Mr Barwell, his colleague. He entered parliament in 1784 as member for Yarmouth in the Isle of Wight, afterwards sitting for Appleby till 1807. He was energetic in the proceedings against Hastings. He wrote many pamphlets. His ambition was to be governor-general of India; he received a knight-companionship of the Bath. He was devoted to the prince-regent, and a warm supporter of the 'Friends of the People.' In 1816 Mr John Taylor sent forth a book identifying Francis with Junius, but Francis never acknowledged having written the *Letters*. His young second wife, whom he married when seventy-four, was convinced that he must be Junius. No indisputable proof that Francis was Junius has yet been made public (see JUNIUS, and works there cited). See *Memoirs of Sir Philip Francis*, by Parkes and Merivale (1867), and *The Francis Letters* (ed. B. Francis and E. Keary, 1900).

Franciscans, also called MINORITES or LESSER BRETHREN, a religious order of the Roman Catholic Church, founded in 1208 by St Francis of Assisi (q.v.). Some idea of the extraordinary extension

of this remarkable institute may be formed from the startling statement that, in the dreadful plague of the Black Death in the following century, no fewer than 124,000 Franciscans fell victims to their zeal for the care of the sick and for the spiritual ministration to the dying. But this marvellous external progress was accompanied by serious internal controversies and divisions. In the original scheme of the institute its great fundamental characteristic was poverty, which St Francis proposed to render in his order not only more perfect theoretically, but more systematic in its practice, than in any of the contemporary institutes. For the accomplishment of this design, the rule which he drew up contained a few brief and simple provisions. But the difficulty of their literal observance led, even in the lifetime of St Francis, to an attempt in the general assembly of the order to introduce some important modifications; and, though the authority of the founder was sufficient to prevent the adoption of these modifications during his lifetime, and although his last will contained a special clause prohibiting all change of the rule, the attempt was renewed with still more determination under Brother Elias, his successor in the office of general of the order. The great subject of controversy was the nature and extent of the obligation of religious poverty, as vowed in the order. Francis desired that it should be understood in the most rigorous sense; and, in his scheme of poverty, neither the individual brethren nor the community could acquire or retain any right of property even in things of necessary use. The rigorous party in the order sought to carry out this principle to the fullest extent; contended that it was unlawful for the order to acquire a right of property in houses, convents, or even churches; and restricted their right in everything which they possessed to the simple use. Several successive popes sought, by explanatory decrees, to settle the dispute; and for a time a compromise was received, by which it was understood that the right of property in all *de facto* possessions of the order was vested in the see of Rome; but the foundations of the real controversy lay deeper than this. They regarded the practice, far more than the theory, of poverty; and the disputes to which they led issued not only in the formation of fresh offsets from the body in the new religious orders to be named hereafter, but also in a large, and, for a time, formidable, secession from the church in the sect of the Fraticelli (q.v.).

The supreme government of the Franciscan order, which is commonly said to be the especial embodiment of the democratic element in the Roman Catholic Church, is vested in a minister-general elected for six years, who resides at Rome. The subordinate superiors are the 'procurator-general,' the minister-general's substitute in case of absence from Rome or vacation of office; the 'minister-provincial,' who presides over all the brethren in a province; and the *custos* or 'guardian' (not called 'abbot'), who is the head of a single convent or community. The provincial alone has power to admit candidates, who are subjected to a novitiate or probation of two years; after which they may, if approved, take the vows of the order. Members advanced to holy orders undergo as 'scholars' a preparatory course of study; and if eventually promoted to the priesthood they are styled 'fathers' of the order; the title of the other members being 'brother' or 'lay-brother.'

A very important feature, however, of the organisation of the Franciscan, as it subsequently became of other orders, is the enrolment of non-conventual members, who continue to live in society without the obligation of celibacy; and in general are bound only by the spirit, and not the letter, of the rule. They are called 'Tertiaries' or members of the Third Order of St Francis. It is impossible to overestimate the value of this institution in the disorganised social condition of that age. The Tertiaries were bound, as the very first condition of enrolment, to restore all ill-gotten goods; to be reconciled with all those with whom they had been at feud; to devote themselves to the practice of works of Christian charity; to avoid all unnecessary expenditure; to renounce the use of personal ornaments; to hear mass daily; to serve the sick and the hospitals; to instruct the ignorant; and, in a word, to practise as far as possible in the world the substance of the virtues of the cloister. The institute in this form undoubtedly exercised a powerful influence in medieval society. It counted members in every rank, from the throne to the cottage; and, although it was in some instances deformed by abuses and superstitious practices, the aggregate results were undoubtedly beneficial.

The Franciscan order has been the parent of many other religious institutes. The earliest of these is that of the 'Observantists' or 'brethren of more strict observance,' called in France Cordeliers (q.v.). The party in the order which contended for the more rigid observance of the rule, after a protracted struggle—in which disaffection to the church itself was often strongly exhibited—obtained a separate organisation, which may be said to have been finally settled at the time of Leo X. The less rigid party, under the name of 'Conventuals,' obtained a distinct general, and an authorisation for their mitigated observance of the rule. Their churches and convents admit greater richness of architecture and decoration; and they are at liberty to acquire and retain, in the name of the order, the property of these and similar possessions, all of which are renounced by the Observant Franciscans. The latter community comprises nearly 100 provinces. Their constitution is that of the original rule, as already explained. A second offshoot of the Franciscan order, and in the same direction of rigorism, is that known as the 'Capuchin,' founded by Matteo di Basio, a Franciscan brother of the Observant rule, in the early part of the 16th century. Believing himself divinely called to revive the old spirit of his order, and learning that the modern habit of the brethren was different from that of St Francis, he began with externals, and procured for himself, and obtained the papal permission to introduce (1528), the peculiar habit, with a pointed hood or cowl (*capuche*), from which the name of the reformed order is derived. Along with this habit, however, Matteo adopted a very rigorous and mortified course of life, in which he was joined by others of the brethren; and the reform spread so rapidly among the community that in the year 1536 a general chapter of the new congregation was held. They were subject, however, to the jurisdiction of the general of the Franciscan order. One of the first generals of the new reform was Bernardino Ochino, afterwards notable by his defection to Calvinism. After the Council of Trent the Capuchins multiplied rapidly, though they were not introduced in France till the end of that century. A similar reform, to which the name of 'Recollets' was given (introduced in Spain by John of Guadalupe in 1500), was approved by Clement VII. in 1532; and many of the new brethren were among the first Spanish missionaries to the New World. A further development of the rigoristic spirit is the congregation of 'Discalced' or 'Barefooted' Franciscans. The author of this reform was a Spanish Capuchin, Peter of Alcantara. In his capacity of provincial of Estremadura, Peter introduced many reforms, and in 1555 obtained the approval of Pope Julius III. for a new rule, which was afterwards confirmed by Pius IV.

The notice of the Franciscan institute would be incomplete without the mention of the several orders of nuns; as those of St Clare (q.v.) or Poor Clares, the Capuchinesses, the Urbanist nuns, &c., which formed part of the same general organisation. None of these, however, presents any very peculiar features.

The Franciscan order in these several branches has at all times maintained its popularity in the Roman Catholic Church. When Helyot, in the beginning of the 18th century, published his great *Histoire des Ordres Religieux*, the Franciscan order numbered nearly 120,000 friars, distributed over above 7000 convents, and nearly 30,000 nuns, occupying about 900 convents. Since the French Revolution the number has of course been very much diminished, the order having been suppressed in more than one state; but it is still one of the most numerous in the Roman Catholic Church. Many of the foreign missions are mainly supplied by Franciscans, and they possess convents in almost every part of the world. They were preaching in Morocco, Armenia, and China before the end of the 13th century; in Abyssinia and on the Congo in the 15th; and in the 16th were active in Mexico and elsewhere in America.

As a literary order the Franciscans have chiefly been eminent in the theological sciences. The great school of the Scotists takes its name from John Duns Scotus (see DUNS), a Franciscan friar, and it has been the pride of this order to maintain his distinctive doctrines both in philosophy and in theology against the rival school of the Thomists, to which the Dominican order gave its allegiance (see AQUINAS). In the Nominalistic controversy the Thomists were for the most part Conceptualists; the Franciscans adhered to rigid Realism (see NOMINALISM). In the Free-will question the Franciscans strenuously resisted the Thomist doctrine of 'predetermining decrees.' Indeed, all the greatest names of the early Scotist school are the Franciscans, St Bonaventure, Alexander of Hales, and William of Ockham, the latter two, like Scotus himself, British theologians. The single name of Roger Bacon, the marvel of medieval letters, the divine, the philosopher, the linguist, the experimentalist, the practical mechanician, would in itself have sufficed to make the reputation of his order, had his contemporaries not failed to appreciate his merit. Two centuries later the great Cardinal Ximenes was a member of this order. The Popes Nicholas IV., Alexander V., Sixtus IV., the still more celebrated Sixtus V., and Clement XIV., also belonged to the institute of St Francis. In history this order is less distinguished, except for its own annalist, Luke Wadding (q.v.). In poetry we have St Francis himself. Jacopone da Todi is one of the most characteristic of mediæval hymn-writers; and in later times Lope de Vega closed his eventful career as a member of the Third Order of St Francis. In the revival of art the Franciscan order bore an active and enlightened part.

The first Franciscans reached England in 1220, and founded monasteries at Canterbury and Northampton. They made rapid progress; at the dissolution there were sixty-five Franciscan monasteries in England. The order was restored by the foundation of the English convent at Douay in 1617.

See Luke Wadding's *Annales Fratrum Minorum* (8 vols. 1626–40); Jessopp's *Coming of the Friars* (1888); *Monumenta Franciscana* (Rolls Series, 1858–82); Meehan, *Irish Franciscan Monasteries* (1891); Mrs Hope, *Franciscan Martyrs in England* (new ed. 1891); Miss Macdonell, *Sons of Francis* (1902); *Edin. Review* (1904); W. Moir Bryce, *The Scottish Grey Friars* (1909); C. L. Kingsford, *The Grey Friars of London* (1915); Little, *Studies in English Franciscan History* (1917).

Francis de Sales. See FRANCIS OF SALES.

Francis Joseph, emperor of Austria, king of Hungary, born 18th August 1830, the eldest son of the Archduke Francis (son of the Emperor Francis I.), came to the imperial throne in 1848 as the successor of his uncle Ferdinand I., who had been forced to abdicate (see AUSTRIA). His first task was to subdue the Hungarian revolt, and to effect the pacification of Lombardy. This accomplished, an era of reaction began. The national aspirations of the various ethnic constituents of the empire for political autonomy and freedom were rigorously suppressed, and a determined effort made to fuse them into one state, the nucleus and support of which should be the army; the emperor reasserted his claim to rule as an absolute sovereign; the policy of bureaucratic centralisation was again reverted to; and a close alliance was entered into with the Roman Catholic party to combat the advocates of liberal progress. In 1859 Lombardy was ceded to Sardinia; and by the war with Prussia in 1866 Austria was excluded altogether from Germany. At the same time she was compelled to hand over Venetia to the king of Sardinia, who had fought as the ally of Prussia. From this time a change came over the policy of Austria. The emperor thenceforward adopted a policy of conciliation towards the nationalities comprised in his dominions, and appeared especially desirous of gratifying Bohemia. In 1908 he annexed Bosnia-Herzegovina, which had been under Austro-Hungarian administration since 1878. By the death of his only son Rudolf (1858–89), Francis Ferdinand, son of the emperor's brother Karl Ludwig, who renounced his claims to the throne, became heir-presumptive. His assassination at Sarajevo (28th June 1914) was the immediate cause of the outbreak of the Great War. Francis Joseph died 21st November 1916, and was succeeded by Karl, a grandson of Karl Ludwig.

Francis of Assisi, founder of the Franciscan order, and a saint of the Roman Catholic Church, was one of the most extraordinary men of his age, illustrating in his career all the most remarkable characteristics of the religious life of the middle ages. He was born in 1182, of a family called Bernardone, at Assisi, where his father was engaged in trade. His baptismal name was John; but from his familiarity in his youth with the Romance, or language of the troubadours, he acquired the name of *Il Francesco* ('the little Frenchman'). In his early years he was remarkable for his love of gaiety and ostentatious prodigality; but even then his bounty to the poor was one of the largest channels of his wastefulness. He engaged eagerly in exercises of chivalry and of arms; and in one of the petty feuds of the time he was taken prisoner, and detained for a year in captivity at Perugia. An illness there turned his thoughts from earth; and, although he again engaged in military pursuits, a second illness at Spoleto decided his career for life. He now resolved to fulfil literally the counsels of the gospel, and he especially devoted himself to poverty, which, in the mystic language thenceforth familiar to him, he designated as 'his bride;' and he took a vow never to refuse alms to a beggar. He exchanged clothes with a poor mendicant; and, disregarding all remonstrance and ridicule, he ever afterwards continued to wear the meanest attire. He gave to a priest who was rebuilding a ruined church the price of his horse, which he sold for the purpose, and even sought to appropriate to the same use the moneys of his father, which, however, the priest refused to accept. To avoid his father's anger he took refuge in a cave, in which he spent a month in solitary prayer. His father, having in vain confined him in a dark room of his own house, cited him before the magistrates, and, on Francis's declining all civil

jurisdiction in such a case, before the bishop, in order to compel him to renounce his inheritance. Francis abandoned all, even to the very clothes he wore, and then declared 'till now he had been the son of Bernardone, but that henceforth he had but one Father, Him that is in heaven.' Thenceforth no humiliation was too low for Francis; he begged at the gates of monasteries; he discharged the most menial offices; he served the lepers in the hospital at Gubbio with the most tender assiduity. He worked with his own hands at the building of the church of St Damian, and at that of Sta Maria degli Angeli, which he afterwards called his 'Portiuncula,' or 'little inheritance;' and as the last act of self-spoliation, and the final acceptance of the gift of poverty, he threw aside his wallet, his staff, and his shoes, and arrayed himself in a single brown tunic of coarse woollen cloth, girt with a hempen cord. This was in his twenty-sixth year, in 1208. His enthusiasm by degrees excited emulation. Two of his fellow-townsmen, Bernard Quintavalle and Peter Cattano, were his first associates. They were followed, although slowly, by others; and it was not till 1210 that, his brotherhood having now increased to eleven in number, he drew up for it a rule, selected by thrice opening at random the gospels upon the altar, and taking the passages thus indicated as the basis of the young institute. The new brethren repaired to Rome, where their rule was approved at first only orally by Pope Innocent III. in 1210. The two following years were spent by the brotherhood in preaching and exhorting the people in various rural districts; and Francis, returning to Assisi in 1212, finally settled the simple constitution of his order, the church of Sta Maria degli Angeli being assigned to them as their home.

In common with the older forms of monastic life, the Franciscan institute is founded on the three vows of chastity, poverty, and obedience; but of these the second was, in the eyes of Francis, the first in importance and in spiritual efficacy. In other orders the practice of poverty consisted in the mere negation of riches. With Francis it was an active and positive principle. In other orders, although the individuals could not possess, it was lawful for the community to hold property in common. Francis repudiated all idea of property, alike for his order and for its members; he even disclaimed for them the property in those things which they retained for personal use—the clothes which they wore, the cord with which they were girded, the very breviary from which they chanted the divine office. The very impossibility, to human seeming, of these vows, was their strength. Numbers crowded to the standard of Francis. He told them off in parties to different provinces of Italy. Five of the brotherhood repaired to Morocco to preach to the Moors, and, as the first martyrs of the order, fell victims to their holy daring. Success removed all the hesitation with which the institute at first was regarded, and in 1216 the order was solemnly approved by Pope Innocent. From this date it increased with extraordinary rapidity. At the first general assembly, held in 1219, 5000 members were present; 500 more were claimants for admission. Francis himself inaugurated the future missionary character of his brotherhood by going (1223) to the East, and preaching the gospel in the presence of the sultan of Egypt himself; but the only fruit of his mission was a promise from the sultan of more indulgent treatment for the Christian captives, and for the Franciscan order the privilege which they have since enjoyed as guardians of the Church of the Holy Sepulchre. It is after his return to Italy that his biographers place the celebrated legend, which, to friends or to enemies, has so long been a subject of veneration or of ridicule—his receiving, while in an ecstasy of prayer, the marks (*stigmata*) upon his own person of the wounds of our Divine Redeemer. The scene of this event is laid on Monte Alverno, a place still sacred in the traditions of the order; and the date is September 17, 1224. Two years later St Francis died, October 4, 1226. On the approach of his last hour he requested that he should be carried upon a bier to the church, where he had himself placed on the bare ground, thus realising in his death the doctrine which he had made in life the basis of his system. He was canonised by Pope Gregory IX. in 1228.

The works of St Francis (folio, 1739) consist of letters, sermons, ascetic treatises, proverbs, moral apothegms, and hymns. The latter are among the earliest metrical specimens of the Italian language. They are exceedingly simple, and full of the tenderest expressions of the love of God. His prose is often more poetical than his poetry itself, abounding in allegory and poetical personification. Few writers have ever turned the love and admiration of external nature to a purpose so beautifully devotional. 'Of all the saints,' says Dean Milman, 'St Francis was the most blameless and gentle.' No saint, it may be added, has been the subject of more exaggerated panegyric from the writers of his order: one work—a parallel between St Francis and Christ—is disowned by the Roman Catholic community as a most reprehensible exaggeration, the fruit of an affectionate but most misdirected zeal.

See FRANCISCANS; also the Bollandist *Acta Sanctorum* for October 4; St Bonaventure, *Life of St Francis;* Butler, *Lives of the Saints;* Milman, *Latin Christianity;* Hase, *Franz von Assisi* (1856); Mrs Oliphant, *Francis of Assisi* (1871); books by Alemany (New York), Chérancé (trans. 1887), Le Monnier (2 vols. 1889; trans. 1894), Sabatier (trans. 1894), Canon Knox Little (1897), Tamassia (trans. 1911), Jörgensen (trans. 1912), Father Cuthbert (1912 and 1915), G. K. Chesterton (1923).

Francis of Paola. See FRANCESCO DI PAULA.

Francis of Sales, a distinguished Catholic saint, was born August 21, 1567, at the family castle of Sales, near Annecy, in Savoy. He was the heir of the family honours, and his education was designed by his father to fit him for a career of distinction. From the provincial colleges of La Roche and Annecy he was sent to Paris in 1580, where he entered the then brilliant school of the Jesuits. In 1588 he went to Padua to read canon and civil law, and pursued his studies there with great distinction till 1591. At this time his father, who had obtained for him a place in the senate, proposed to him a very brilliant and advantageous marriage; but he had already resolved to devote himself to the priesthood, and with difficulty obtained his father's consent to enter into orders in the diocese of Geneva. He soon became distinguished as a preacher. Very soon after his ordination he was employed by his bishop in a mission for the conversion of the Calvinistic population of Chablais, which had been recently annexed to the duchy of Savoy. The success of this mission was almost unprecedented. One of the most remarkable incidents of his mission was a conference with the celebrated Calvinist leader, Theodore de Beza. At the termination of this mission, Francis was in 1598 appointed coadjutor to the Bishop of Geneva, Mgr. Granier, with the title of Bishop of Nicopolis. It was with much difficulty that the pope, Clement VIII., induced him to accept this dignity. In 1602, having occasion to go to Paris, he was invited to preach the Lent in the chapel of the Louvre; and his lectures were reputed to have had so much influence in bringing about the conversion of several Huguenot nobles, that the king tried to induce him to accept a French bishopric, but in vain. Mgr. Granier died

before the preacher's return to the diocese, whereupon Francis succeeded to the bishopric of Geneva. His administration of this charge was beyond all praise. Being invited to preach the Lent at Dijon, he was once more pressed to accept a French bishopric. But he still declined this honour—but it is not the fact (as has been sometimes asserted) that he declined a cardinalate. It was about this time that he published his well-known *Introduction to a Devout Life*, which has continued to the present day one of the most popular manuals of piety and the ascetic life. Among his measures for the renovation of the monastic spirit, a very important one was the establishment of a congregation of nuns of the order of the Visitation, under the direction of Madame de Chantal, with whom he long maintained a correspondence on every subject connected with the spiritual and religious life, published in 1625. In 1620 his brother Jean François was given him as a coadjutor in the charge of his diocese. He continued, however, to labour to the last. His last sermon was delivered at Lyons on Christmas-day in 1622; on 27th December he was seized with paralysis, and on the 28th of the same month he expired. His remains were immediately translated to Annecy; and in 1665 he was solemnly canonised as a saint by Alexander VII., his festival being held on January 29.

His works were published in a collected form in 2 vols. folio at Paris in 1641, and by Migne in 9 vols. 1861–64; a new edition by Dom Benedict Mackey was issued in 1891–1912. The separate works (especially the *Devout Life*) have passed through innumerable editions and translations. There are French Lives by De Sales, Hamon, and Perennes (often reprinted), and in English by Lear (new ed. 1880). And see a book by Guillot (1873).

Francis Xavier. See XAVIER.

Franck, CÉSAR, composer, organist, and teacher, was born 10th Decemher 1822 at Liége, studied at the conservatory there, and from 1837 at that of Paris, where he was the pupil of Leborne for counterpoint and fugue, of Zimmermann for the pianoforte, and of Benoist for the organ, and gained a prize by a feat of transposition at sight. After teaching a while in Belgium, he returned to Paris as a teacher of the pianoforte. He was organist for many years at Ste. Clotilde, and in 1872 succeeded Benoist as professor of the organ at the Conservatoire. He was naturalised a Frenchman next year. He died 8th November 1890. Franck was a hard-working musician of genius. Ten hours a day given to teaching yet allowed him time for a great body of serious and sincere composition. He did not become widely famous till his appointment to the chair at the Conservatoire. About that time his cantata *Ruth*, unsuccessful some twenty-five years earlier, attracted notice. *La Rédemption* increased his renown in 1873; and was followed by *Rebecca*, a biblical idyll; *Les Béatitudes*, an oratorio, thought by some to be his best work; a number of symphonic pieces (*Le Chasseur Maudit*, *Les Djinns*, &c.); a symphony in D; much church and chamber music; and two posthumous operas, *Hulda* and *Ghisèle*. Belgian-born, of German family and character, Franck powerfully influenced the younger French musicians. Like Bach an organist, he often reminds one of Bach. See a book by his pupil Vincent d'Indy (Eng. trans. 1909).

Franck, SEBASTIAN, one of the earliest masters of German prose, was born at Donauwörth in 1499, and became a priest. Converted to Protestantism, he showed the bent of his mind in a *Treatise against the Horrible Vice of Drunkenness* (1528). But his insistence upon a moral reform in men's lives as being more important than a reform of dogma soon caused him to drift away from the school of Luther, and in 1531 he was banished from Strasburg, largely because of his advocacy of religious toleration in his *Chronica*, probably the first attempt at a universal history in the German tongue. Thereupon Franck settled in Esslingen as a soap-boiler, but in 1531 removed to Ulm, where he took up the calling of printer. The publication of his *Paradoxa* in 1534 was the ultimate cause of his expulsion from that city in 1539. He died in 1542 at Basel. Franck also published *Weltbuch: Spiegel und Bildniss des ganzen Erdbodens* (1534), *Chronica des ganzen teutschen Lands* (1538), *Die güldene Arche* (1539), and one of the earliest collections of popular proverbs in German in 1541. His historical writings, although distorted by mystic fancies, and from the modern point of view uncritical, are nevertheless distinguished for their justness and love of truth. See works by Bischof (1856), Hase (1869), Weinkauff (1877), Haggenmacher (1886), Löwenberg (1893).

Francke, AUGUST HERMANN (1663–1727), born at Lübeck, in 1692 became professor of Oriental Languages at Halle, in 1698 of Theology. A conspicuous Pietist and pupil of Spencer, he founded in 1695 at Halle a school for the poor, a pædagogium, a burgher school, a Latin school, a training seminary, and an orphanage, which last became the most important of them all.

Franco-German War. See FRANCE.

Francolin (*Francolinus*), a genus of birds of the grouse family, Tetraonidæ, closely allied to

Gray Francolin (*Francolinus ponticerianus*).

partridges. They are distinctly Ethiopian and Oriental birds, but one handsome species, the Black Francolin (*F. vulgaris*), used to be found in Spain, Italy, and Sicily, whence it has been hunted out. In Cyprus it still occurs, and has its home in Asia Minor, Palestine, and farther east.

Franconia, a loosely connected aggregate of districts and territories lying chiefly within the basins of the Rhine, the Main, and the Neckar, the exact boundaries of which have varied at different periods of history. Strictly taken, the name seems to have come into general use as a politico-territorial designation in the end of the 9th century, to indicate the districts included within a line drawn from Cologne to Cassel, thence to the Fichtelgebirge, and further by way of Nuremberg and Spires back to Cologne. This region was looked upon as the original home of the Frankish people, and as the centre of the Germanic empire; within its boundaries, and on its soil, the king of the Germans was for a long time both elected and crowned. It was, however, divided into two portions, East Franconia and Rhenish Franconia, the line of division between them coinciding, generally speaking, with the Spessart. The first duke in

(not of) Franconia was Conrad I., recognised in 906, but five years later elevated to the German throne. Shortly afterwards Franconia became immediately subject to the imperial crown, the dignity of duke being, it would seem, conferred or withheld at the emperor's pleasure. Meanwhile the region itself was split up into a great number of lordships, countships, and ecclesiastical domains, these last belonging in great part to the powerful bishops of Würzburg, Worms, Spires, Bamberg, and Mayence. In 1268, however, the bishop of Würzburg successfully asserted his claim to the title of duke in East Franconia, but it was a Franconia reduced to little more than the territory immediately subject to the bishop. In 1501 Maximilian I., when dividing the empire into circles, abolished Rhenish Franconia, and restricted the title Franconia to a circle nearly conterminous with the district included within a line drawn through Würzburg, Bayreuth, and Eichstädt. The name, however, ceased to be used officially from 1806 to 1837; in this latter year the three northern divisions of the kingdom of Bavaria (q.v.) were called Upper, Middle, and Lower Franconia.

Francs-tireurs ('free-shooters'), armed bands of French peasants and others that sprang into existence during the progress of the Franco-Prussian war. At first their military organisation was very imperfect; afterwards this defect was in some measure remedied, and they were even formed into regular corps. For the most part they carried on a guerilla warfare, attacking small detachments of the enemy, and cutting off foraging parties. At first they were not recognised by the Germans as having any military standing at all, and when captured they were shot; but after a time, when they co-operated with the regular French army, such recognition was accorded them.

Franeker, a handsome town of the Netherlands, province of Friesland, 9 miles WSW. of Leeuwarden by rail. It was formerly the seat of a university, founded in 1585, but abolished by Napoleon in 1810. Franeker possesses Elsinga's notable planetarium (1773–80). Pop. 8000.

Frangipani, an illustrious Roman house, whose authentic history goes back to 1014, and which played an important part in the quarrels of the Guelphs and Ghibellines in the 12th and 13th centuries. They fortified the Colosseum, and included the arch of Titus and part of the Palatine in their castles. One of the most notable of the family was Giovanni Frangipani, lord of Astura, who captured Conradin (q.v.) of Swabia in 1268, and delivered him to his enemies. A branch of the Frangipani still flourishes in the province of Udine. The Croatian family of the same name claim descent from the great Roman barons, but are really of Slav origin, their title being properly *Frankopan* ('Frank the lord').

Frankalmoign (Lat. *libera eleēmosyna*, 'free alms'). See FEUDALISM.

Franken. See FRANCONIA.

Frankenberg, a manufacturing town of Saxony, on an affluent of the Mulde, 32 miles SW. of Dresden, has manufactures of cottons, woollens, and silk-stuffs, also dye-works, a cigar-factory, and a foundry. It possesses some technical schools. Population, 13,000.

Frankenhausen, a town of Germany, in Thuringia, standing on the Wipper, 27 miles NNW. of Weimar, has brine-springs and a hospital. In the vicinity are the Kyffhäuser and Falkenburg with Barbarossa's Cave. Pop. 8000. Near Frankenhausen, on 15th May 1525, the revolted peasants under Münzer were defeated by the Saxon, Brunswick, and Hessian troops.

Frankenstein, a town of Prussian Silesia, on an affluent of the Neisse, 37 miles SSW. of Breslau, has a large trade in corn, also joiners' workshops, and establishments for making straw hats and carriages. Pop. 9000.

Frankenstein, in the romance of that name, written in 1816–18 by Mrs Shelley (Mary Godwin) in imitation of the old German stories of the supernatural, is the mortal who, having by the resources of natural science created a being in the form of man, is tormented by the monster of his own creation. In popular usage the term Frankenstein itself is often inaccurately applied to any creation which proves a cause of anxiety or disaster to its author.

Frankenthal, a manufacturing town of Bavaria, in the Rhine Palatinate, 7 miles SW. of Worms by rail, and 3½ W. of the Rhine by a canal. Its industries include a sugar-factory, machine and boiler works, a cork-cutting factory, a bell-foundry, and breweries, and it has a trade in wine, iron, and timber. A village existed here in the 8th century. Created a town in 1577, and shortly afterwards made a fortress, Frankenthal suffered severely in the Thirty Years' War; it was burned to the ground by the French in 1689, but rebuilt in 1697. Pop. 23,000.

Frankfort, the capital of Kentucky, is situated amid picturesque scenery on the Kentucky River, here crossed by a bridge, 29 miles NW. of Lexington, with a state-house, reformatory, and other institutions; pop. 10,000, trading in timber and manufacturing shoes, chairs, carriages, &c.—There is another Frankfort in Indiana, 45 miles NW. of Indianopolis; pop. 11,600.

Frankfort-on-the-Main (Ger. *Frankfurt-am-Main*), a wealthy commercial city in the Prussian province of Hesse-Nassau, formerly a free city, long famous as the place of election of the German emperors, and the seat of the Diet from 1816 till 1866, is situated on the right bank of the Main, 22 miles from its confluence with the Rhine at Mainz, and 112 SE. of Cologne by rail. Pop. (1800) 40,000; (1867) 78,000; (1875) 103,315; (1885) 154,513; (1900) 288,989; (1905) 334,978; (1910) 414,918; (1919) 433,002—mostly Protestants. The city has been much extended, and many handsome public and private buildings have been erected; but the oldest part still contains many narrow and crooked streets, with quaint, high-gabled houses. The fortifications have been replaced by ornamental promenades; the river is bordered by broad quays; and the ancestral house of the Rothschilds is now the solitary relic of the famous Juden-Gasse, the ghetto of Frankfort. The Roemer or town-house, a Gothic edifice of 1405–16, contains the Kaisersaal or imperial hall, where each newly-elected emperor held his public banquet, at which he was waited upon by the high officers of the empire. On the walls hang the portraits of the emperors from Conrad to Leopold II. The coronation took place in the cathedral of St Bartholomew (13th to 16th centuries), which also contains the chapel in which the Electors (q.v.) voted. The palace of the Prince of Thurn and Taxis (1730) was the meeting-place of the North German Diet from 1816 till 1866, while the Constituent Assembly of 1848–49 met in the church of St Paul. The Saalhof stands on the site of an earlier palace of the Carlovingian kings; the chapel dates from the 12th century. The new exchange was opened in 1879, the opera-house in 1880, and there are several other imposing public buildings, besides museums, art-galleries, a public library, numerous churches, many charitable institutions, a university (1913–14), to which is attached an 'academy of labour' for the better education of leaders of the labour movement, and two conservatories of music.

One of the squares is adorned with a statue of Goethe, a native of the town; in another is the elaborate Gutenberg monument, commemorating the invention of printing. Frankfort is connected with the suburb of Sachsenhausen, on the left bank of the Main, by seven bridges (two railway bridges), the oldest of which was built in 1342. The city lies at the junction of seven railways, which since 1888 have converged in the new Central Station, one of the largest and handsomest in Europe; it is the focus of many important roads; and it has direct water-communication with the North Sea *viâ* the Main and the Rhine. The commerce has thus at all times been considerable; and in the 16th century the Frankfort spring and autumn fairs, now insignificant except as leather and horse markets, were among the most important in Europe. The chief articles of trade are colonial wares, iron and steel goods, leather, hides, skins, coals, wine, and beer. The manufacturing industry has largely developed since the town became Prussian. Sewing-machines and other machinery, chemicals, soap and perfumery, iron goods, straw and felt hats are among the chief manufactures. Its chief importance, however, is due to its position as one of the leading money-markets of the world.

Frankfort is said to owe its name to Charlemagne, who led his Franks across a ford here to attack the Saxons beyond the Main. It was early recognised as a suitable place for national meetings, and in 794 Charlemagne convoked a council here. From 843 till 889 it was the capital of the eastern Frankish kingdom. In 1257 Frankfort was made the first free city of the German empire, and it also became the most important. In 1356 Charles IV. confirmed by the 'Golden Bull' (carefully preserved in the city archives) the right, which it had enjoyed since the days of Frederick Barbarossa (1152), of being the place for the election of the German emperors. The city embraced the Reformation in 1530; and in 1558 certain of the Protestant princes of Germany issued a declaration known as the *Frankfort Recess* in favour of the Augsburg Confession. Frankfort lost its independence in the Confederation of the Rhine, and from 1810 till 1813 it was the capital of a temporary grand-duchy. It recovered its privileges as a free city in 1816; but in 1866, having espoused the Austrian cause in the seven weeks' war, it was seized by the Prussians (July 16th), a fine of 6,000,000 florins was imposed on it, and on October 18th it was formally incorporated with Prussia. The Peace of Frankfort, which ended the Franco-German war of 1870–71, was signed 10th May 1871 at the Swan Hotel (now swept away) by Prince Bismarck and Jules Favre. The French occupied Frankfort from 6th April to 17th May 1920.

Frankfort-on-the-Oder, a town of Prussia, in the province of Brandenburg, 51 miles ESE. of Berlin, is a handsome, well-built town, with three suburbs, one of which lies on the right bank of the Oder, and is connected with the remainder of the town by a wooden bridge. The university, founded in 1506, was in 1811 incorporated with that of Breslau. Three great fairs are held annually. The principal manufactures embrace machines, hardware, organs, chemicals, stoneware, sugar, tobacco, spirits, leather, and paper. The town has also iron-foundries, tanneries, and breweries. Its situation on a navigable river, connected by canals with the Vistula and the Elbe, has always made it a place of considerable commercial importance. Pop. (1875) 47,176; (1919) 65,055. It was a flourishing member of the Hanseatic League in the 14th and 15th centuries; since then it has been several times besieged and ravaged in war. At Kunersdorf, 4½ miles E. of Frankfort, on 12th August 1759, Frederick the Great suffered a great defeat from the Russo-Austrian forces.

Frankincense (Lat. *tus* or *thus;* Gr. *libanōtos*), a name employed to designate various fragrant resinous substances which diffuse a strong fragrance in burning, and are on that account used in certain religious services. The frankincense of the Jews, and also of the ancient Greeks and Romans, was chiefly or entirely the substance now known as *Olibanum* (q.v.), the produce of the genus Boswellia (q.v.). Several trees, however, of different orders, yield substances used as frankincense instead of olibanum, in different parts of the world, as several species of Icica and of Croton in America; and the common fir (see FIR) in Europe, the resinous product of which is the Common Frankincense of the pharmacopœias, although in the shops concrete American turpentine is very often sold under this name. It is used in the composition of stimulating plasters, &c. Burgundy pitch is made from it. It is a spontaneous exudation from the tree, hardening by exposure to the air, and generally of a whitish or pinkish colour, with a rather agreeable odour and a balsamic taste. See INCENSE.

Franking Letters. On the introduction of the uniform penny-postage on all inland letters in 1840, the privilege formerly enjoyed by peers and members of the House of Commons, and many official persons, of *franking*—i.e. of sending and receiving letters duty free—was finally abolished. The privilege was claimed by the House of Commons in 1660, but the claim was rejected by the Lords, when it came before them as a clause in the Act 12 Charles II. chap. 35. Nevertheless, the indenture deposited with the letters-patent appointing Henry Bishop postmaster-general in that year expressly allowed the free transport of all letters to or from the king, the great officers of state, and single inland letters of the members of parliament for that session only. The practice of franking letters seems, however, to have been carried on until it was expressly granted, and the beneficiaries of the privilege defined, by the Act 4 George III. chap. 24 (1764). By this statute each member of either House of Parliament was entitled to send free ten letters every day, not exceeding an ounce in weight each, to any place in the United Kingdom, and to receive fifteen. As it was not necessary that the letter should be either written by or to the privileged person, the privilege was greatly abused. All that was requisite was that the member should write his name or title on the corner of the letter. But from 1837 till the abolition of the privilege it was required that the whole address should be written by the member; that he should add not only his name, but the name of the post-town, and the day of the month; and that the letter should be posted on the day on which it was written or the following day, and in a post-town within 20 miles of which the person franking was then actually resident.

Frankland, SIR EDWARD, D.C.L., LL.D., K.C.B. (1897), chemist, was born near Lancaster in 1825, and was appointed professor of Chemistry in Owens College in 1851, Bartholomew's Hospital in 1857, the Royal Institution in 1863, the Royal College of Chemistry in 1865, and the Normal School of Science, South Kensington, in 1881 (resigned 1885). He propounded the theory of valency. He was made F.R.S. in 1853, a corresponding member of the French Academy in 1866. He collected many of his papers in *Experimental Researches in Pure, Applied, and Physical Chemistry* (1878), and published, in addition to manuals and lectures, works on lighting, sanitation, &c., besides sharing

Lockyer's researches in the atmosphere of the sun. He died in August 1899.

Franklin, the English freeholder of former times, who held his lands of the crown, free from any feudal servitude to a subject-superior. He is one of Chaucer's group, and his description in the prologue to the *Canterbury Tales* will keep his memory from ever being forgotten. It is the finest picture in our literature of the hearty old country gentleman. In later times the franklin seems to have fallen in dignity (cf. *Winter's Tale*, V. ii. 173), his position apparently corresponding to that of the well-to-do yeoman; yet Dr Johnson's remark that franklin is 'not improperly Englished a gentleman servant' was at no time accurate.

Franklin, capital of Venango county, Pennsylvania, on the Alleghany River, 123 miles by rail (65 direct) N. of Pittsburg, with iron and lumber industries, and oil refineries. Its chief trade is in petroleum. Pop. 10,000.—Franklin in Tennessee, 20 miles S. of Nashville, gives name to a great defeat of the Confederates, 30th November 1864.—For Franklin district of Canada, see NORTHWEST TERRITORIES.

Franklin, BENJAMIN, youngest son and fifteenth child in a family of seventeen, was born in Boston, Massachusetts, 17th Jan. 1706. Equipped with such education as he could pick up in scant two years at a primary school, he was apprenticed at twelve to his brother James to learn the trade of a printer, at which he soon became notably expert. He had been there about three years when his brother established a newspaper called the *New England Courant*, which Benjamin, after assisting in the printing, was required to deliver to the subscribers. He so effectively repaired the deficiencies of his early education during the three or four years of his apprenticeship that he ventured to try his hand as a contributor to the columns of the newspaper, and with such success that, when his brother was arrested and imprisoned for a month by the Speaker of the Assembly for a too liberal exercise of his critical faculties, the management of the paper was confided to Benjamin. The younger brother presumed perhaps too much upon his success; and for this and other reasons, the relations of the two gradually ceased to be harmonious, and despairing of finding satisfactory employment elsewhere in Boston, Franklin sold some of his books for a little money, with the determination to try his fortune elsewhere. He finally drifted to Philadelphia, where he landed on the Market Street wharf one Sunday morning, a friendless lad of seventeen, with one dollar and one shilling only in his pocket. He was fortunate enough to find employment immediately with a printer who had very little knowledge of his business, and to whom therefore Franklin's expertness and ingenuity were not long in proving almost indispensable. Not many months elapsed before an accident secured him the acquaintance of Sir William Keith, the governor of the colony, who persuaded him to go over to England for the requisite material to establish himself in the printing business in Philadelphia, by the promise to advance what money he would need for this purpose, and also to secure to him the printing for the government. Franklin arrived in London on the 12th December 1724. Instead of the letters of credit he was authorised to expect were awaiting him there he discovered to his consternation that no one who knew Keith placed the smallest dependence upon his word, and a gentleman whose acquaintance he had made on the passage laughed at the idea of the governor giving a letter of credit, who, as he said, had no credit to give. Franklin soon sought and found employment in a London printing-house, where he remained for the next eighteen months. He then returned to Philadelphia, where, in connection with a fellow-printer whose father advanced some capital, he established a printing-house for himself. His skill as a printer, his industry, his good sense and personal popularity ensured him prompt and signal success. In September 1729 he bought for a trifle the *Pennsylvania Gazette*, a newspaper then only three months old, and in its columns proceeded to lay the foundations of a reputation as a journalist to which he owes no inconsiderable portion of his distinction among men.

In the following year Franklin married his old love, Deborah Read, now a widow, a young woman of his own station in life, by whom he had two children, a son who died in his youth, and a daughter, Sally, who afterwards became Mrs Bache, a name since honourably associated with the history of American science. In 1732 he commenced the publication of what is still known to literature as *Poor Richard's Almanac*, which attained a circulation then unprecedented in the colonies. His contributions to it have been republished in many languages. In 1736 Franklin was appointed clerk of the Assembly, in 1737 postmaster of Philadelphia; and shortly after he was elected a member of the Assembly, to which body he was re-elected almost uninterruptedly until his first mission to England, previous to which he was promoted to the office of deputy postmaster-general for the colonies.

In 1746 he commenced those fruitful researches in electricity which gave him a position among the most illustrious natural philosophers. He exhibited in a more distinct form than heretofore the theory of positive and negative electricity; by his famous experiment with a boy's kite he proved that lightning and electricity are identical; and he it was who suggested the protecting of buildings by lightning-conductors. His electrical discoveries secured to him at the comparatively early age of forty-seven an election to the Royal Society of London. Outside of his contributions to electrical science Franklin was the author of many other discoveries of only less importance; among them three are deserving of special mention. They are: (1) The course of storms over the North American continent—a discovery which marked an epoch in the science of meteorology, and which has since been utilised by the aid of land and ocean telegraphy. (2) The course and most important characteristics of the Gulf Stream, its high temperature, and the consequent uses of the thermometer in navigation. (3) The diverse powers of different colours to absorb solar heat.

But the researches upon which Franklin's scientific celebrity mainly depends occupied at the most only seven or eight years, and then gave way to the more immediately pressing calls of his country in other spheres, where only the true proportions of his genius were revealed. His electrical experiments, brilliant as they were, were only the embellishments of his greater career as a statesman and diplomatist. In 1757 he was sent to England to insist upon the right of the province to tax the proprietors of the land still held under the Penn charter for their share of the cost of defending it from hostile Frenchmen and Indians. His mission was crowned with success. He was absent on this work five years, during which he received honorary degrees from Oxford and Edinburgh. In 1764 he was again sent to England to contest the pretensions of parliament to tax the American colonies without representation. The differences, however, between the mother-government and the colonies in regard to the prerogatives of the crown and the powers of parliament at last became too grave to be recon-

ciled by negotiation. The officers sent by the home government to New England were resisted in the discharge of their duty, and in 1775 patriotism as well as regard for his personal safety decided Franklin to return to the United States, where he at once participated actively in the measures and deliberations of the colonists, which resulted in the declaration of their independence on the 4th July 1776, and in constituting what has since been known as the Republic of the United States.

To secure foreign assistance in prosecuting the war in which the colonies were already engaged with Great Britain, Franklin, now in the seventy-first year of his age, was sent to Paris. He reached the French capital in the winter of 1776–77, where his fame as a natural philosopher as well as a statesman had preceded him. His great skill as a negotiator and immense personal popularity, reinforced by the then hereditary antipathy of the French and English people for each other, conspired to favour the purpose of Franklin's mission. A treaty of alliance with the United States was signed by the French king on the 6th of February 1778, while opportune and substantial aids in arms and munitions of war as well as money were supplied from the royal arsenals and treasury. On the 3d of September 1783 his mission was crowned with success through England's recognition of the independence of the United States. Franklin continued to discharge the duties of minister-plenipotentiary in Paris until 1785, when, in consequence of his advanced age and increasing infirmities, he was relieved at his own request. He reached Philadelphia on the 14th of September 1785, when he was elected almost immediately president of the state of Pennsylvania, with but one dissenting vote besides his own. To this office he was twice re-elected unanimously. During the period of his service as president he was also chosen a delegate to the convention which framed the constitution of the United States. With the expiration of his third term as president in 1788 Franklin retired from public life, after an almost continuous service of more than forty years, with a fortune neither too large nor too small for his fame or his comfort. Franklin was the founder and first president of the Philosophical Society of Pennsylvania, and an honorary member of all the leading scientific societies of the Old World.

He died on the 17th April 1790, in the eighty-fourth year of his age, and was buried in the graveyard of Christ Church, Philadelphia. His writings continue to this day to be republished in almost every written tongue, and yet curiously enough he wrote nothing for the press after the termination of his editorial career except a half-dozen or more comparatively brief contributions to the journals of the day, for the rectification of public opinion in Europe on American affairs.

His complete writings, which have been edited by John Bigelow (10 vols. New York, 1886–87) and by Professor A. H. Smyth (with a Life, 10 vols. 1907), consist almost exclusively of letters addressed to private individuals, very few of which were given to the press in his lifetime. Even his scientific discoveries were communicated to the world in letters to personal friends. The very interesting autobiography was specially edited by Bigelow (1868). In the *Life of Franklin* by Bigelow, the author says he had 'tried to condense everything Franklin left behind him that any one not pursuing special investigations now cares to read of the most eminent journalist, philosopher, diplomatist, and statesman of his time.'

Franklin, Sir John, rear-admiral, Arctic explorer, and colonial governor, was born at Spilsby, Lincolnshire, 16th April 1786, the youngest son of a family of twelve children. Franklin acquired the rudiments of learning at St Ives, and attended Louth grammar-school for two years. His father, in business in Spilsby, had destined John for the church. Such, however, was his enthusiasm for the sea that he determined to be a sailor. A trial voyage to Lisbon only confirming him in this determination, he was in 1800 appointed to the quarter-deck of the *Polyphemus*, and had the following year the honour of serving in the hard-fought battle of Copenhagen. Two months after this engagement Franklin joined the *Investigator*, commanded by his relative Captain Flinders, and under this able scientific officer, who was commissioned to explore and map the coasts of Australia, acquired the skill in surveying so eminently serviceable to him in his future career. Wrecked in the *Porpoise*, August 18, 1803, off the coast of Australia, he made his passage from Canton to England in the *Earl Camden*, commanded by Sir Nathaniel Dance, and acted as signal midshipman in the action, on 15th February 1804, in which Captain Dance repulsed a strong French squadron led by Admiral Linois. A similar post he occupied with equal intrepidity on the *Bellerophon* in the battle of Trafalgar. Lieutenant, and latterly first-lieutenant, in the *Bedford*, Franklin distinguished himself in the attack on New Orleans by capturing one of the enemy's gunboats, receiving a slight wound in the hand-to-hand combat.

The project for the discovery of a north-west passage revived at this period in the nation, and Franklin was appointed to the *Trent*, as second to Captain Buchan of the *Dorothea*, in the expedition of 1818 sent by way of Spitzbergen. Though unsuccessful in its purpose, this voyage yet served to bring conspicuously before the leading scientific men of London Franklin's eminent qualifications for the command of such enterprises, his excellent seamanship, resourcefulness, disinterested love of science, perfect truthfulness and liberal candour in the recognition of the merits of his subordinates, his buoyant cheerfulness of temper, sustained by a deep sense of religion, and calm courage in danger. He was accordingly in 1819 entrusted with the command of an Arctic expedition proceeding from York Factory through Rupert's Land. Wintering the first year on the Saskatchewan, and in the next on the 'barren grounds,' the expedition in the following summer descended the Coppermine River and surveyed a considerable stretch of coast to the eastward, returning in 1822 to York Factory after having traversed 5550 miles by land and water. On his arrival the same year in England, Franklin was raised to the post-rank of captain, and elected a Fellow of the Royal Society. The succeeding year, 1823, he married Eleanor, youngest daughter of Mr Porden, a distinguished architect. In a second expedition, 1825–27, Franklin descended the Mackenzie River, and traced the coast thence through 37° to near the 150th meridian, approaching within 160 miles of the most eastern point attained by Captain Beechey co-operating from Behring Strait. In recognition of his achievements Franklin was knighted in 1829, and awarded the gold medal of the Geographical Society of Paris. His first wife having died in 1825, in 1828 he married his second wife Jane, second daughter of Mr John Griffin.

Appointed to the command of the *Rainbow* in the Mediterranean, Franklin rendered such important service in the 'war of liberation' as to receive from King Otho the Cross of the Redeemer of Greece, and on his return to England was created Knight Commander of the Guelphic order of Hanover. As lieutenant-governor of Van Diemen's Land (now Tasmania), 1834–43, he laboured strenuously to promote the social as well as the political well-being of the colony.

In 1845 Sir John was appointed to the command

of an expedition for the discovery of the North-west Passage. The expedition, consisting of the *Erebus* and *Terror*, with 134 chosen officers and men, sailed from Greenhithe on 19th May 1845, and was last seen on the 26th July following by a whaler in Baffin Bay, in 74° 48′ N. lat. and 66° 13′ W. long. Franklin's instructions directed him, after approaching the longitude of about 98° W., to make southwards for the coast, along which, basing his conclusions on previous surveys, he felt assured a passage could be navigated from the Fish River to Behring Strait. No tidings of the expedition having reached England, as many as fifteen expeditions were despatched between 1848 and 1854 by England and America, with the object of rescuing or at least finding traces of the missing explorers—a mission in which Lady Franklin bore a noble part. Traces of the missing ships were discovered by Ommanney and Penny in August 1850, and brought home by the *Prince Albert*, which had been fitted out by Lady Franklin. The first winter, as late at least as April 1846, had, it was ascertained, been spent by Franklin and his company behind Beechey Island. In 1854 Dr Rae, conducting an exploring party of the Hudson Bay Company from Repulse Bay, was told by the Eskimos that in 1850 about forty white men had been seen dragging a boat over the ice near the north shore of King William Island, and that later in the same season their bodies were found a little to the north-west of Back's Great Fish River, where they had perished of cold and famine. The latter statement was afterwards disproved, but articles obtained by the Eskimos from Franklin's party and brought home by Dr Rae indisputably proved that the Eskimos had communicated with members of the missing expedition. Following up the direction of Dr Rae's information, the government in 1855 sent two canoes down the Great Fish River. The results of this expedition, added to the examinations which had been made by the many other expeditions of all straits, inlets, and coasts, except the region to the north of the Great Fish River, showed that a party from the *Erebus* and *Terror* endeavouring to reach the Hudson Bay Company settlements had been arrested within the channel into which the Great Fish River discharges. The next exploring party in the yacht *Fox*, purchased and fitted out by Lady Franklin, Captain (afterwards Sir) Leopold M'Clintock, sailed from Aberdeen in July 1857. From the Eskimos in Boothia many relics of Franklin's expedition were gathered by the *Fox*, while articles belonging to Franklin's ships and skeletons found along the west and south coasts told a terrible tale of disaster. Above all, a record found in a cairn at Point Victory told the history of the expedition down to April 25, 1848. This record attested how Franklin on attempting to reach the coast of America was arrested by the obstruction of heavy ice pressing down from Melville Island through M'Clintock Channel (then unknown) upon King William Island.

An addendum in the handwriting of Captain Fitzjames, dated 25th April 1848, briefly narrated that the *Erebus* and *Terror* were deserted 22d April, 5 leagues NNW. of this, having been beset since 12th September 1846; that the officers and crews, 105 souls, under Captain Crozier, landed here in 69° 37′ 42″ N. lat., 98° 41′ W. long.; and that Sir J. Franklin died 11th June 1847. Although many relics of the ships were found in the possession of the Eskimos there is no reason to believe that the retreating crews met with foul play. The American Captain Hall's five years' sojourn among the Eskimos, during which he collected a variety of relics, only confirmed the conclusions reached by M'Clintock. In 1878–80 the expedition of Lieutenant Schwatka of the United States army found the skeletons and other relics of Franklin's men; the bones of one of Franklin's lieutenants (Irving) were brought to Edinburgh and buried. Such is all that is known of the fate of Franklin and his brave men. He is entitled to the honour of being the first discoverer of the North-west Passage. The point reached by his ships brought him to within a few miles of that attained from the westward by previous explorations. A monument erected in 1875 in Westminster Abbey commemorates his heroic exploits and fate. Lady Franklin, whose devotion to her husband and his work has been referred to, died on 18th July 1875 at the age of eighty-three years.

See the article POLAR EXPLORATION and the map there; also the narratives of the expeditions above referred to, especially M'Clintock's *Narrative of the Fate of Sir John Franklin* (1860); the Report of the committee appointed by the Lords Commissioners of the Admiralty (1852), with additional papers (1852), and papers relative to the recent Arctic expeditions in search of Sir John Franklin (1854); Brown, *The North-west Passage* (1858); comparatively brief monographs by Beesly (1880) and Markham (1891); and the Life by H. D. Traill (1896). Sir John's own works were a *Narrative of a Journey to the Shores of the Polar Sea in 1819–22* (1823), and a *Narrative of a Second Expedition in 1825, 1826, and 1827* (1828).

Franklinite, a mineral composed chiefly of peroxide of iron, with oxides of zinc and of manganese, found in considerable quantity in Suffolk county, New Jersey, near the village of Franklin, where it is smelted into iron.

Frankmarriage (*liberum maritagium*) was a species of estate tail, where a man, on the marriage of his daughter or cousin or near blood-relation, gave lands to be held of the donor for four generations by the donees and heirs of their bodies.

Frank-pledge, a custom prevailing in England before the Norman Conquest, whereby the freemen of a neighbourhood were responsible for the good-conduct of each other. Ten men formed an association called a *tithing*, in which the ten were answerable each for the others, so that, if one committed an offence, the other nine were liable for his appearance to make reparation. Should the offender abscond, the tithing, if unable to clear themselves from participation in the crime, were compelled to make good the penalty. The custom seems to have arisen out of the old family obligations, a man's relations being called upon to become securities for payment of the compensation and other fines to which he was liable. A law of Edgar compels every man to find a surety who shall be responsible for his appearance when judicially summoned; and the laws of Canute insist on every one belonging to some hundred and tithing, as well as on his providing sureties.

The *View of Pledge*, or ascertaining to what tithing a man belonged, was an important part of the business of the local courts, and ultimately fell to the *Court leet* or *Court of Frank Pledge*, a court of record held once in the year, and not oftener, within a particular hundred, lordship, or manor, before the steward of the leet: being the king's court granted by charter to the lords of those hundreds or manors. See MANOR.

Franks, the name applied about the middle of the 3d century to a confederation of Germanic tribes dwelling on the Middle and Lower Rhine. The most important of these were the Sigambri, Chamavi, Bructerii, Ampsivarii, Chatti, Attuarii, and Salii. Later they became divided into two principal groups—the Salians, inhabiting the districts on both sides of the Lower Rhine, and the Ripuarians, settled on the Middle Rhine. In the 3d and 4th centuries hordes of them began to move

southwards and westwards into Gaul. In 358 the Emperor Julian, although he defeated the Salian invaders, allowed them to establish themselves permanently in Toxandria, the country between the Meuse and the Scheldt. From this time Frankish chiefs and warriors frequently served in the Roman armies; and during the 5th century they rendered valuable service to the empire in stemming the tide of barbarian invasion, especially at Mainz in 406 and at Châlons in 451. By this time the Salian Franks had made themselves masters of northern Gaul, whilst the Ripuarians were still concentrated around Cologne. Under Hlodowig or Clovis, king (481–511) of the former confederation, the Franks were converted to Christianity, whilst by his conquests in central Gaul, and by his subjugation of the Alemanni and the Ripuarian Franks, he not only extended his dominions as far as the Loire in the one direction and the Main in the other, but he laid the foundations of what subsequently developed into the kingdom of France (q.v.). To the Salian Franks is due the celebrated Salic Law (q.v.), which was probably drawn up before their conversion to Christianity, and to the cognate confederation the *Lex Ripuariorum*, a code that differed very little from the *Lex Salica*. We learn that the Franks were a stalwart race of warriors, distinguished by their free martial bearing, their general aspect of fierceness, their long flowing hair, their blue eyes, and largeness of limb. They constituted a nation of democratic fighting-men, the voice of each individual being of as much weight in the council-hall as his arm was in the thick of battle. In the intervals of peace they tilled the soil, reared cattle, fished, and hunted. They lived together in villages, and had gardens and vineyards. Some amongst them also wrought in gold and iron. The only social grades in their communities were the king, the free Franks, and the slaves taken in war. To the king and his counts belonged the execution of the laws, which were not, however, administered by them, but by specially elected officers in each hundred. The king, although an hereditary ruler, was not an absolute one, his power being controlled in matters of greater moment by the tribal assembly (Marchfield), when all the men of the tribe met together once a year fully armed. See L. Sergeant, *The Franks* ('Story of the Nations' series, 1898).

Franz, Robert, composer, was born at Halle, 28th June 1815, studied under Schneider at Dessau in 1835–37, and in 1843 published his first set of twelve songs, which won the warm praises of Schumann, Mendelssohn, Liszt, and other masters. From then till 1868 he held various appointments at Halle; and when he was compelled to resign them from ill-health, the pecuniary difficulties that ensued were overcome by the exertions of Liszt, Joachim, and others, who in 1872 got up a series of concerts for Franz's benefit, which realised nearly £6000. He published over 250 songs with pianoforte accompaniments, a Kyrie, and several chorales and four-part songs, besides arrangements of the vocal masterpieces of Bach and Handel. Franz's best songs rank with those of Schubert and Schumann. He died 24th October 1892. See *critiques* by Liszt (1872) and Saran (1875).

Franzensbad, or Franzensbrunn, a watering-place situated on the north-western frontier of Bohemia, 3 miles NW. of Eger by rail. Lying 1460 feet above sea-level, between spurs of the Erzgebirge and the Fichtelgebirge, Franzensbad has a pure, fresh air and a yearly mean temperature of 45° F. There are a number of mineral springs, besides one which gives off carbonic acid gas and a ferruginous mud spring. The first named, which have a constant temperature of 51° to 54·5° F., are of saline and alkaline composition, and are beneficial for diseases of the throat, chest, stomach, liver, for gout and nervous disorders. Pop. 3000, increased by about 5000 visitors during the season. The Czech name is Frantiskovy Lazne.

Franz-Josef. See Francis Joseph.

Franz-Josef Land, an archipelago in the Arctic Ocean, north of Nova Zembla, extending, so far as it has yet been explored, between 80° and 83° N. lat. It consists of Graham Bell Land to the north-east, Wilczek Land to the east, Crown Prince Rudolf Land to the north, Alexandra Land to the south-west, and many other islands. Zichy Land, reported by Payer (1874) as separated by Austria Sound from Wilczek Land, turns out to be a group of islands. See map at Polar Exploration. The southern shores are deeply indented with fjords; and the whole archipelago, which rises into isolated flat-topped or dome-shaped mountains of basalt, is sheeted with ice. Owing to the open water round its shores in summer, and the comparative abundance of its animal life—bears, walruses, foxes, and numerous birds occurring—Franz-Josef Land was long regarded by experienced Arctic explorers as the most favourable base for an attempt to reach the North Pole. The archipelago was discovered and partly explored by Payer and Weyprecht in 1873–74; its southern shores were explored by Leigh Smith in 1880–82, and much of it by Jackson, who met Nansen there (1896), and by later explorers. The Russian flag was hoisted in 1914.

Franzos, Karl Emil, author, was born in 1848 in Russian Podolia, the son of a Jewish doctor, and passed his earliest years in the Polish-Jewish village of Czortckow in Galicia (the Barnow of his novels). Left an orphan at an early age, he was educated at the German gymnasium at Czernowitz, and studied jurisprudence at Vienna and Gratz, but afterwards settled as a journalist in Vienna. Among his principal works is *Aus Halbasien: Kulturbilder aus Galizien, der Bukowina, Südrussland und Rumänien* (1876), in which the varied surroundings of his boyhood are gathered into one masterly picture, and which has been translated into most European languages; it is continued in *Vom Don zur Donau* (1878); and *Das Ghetto des Ostens* (1883). His novels include *Junge Liebe*, two tales (1878; 4th ed. 1884); *Die Juden von Barnow* (3d ed. enlarged, 1880; Eng. trans., *The Jews of Barnow*, 1882); *Moschko von Parma* (1880); *Ein Kampf ums Recht* (1881; Eng. trans., *For the Right*, 1887); *Der Präsident* (1884); *Die Reise nach dem Schicksal* (1885); *Tragische Novellen* (1886); *Judith Trachtenberg* (1890; 4th ed. 1893); *Der Gott des alten Doktors* (1892); and *Der Wahrheitssucher* (1894). Franzos' tales present pictures strong, truthful, and pathetic of life among the Polish and Galician Jews. He died in April 1904.

Frasca'ti, a town of Italy, 15 miles SE. of Rome by rail, stands on the slope of the Alban Hills, near the site of ancient Tusculum. On account of its lovely villas and salubrious air it is a fashionable resort for the people of Rome. The most splendid of these summer residences are the villas Aldobrandini, Rufinella, and Torlonia. Cardinal York was bishop of Frascati, and Prince Charles Edward died here in 1788. Pop. 10,000.

Fraser, Alexander Campbell (1819–1914), born at Ardchattan in Argyllshire, studied at the university of Edinburgh, and in 1850–57 was editor of the *North British Review*. At first professor of Logic in the New College, and for a few months a Free Church minister, in 1856–91 he held the chair of Logic and Metaphysics at Edinburgh, and in 1859 became Dean of the Faculty of Arts. His edition of Berkeley's works, with dissertations and

notes, a life of the bishop, and an account of his philosophy, appeared in 1871, *Selections from Berkeley* in 1874, and in 1881 his monograph on *Berkeley* in Blackwood's 'Philosophical Classics,' to which series he also contributed *Locke* (1890). In 1894 he edited Locke's *Essay*, with prolegomena and biography; in 1895–96 delivered the Gifford Lectures on *The Philosophy of Religion*. In 1896 appeared his *Philosophy of Theism* (revised 1899). The article LOCKE in the present work is his. See his *Biographia Philosophica* (1904).

Fraser, CLAUD LOVAT (1890–1921), born in London, was educated at the Charterhouse, studied with Mr Walter Sickert and achieved great popularity as a stage and costume designer for the theatre, notably in *The Beggar's Opera*. See a book by Drinkwater and Rutherston (1923).

Fraser, JAMES, D.D., second Bishop of Manchester, was born near Cheltenham in 1818, took a first-class in classics at Oxford in 1839, and in 1840 was elected to a fellowship at Oriel. He was ordained in 1846, and held the livings of Cholderton, Wiltshire, in 1847–60, and Ufton Nervet, near Reading, in 1860–70. He was a select preacher before the university of Oxford in 1854–56, and again in 1862–64, and published valuable reports on elementary education in England, on the educational systems of the United States and Canada, and on the employment of children; indeed, it was specifically on the ground of his 'interest in and mastery of the question of public education' that Mr Gladstone in 1870 offered him the bishopric of Manchester. Here his energy, his wide sympathy, and his strong sense secured him a unique position in his vast diocese, and caused his death, on the 22d October 1885, to be deplored as sincerely by dissenters as by churchmen. See Lives by Hughes (1887) and Diggle (1889).

Fraser, SIMON. See LOVAT, LORD.

Fraser, SIR WILLIAM (1816–98), from 1852 an assistant-keeper in the Register House at Edinburgh, was in 1880–92 deputy-keeper of records there. From 1858 he issued a long series of sumptuous Scottish family histories.

Fraserburgh, a fishing town and port in the NE. of Aberdeenshire, 47 miles N. of Aberdeen by a branch railway (1865). It stands on a bay 2½ miles wide, immediately south of Kinnaird Head (the *Taixalon Akron* of Ptolemy), on which are the Frasers' old castle, a lighthouse now, and the mysterious 'Wine Tower,' with a cave below. It was founded as Faithlie in 1569 by Alexander Fraser of Philorth, Lord Saltoun's ancestor, and in 1601 was erected into the free port, free burgh of barony, and free regality of Fraserburgh. There are a handsome town-house (1855), a restored market-cross, a public hall, &c.; but hardly a trace remains of an abortive university (1592). The harbour has been much improved and extended since 1855, and the rapid growth of the place is due to the great development of the herring-fishery. Pop. 10,000, doubled during the fishing season.

Fraser Island (also called Great Sandy Island) projects for 50 miles NE. from the coast of southern Queensland, enclosing Hervey Bay.

Fraser River, the principal stream of British Columbia, is formed by two branches, the chief of which rises in the Rocky Mountains, in 53° 45′ N. lat. and 119° W. long., and proceeds in a north-west course to meet its fellow, which flows south-east from Lakes Stuart and Fraser. They unite near Fort George, in 54° N. lat. and 122° 45′ W. long.; thence the river flows in a southern direction, and after a total course of 800 miles falls into the Georgian Gulf, just north of the international boundary of 49° lat. Its chief affluent is the Thompson River. Platinum is got along the Fraser and its tributaries. The rich alluvial deposits of gold along the lower basin of the Fraser first attracted emigration to British Columbia, and the precious metal has since been steadily worked; but the lower valley now enjoys a more secure reputation, as containing some of the best farming land in the province. The salmon canneries are also important. Steamboats can navigate the river for about 100 miles from its mouth to Yale, where the rapids occurring during the passage through the Cascade Range, with its magnificent scenery, begin. See COLUMBIA (BRITISH).

Fraticelli ('little brethren'), a sect of the middle ages which may be regarded as an embodiment, outside of the mediæval church, of the same spirit to which is due, within the church, the Franciscan order with its many offshoots. The Italian word *Fraticelli* originally was the popular name of the Franciscan monks; but, in the progress of the disputes that arose in the order (see FRANCISCANS), the name was specially attached to the members of the rigorist party, and eventually to those among them who pertinaciously refused to accept the pontifical explanations of the monastic rule, and in the end threw off all subjection to the authority of the church. Several of the popes, especially Gregory IX. and Nicholas III., attempted to reconcile the disputants. Pope Celestine V. granted permission to the rigorists to form for themselves a separate organisation, in which the rule of St Francis might be observed in all its primitive and literal rigour. The suppression of this order by Boniface VIII. appears to have furnished the direct occasion for the secession of the extreme party from the church. They openly resisted the authority of the pope, whom they proclaimed an apostate from the faith. The party thus formed was increased by adhesions from other sectarian bodies, as the 'Beghards' and the 'Brethren of the Free Spirit.' In vain Clement V., in the Council of Vienna (1311–12), put forward a new declaration regarding the rule of St Francis. They still held their ground, especially in Sicily, central and northern Italy, and Provence. John XXII., against whom they sided actively with Louis of Bavaria, condemned them by a special bull in 1317, and again in a similar document directed against Henry of Ceva, one of their chief leaders in Sicily. From these sources we learn that they regarded the existing church as in a state of apostasy, and claimed for their own community the exclusive title of the Church of God. They forbade oaths, and discountenanced marriage. They professed a divine mission for the restoration of the gospel truth. They held that all spiritual authority was forfeited by sin on the part of the minister. It would even appear that they proceeded so far as to elect for themselves a pope, with a college of cardinals, and a regular hierarchy. Their principles, in a word, seem to have partaken largely of the same fanatical and anti-social tendencies as characterised the Brethren of the Free Spirit; and in common with them the Fraticelli were the object of a rigorous persecution about the middle of the 14th century. The principles of the sect formed the subject of a public discussion at Perugia in 1374 between them and a Franciscan monk named Paolucci, which appears to have ended in their discomfiture. They still maintained themselves, nevertheless, in central Italy, down to the 15th century, when John of Capistrano received a commission to labour for their conversion in the March of Ancona; but before the beginning of the following century they seem to have disappeared altogether. See Mosheim, *De Beghardis et Beguinabus* (Leip. 1790); Mil-

man's *Latin Christianity*, vol. v.; Herzog's *Real-encyklopädie;* Lea's *History of the Inquisition* (1888), and the *Catholic Encyclopœdia* (1910).

Fratta-Maggiore, a town of Italy, 9 miles by rail N. of Naples, with many villas belonging to Neapolitans. It has extensive rope-works, and cultivates wine and hemp. Silkworms are reared in great quantities. Pop. 13,000.

Fraud, in the legal sense, may be defined as deceit which causes injury to another. Active misrepresentation usually amounts to fraud; but a certain latitude is tacitly permitted to persons puffing their own goods, or exaggerating their own resources and credit. Concealment of the truth amounts to fraud if the party who withholds information is under a legal duty to disclose what he knows. A person purchasing an estate is not bound in law to inform the owner of its advantages; he may have discovered a mine of which the owner knows nothing, but he may conceal his discovery without being guilty of fraud. There are certain cases in which the rules are applied with special rigour. The party deceiving may be in a fiduciary position. A solicitor dealing with his client; a director dealing with a person applying for shares; a man of business dealing with a person who trusts to him and can make no inquiries—all these are plainly under a special duty to state the facts fairly. The party deceived may be incapable of protecting himself; —e.g. transactions with infants or with persons of weak mind must be strictly scrutinised. Again, the transaction itself may be one *uberrimæ fidei*, in which the law requires perfect good faith. A person insuring a ship, for example, is bound to tell whatever he knows of the condition and situation of the ship. It is to be observed that fraudulent intention is not a necessary element in fraud. A prospectus which omits to notice a contract entered into by promoters of a company is none the less fraudulent because the omission is accidental. A gift of property may be set aside as a fraud on creditors, although the donor made it in the full belief that he was perfectly solvent. The general effect of fraud is to render void the contract or disposition of property induced by it, or to give the party injured a right of action for damages or restitution. Even marriage may be treated as a nullity on this ground, if the fraud be such as to exclude the notion of true consent. The principles set forth above are, in substance, common to the laws of all civilised nations.

Fraud is an element in theft, embezzlement, personation, and many other crimes. The offence of obtaining goods or money by false pretences was not indictable by the English common law; it was made punishable by acts passed in 1542 and 1757, the provisions of which were consolidated and amended by the 24 and 25 Vict. chap. 96, which prescribes five years' penal servitude as the maximum punishment. Every person who fraudulently represents as an existing fact that which is not a fact, and so obtains money or money's worth, commits an offence within the act. The false pretence must relate to some present fact, and therefore a promise merely to do some act is not such a false representation as will sustain a conviction. It is not necessary that the deception should be by words or writing, but any act tending to deceive will bring a person within the statute. Thus, a man at Oxford wearing a cap and gown, in order to induce a tradesman of whom he ordered goods to believe that he was a member of the university, was properly convicted. The deception practised, however, must not be simply as to the *quality* of an article, for this is regarded as merely a dishonest trick of trade, and not criminally punishable. It is also necessary that the owner should be deceived by the pretence; and where a tradesman is induced to part with goods to a regular customer making a false statement, not on account of the statement, but from his belief in the credit of the party, the transaction is not punishable under the act. It is no bar to a conviction that the crime on being proved amounts to larceny, nor is it necessary to prove an intent to defraud any particular person; the obtaining delivery of money, &c. to another person for the benefit of the party using the deception, and also the obtaining signature to, or destruction of, a valuable security, &c. by a false representation subject the offender to punishment. The same statute provides that a person attempting to extort money by threatening to accuse another of certain felonies, or of an infamous crime, is liable to penal servitude for life (see THREAT).—*Long Firm* is the name given to a company of swindlers who pretend to be established in business at a particular place, order goods to be sent to them as such, and decamp without payment to resume the system elsewhere. The *Statute of Frauds*, frequently referred to, was passed in 1677.

In Scotland this offence is known as Falsehood, Fraud, and Wilful Imposition. Each species of the offence which in England is punishable under the statute is in Scotland indictable at common law. Thus, false personation, as where a man in the assumed character of an exciseman received money as a composition for smuggled goods, has been held to warrant a conviction of falsehood. So, also, where the deception consists in fictitious appearances; as where a man by fitting his shop with false bales induced another to trust him with goods. Obtaining money by begging-letters and the common practice of ring-dropping fall under this denomination of crime.

In the United States, to constitute the offence known as False Pretences, it is not necessary that the loss occasioned be of a public nature. It consists of a false representation as to some fact existing in the past or present, made with the intent to defraud, by which representation a party is induced to part with something of value to him, generally money, goods, or merchandise. The offence may be committed by a false representation of the nature, quality, or quantity of the goods, or by a false personation, or a false representation of the capacity in which one assumes to transact business; also by the use of false marks or brands, or fictitious or worthless writings, or the false reading of a deed of conveyance to an illiterate person, or by a warranty consisting of a positive false statement of a material latent fact by which a party is induced to purchase. It differs from larceny in that the property is obtained with the consent of the owner, and the false pretence must be the operative cause of the transfer. It is usually a misdemeanour, but the grade of the offence, as also the punishment therefor, is governed by statutes of the several different states. It is recognised as an offence by act of congress, known as the Bankrupt Act (*Rev. Stat.* 3732), but congress has no power to define what shall constitute the offence within a state. The money or goods obtained on false pretence may also be recovered by civil action.

Fraudulent Enlistment. See DESERTION.

Fraunhofer, JOSEPH VON, German optician, was born at Straubing, in Bavaria, 6th March 1787. In 1799 he was apprenticed to a glass-cutter and polisher in Munich, and in 1807 he was employed to found an optical institute at Benediktbeuern, of which he became sole manager in 1818, and which a year later was removed to Munich. There he became a member of the Academy of Sciences in 1823, and

was also appointed professor and conservator of the physical cabinet of the same institution. He died 7th June 1826. His more important inventions and improvements in optical instruments include a machine for polishing parabolic surfaces, another for polishing lenses and mirrors without altering their curvature, a spherometer, a heliometer, a micrometer, an achromatic microscope, and the great parallactic telescope at Dorpat. But his name has been rendered most celebrated by the improvements he effected in the quality of telescopic prisms and in the mechanism for manipulating telescopes of large size, and above all by his discovery of the dark lines in the sun's spectrum (see SPECTRUM), which bear the name of Fraunhofer's lines.

Fraustadt (Polish *Wszowa*), a town of Prussia, 14 miles NE. of Glogau by rail. It has a tannery, dye-works, a cigar and a sugar factory; here in 1706 the Saxons were routed by Charles XII. of Sweden. Pop. 8000.

Frazer, SIR JAMES GEORGE, folklorist, born in Glasgow in 1854, graduated at Cambridge in 1878 and became a fellow of Trinity. His *Totemism and Exogamy* (1910) developed out of *Totemism* (1887); and *The Golden Bough* (2 vols. 1890; 3d ed. rewritten, 12 vols. 1911–15; abridged 1922) absorbed many of his separately published studies of early superstition, religion, and society. In 1898 he issued a masterly translation of Pausanias; in 1918 *Folklore in the Old Testament*. Professor of Social Anthropology at Liverpool since 1907, he was knighted in 1914. A folklorist of the 'anthropological' school, he amassed a vast body of information relating to the killing of divine kings (see NEMI), vegetation spirits, &c.

Fréchette, LOUIS HONORÉ (1839–1908), 'Canadian poet-laureate,' was born at Levis, Quebec, called to the bar in 1864, and, after five years' residence in Chicago, elected to the Dominion parliament in 1874. He edited several journals, and published some prose works, plays, and translations into French; but his important productions are his poems, two volumes of which were crowned by the French Academy in 1880. Others are *Mes Loisirs* (1863), *La Voix d'un Exilé* (1869), *Pêle-mêle* (1877), *Les Oubliés* (1886), and *Voix d'Outremer* (1886), which proved him the most sympathetic of the interpreters of Canadian scenery and of French-Canadian traditions and aspirations.

Freckles (sometimes called *lentigo*) are small yellowish or brownish-yellow irregularly rounded spots, from the size of a pin's head to that of a split pea, frequently seen on the skin, especially of fair or reddish-haired persons. They are not often met with under the age of six or eight. They are most common on the face, but often occur on the hands and sometimes elsewhere. They are always most distinct in summer; but, though the influence of the sun's rays undoubtedly increases their distinctness, it is doubtful whether it can cause them. They are due to increased local deposit of pigment in the skin: and it may be noticed that persons subject to them do not bronze generally under the influence of exposure nearly so deeply as others. Many methods of treatment have been advocated for their removal; but in most cases at least the improvement is not permanent. Among the milder measures which sometimes succeed in improving the condition, is a lotion of hyposulphite of soda (15 to 30 grains) or of chloride of ammonium (15 grains), along with corrosive sublimate (½ grain to the ounce of water) applied to the part on rag or lint, and they are lessened in intensity by wearing a brown veil in summer.

Fredegond, first mistress, afterwards wife of Chilperic, king of Neustria, a woman of violent and unscrupulous character, who shunned not to slay all who stood in her way, in order to secure the throne for her own son, Clotaire II. She is, however, chiefly memorable on account of the relentless feud she waged with Brunhilda, wife of Sigbert, king of Austrasia, and sister of Chilperic of Neustria's first wife, Galsvintha; a feud whose bitter enmities were intensified by the rivalry between the two kingdoms. She died in 597 or 598.

Fredericia, a seaport and fortress of Denmark, on the east coast of Jutland, at the northern entrance to the Little Belt. Founded by Frederick III. in 1652, it was five years later stormed and razed by the Swedes, nor was it refortified until 1709. It suffered during the wars of 1848–49 and 1864. Pop. 17,000.

Frederick, a well-built city of Maryland, 61 miles W. by N. of Baltimore by rail, with several foundries, tanneries, flour-mills, and other manufactories. It contains a college (1797), a Jesuit establishment, and a state institution for the deaf and dumb. Pop. 11,000.

Frederick I., surnamed BARBAROSSA (Redbeard), Holy Roman emperor, of the Swabian family of Hohenstaufen, was born about 1123. He succeeded his father, Duke Frederick II. of Swabia, in 1147, and his uncle, Conrad III., as emperor in 1152. His reign was one long struggle against refractory but powerful vassals at home, and against the turbulent civic republics of Lombardy and the pope (Alexander III.) in Italy. By the capture in 1162 of Milan, the most hostile of the Italian cities, Frederick brought to his feet all the recalcitrant states of Italy; and even the pope, the last of his enemies, he seemed on the point of subduing five years later when he took Rome by storm. But at this juncture his army was suddenly smitten with a terrible plague, and his forces melted away from him. This was the signal for revolt in Lombardy; and when at length in 1174 Frederick was able to leave Germany with the intention of once more reducing his Italian subjects beneath his iron heel, he incurred a severe defeat at Legnano (1176). Nevertheless it was a defeat that proved to be more valuable to him than his previous successes. For it led him to change his policy of stern repression to one of clemency and concession, whereby he converted the Lombard cities from restless, determined enemies into contented subjects. At the same time, in 1177, he acknowledged Alexander III. as pope, and thus paved the way for the final pacification of 1183. In Germany Frederick endeavoured to curb the power of his greatest vassals by a policy of mingled conciliation and counterpoise: the hostility of the strongest he disarmed by investing them with new fiefs, or by raising their titular dignities, whilst the weaker he sought to keep in check by conferring additional rights upon their rivals, the municipal communities. Thus, he elevated the countship of Austria to the rank of a duchy, created Duke Ladislaus of Bohemia king, and granted Westphalia to the Bishop of Cologne, East Saxony to Bernhard of Anhalt, and Brunswick and Lüneburg to the Guelph princes. Besides this, he quelled the rebellious spirit of Henry the Lion of Bavaria, and asserted his feudal superiority over Poland, Hungary, Denmark, and Burgundy. When at the height of his power, however, he took the cross to go and war against Saladin. Marching by way of Hungary, Servia, Byzantium, and Asia Minor, he defeated the Moslems in two battles, at Philomelium and Iconium, but died suddenly, or was drowned crossing the Kalykadnus river (Gök-su) in Cilicia, June 10, 1190. Frederick, who was of great personal beauty and had winning manners, exhibited a resolute will, degenerating at times into gross cruelty, considerable administrative

skill, martial ardour, and a magnanimous ambition. No ruler of Germany ever won a more lasting place in the affections of his subjects than Frederick Barbarossa, about whose memory the patriotic aspirations of the German people have continued to cling in legend and song down to the present day. One persistent tradition makes him still asleep in the Untersberg near Salzburg or the Kyffhäuser in Thuringia, whence he will return to succour Germany in her hour of greatest need. His red beard has already grown through the stone table before which he sits, and from time to time he raises his head to see if the ravens are still wheeling round the mountain, or the hour of awakening has come—the dawn of a new golden age for Germany. See works by Prutz (3 vols. Danzig, 1871–73), Ribbeck (Leip. 1881), and Kallsen (Halle, 1882).

Frederick II., OF GERMANY, grandson of Frederick I. (Barbarossa), and son of the Emperor Henry VI., and of Constance, heiress of Sicily, was born at Jesi, in Ancona, 26th December 1194. In the fourth year of his age his father died, leaving him king of Sicily under the guardianship of his mother, who secured the favour of Pope Innocent III. for her son by acknowledging the pope as her feudal superior and conceding to him important privileges. In his eighteenth year Frederick set out, under the auspices of Innocent, to wrest the imperial crown from Otto IV., whom he succeeded in driving out of the empire with little trouble. On his promising to undertake a crusade, the pope sanctioned his coronation at Aix-la-Chapelle in 1215. Like his grandfather, Frederick was actuated by an ardent desire for the consolidation of the imperial power in Italy at the expense of the pontificate, which he wished to reduce to the rank of a mere archiepiscopal dignity. Having secured the nomination of his son Henry to the rank of king of the Romans, and appointed Archbishop Engelbert of Cologne as his vicegerent, he left Germany, and, after having been crowned emperor at Rome in 1220, devoted himself to the task of organising his Italian territories. He founded the university of Naples, gave encouragement to the medical school of Salerno, invited to his court and patronised men of learning, poets, and artists, and commissioned his chancellor, Petrus de Vinea, to draw up a code of laws to suit all classes of his German and Italian subjects. Frederick's schemes for the union of his vast and widely scattered dominions were, however, frustrated by the refractory conduct of the Lombard cities, and still more by the antagonism of the popes Honorius III. and Gregory IX. Frederick's departure to the East was originally fixed for the year 1223, but the necessity of subduing the turbulent Italian nobles and cities, and curbing his Saracen subjects in Sicily, caused a delay of two years, and then a further delay of yet two years more. The pope at length grew so impatient that Frederick was constrained to embark from Italy. Nevertheless he returned a few days later, under the plea of personal sickness; this brought down upon him a bull of excommunication from the vehement Gregory IX. In the following year, however, the emperor at length fulfilled his vow, and fulfilled it in brilliant fashion, by securing from the sultan of Egypt, without striking a single blow, the possession of Jerusalem and the holy places, together with a truce for ten years. Then, after crowning himself king of Jerusalem with his own hand, 18th March 1229, he returned to Italy, where the continental half of his kingdom of Sicily had been overrun, at the instigation of the still irreconcilable pope, by a body of mercenary soldiers. During the remainder of his reign Frederick was engaged in a long and harassing contest with the papal power, the hands of his enemy being gradually strengthened by the accession of the revolted Lombard cities and of several of the princes and towns of Germany, headed by his own son Henry, and by the treachery of his most trusted and intimate friend, the chancellor Vinea. In 1239 he was again excommunicated for having proclaimed his natural son Enzio king of Sardinia, in defiance of the protest of the pope. Nor did the fury of the struggle abate when, in June 1243, Frederick's friend, Sinibaldi Fiesco, succeeded to the pontificate as Innocent IV. And the clouds of disaster, defeat, and misfortune were gathering thicker and more ominously above Frederick's head, when he died somewhat suddenly at Fiorentino, 13th December 1250.

This emperor is one of the most outstanding figures of the middle ages; and, like nearly all such personalities, his character was a blending of contradictory qualities. Intellectually he was perhaps the most enlightened man of his age, in many respects outrunning it by some centuries, as in his tolerance of the Jews and the Mussulmans, in the admiration of the spirit of free trade shown in his commercial legislation and policy, in his recognition of popular representation by annual parliaments, and in his anticipation of the later humanistic movement; but at the same time he was a persecutor of the heretics of the church, a staunch upholder of absolute sovereignty, and a supporter of the power of the princes against the cities. The strength, energy, and elasticity of his character were sadly marred by very conspicuous strains of licentiousness, cruelty, and perfidy. But, though he lacked the moral greatness of his ancestor, Barbarossa, he deserves unstinted admiration for his encouragement of learning and culture, and his fostering care of the arts and sciences. He himself not only spoke the principal languages of his extensive empire—German, French, Italian, Latin, Greek, Arabic, and Hebrew—but he also was one of the first to write Italian poems, took a great interest in the arts, and was himself a diligent student of natural science. It has been brought as a reproach against him that he unduly neglected his territorial possessions in his native country of Germany, and that in religious matters, notwithstanding his crusade, he was far from being a model son of the church, though he was not, in all probability, the 'atheist' his ecclesiastical enemies made him out to be.

See Giesebrecht's history of the emperors; Freeman's essay; books by Schirrmacher (1859–65), Huillard-Bréholles (1852–65), Kington-Oliphant (1862), Winkelmann (1889), Halbe (1888), Felten (1888), Hampe (1899), Blondel (Par. 1892), and Allshorn (*Stupor Mundi*, Lond. 1912).

Frederick III. or **IV.,** German emperor, and the fifth Duke of Austria of that name, was born at Innsbruck, 21st September 1415, being the son of Duke Ernest, of the Styrian branch of the House of Hapsburg. At the age of twenty he assumed the government of Styria, Carniola, and Carinthia. On the death of the Emperor Albert II. in 1440, Frederick was elected king of the Germans; twelve years later he received the imperial crown at the hands of the pope at Rome, and in 1453 he secured the archducal title to his family. Owing to the indolence and indecision of his character his reign was a period of anarchy, wars raging on all the frontiers of the empire, and internal disorders vexing its peace within. During the course of his long and inglorious reign Frederick lost his hold upon Switzerland; purchased peace from his brother Albert, who ruled in Upper Austria, by the payment of a large sum of money; suffered Sforza to possess himself of Milan, George Podiebrad to seat himself on the throne of Bohemia, and Matthias Corvinus on that of Hungary; surrendered the empire to the pope by the Vienna Concordat of 1448; remained apathetic when the

Turks in 1469 penetrated as far as Carniola, and again in 1475, when they almost reached Salzburg; and finally in 1485 provoked Matthias of Hungary to invade his territories. Nevertheless, by the marriage of his son, Maximilian I., to Mary, daughter of Charles the Bold of Burgundy, he laid the foundation of the subsequent greatness of the Hapsburgs. Frederick died on 19th August 1493. Though he neglected the interests and duties of the imperial crown to indulge in his favourite studies, alchemy, astrology, and botany, he never lost an opportunity of promoting the aggrandisement of his own family. He was temperate, devout, parsimonious, scrupulous about trifles, simple in his habits, mild and phlegmatic in his disposition, and naturally averse to exertion or excitement. From his time the imperial dignity continued almost hereditary in the House of Austria, which has perpetuated the use of his favourite device, A.E.I.O.U.—*Austriæ Est Imperare Orbi Universo* ('It is Austria's destiny to rule the entire world'). See Chmel's *Friedrich IV.* (2 vols. Hamburg, 1840–43).

Frederick I., king of Prussia, and third elector of Brandenburg of that name, was born at Königsberg, 11th July 1657, and succeeded to the electorate in 1688. Following out the policy of his father, Frederick-William, the Great Elector, he lent valuable support to William of Orange in his attempt on England. He employed the treasure collected by his father largely in the purchase of minor principalities and territories; and further increased his revenue by lending his soldiers to fight the battles of the neighbouring princes, especially against France. But the outstanding event of his reign was his own elevation to the dignity of king, 18th January 1701, the title being taken from Prussia, the only independent portion of his dominions. Good-natured but vain, generous but ungrateful, Frederick left the finances of his country in an embarrassed condition. Nevertheless, his public spirit led him to found the university of Halle, to embellish Berlin, to found there the Academy of Sciences and the Academy of Painting and Sculpture, and also to establish a supreme court of appeal. Frederick died 25th February 1713, and was succeeded by his son, King Frederick-William I. See works by Hahn (3d ed. Berlin, 1876), Ledebur (Berlin, 1878), and Heyck (1901).

Frederick II., OF PRUSSIA, surnamed 'THE GREAT,' born at Berlin, January 24, 1712, was the son of Frederick-William I., and of Sophia-Dorothea, daughter of George I. of Great Britain. His early years were spent under the restraints of an irksome military training and a narrow and unsympathetic system of education, against which not only the natural restiveness of youth but also the more liberal tastes implanted by his mother rebelled fiercely but vainly. At the age of eighteen the prince made an unsuccessful effort to escape to the court of Great Britain. His father saw in this attempt an act both of political rebellion and of military insubordination, and, influenced perhaps by the desire of saving the glory and acquisitions of his house from one whom he considered an unworthy successor, would have punished Frederick with death, had it not been for the intercession of the emperor. As it was, the prince was ordered into close confinement at Küstrin, while his confidant, Lieutenant Katte, was beheaded before his eyes. Frederick recognised that submission was inevitable. He threw himself with nervous alacrity into the military and civil duties with which he was after a time entrusted, while his letters to his father of this period are couched in almost servile terms. He won his final restoration to favour when in 1733 he dutifully accepted the bride chosen for him by his father (the Princess Elizabeth-Christina of Brunswick-Wolfenbüttel, 1715–97). From 1734 Frederick resided at Rheinsberg, where he held a kind of small literary court, and devoted his leisure to the study of music and French literature, for which he had a keen and lasting admiration. He corresponded with Voltaire (who afterwards, in 1750, visited Berlin), and studied with much sympathy the 'philosophical' doctrines which were to play so important a part in the century. There is no doubt that he now began to nourish schemes of political ambition. Even before he came to the throne he clearly perceived that, if the House of Hohenzollern was to play an adequate part in European politics, its possessions must be consolidated and extended; before he died the area of Prussia was doubled, and, notwithstanding the temporary eclipse under Napoleon, the foundation of Prussia's greatness was laid. Hostile critics assert that Frederick's prevailing motive was mere selfish dynastic ambition; they point to the fact that all his wars were aggressive, and that in every case he struck the first blow; they reproach him with unpatriotically encouraging the interference of France in the affairs of Germany for his private ends, and they taunt him with his contemptuous neglect of German literature and language, which last he could scarcely speak, and certainly could not spell. But there is no doubt that the terrible struggle of the Seven Years' War left him, if it did not find him, with a true appreciation of the solidarity of his own and his people's interest; he assuredly did not spare himself in their service; and his measures and reforms, harsh and autocratic as many of them now appear, were undertaken with a single eye to the national good. The rise of Prussia under Frederick really rendered possible the union of Germany which his critics accuse him of retarding, but which could never have been effectually carried through under a dominant Austria, haughty with centuries of imperial tradition.

On May 31, 1740, Frederick became king; and in the following October the accession of Maria Theresa separated the crown of Austria from the imperial diadem. Frederick, in possession of an admirably drilled army and a well-filled treasury, seized the opportunity. Reviving an antiquated claim to Silesia, he entered that province (December 1740) before his formal declaration of war reached Vienna, defeated the Austrians at Mollwitz (April 1741) and Chotusitz (May 1742), and, having concluded an alliance for fifteen years with France, forced Maria Theresa to yield him Upper and Lower Silesia by the Treaty of Breslau in June 1742, which closed this first Silesian war. The second Silesian war (August 1744 to December 1745) left Frederick with still further augmented territories, and the reputation of being one of the first military commanders of the day. The next eleven years were years of peace; but Austria was not yet reconciled to the loss of Silesia, and Frederick's energetic internal reforms were coloured by the expectation of renewed war. In 1756 the third Silesian war, better known as the Seven Years' War (q.v.), began. Frederick anticipated attack by himself becoming the aggressor, and during all this momentous struggle—one of the most remarkable of modern times—displayed a courage, a military genius, and a power of resource both in victory and defeat which justly entitle him to the name of 'the Great.' At the Peace of Hubertsburg (February 15, 1763), he had not only maintained his territory undiminished, but he had also added a tenfold prestige to Prussia and to Prussian arms. Jealousy of Austrian aggrandisement continued to influence his policy. In 1772 it induced him to share in that dishonest act, the first partition of Poland, which

added Polish Prussia and a portion of Great Poland to the Prussian crown. In 1778 it led him to take arms in a brief campaign, which ended in the acquisition of the Franconian duchies. And one of his latest political actions was the formation of the 'Fürstenbund,' or League of Princes, which was the first definite appearance of Prussia as a rival to Austria for the lead in Germany. Frederick died at Potsdam, August 17, 1786, and was succeeded by his nephew, Frederick-William II.

Frederick, like Richelieu and like Bismarck, when foreign war ceased turned his immediate attention to the internal affairs of his kingdom. He was an able administrator at all periods of his reign, and not the least remarkable of his feats was his carrying on all his wars without incurring a penny of debt. He regarded himself as, in his own words, the first servant of the state; he was his own prime-minister in a very literal sense, for his cynical suspicions of human motives induced him to interfere directly in things great and small. His conviction of the immaturity of his country explains the discrepancy between his theoretical writings on government and the scant amount of liberty he granted to his people. He considered himself responsible for the good of his people, and he justified his arbitrary actions by his good intentions and his keener insight. As already remarked, Frederick's domestic legislation was influenced by what he believed to be the military requirements of the time; Prussia under him was governed as one huge camp. He endeavoured to increase the population—i.e. the supply of soldiers, by a system of 'planting colonies,' by lending his war-horses to plough the peasants' land, by distributing military stores, and by temporary remission of taxes in certain provinces. But he did not carry the enfranchisement of the peasantry to such an extent as to injure or offend the nobility, whom he required for officers. With a view to providing treasure for future wars he fostered woollen and other manufactures by a high protective tariff; but he made himself unpopular by the introduction of the French excise-system, known as the Regie, and the temporary inflation of his revenue was attended with later disastrous commercial results. During Frederick's reign, however, the country rapidly recovered from the ravages of war, while the army was raised to a strength of 200,000 men. Frederick was essentially a just, if somewhat austere man, and the administration of justice under his rule was pure, though he himself had his usual cynical distrust of his judges' integrity; the press enjoyed comparative freedom; and freedom of conscience was promoted. Though Frederick was himself a voluminous writer on political, historical, and military subjects, he had no sympathy with nascent German literature, a fact on which the latter is perhaps to be congratulated. The spirit of the century went faster than Frederick; had he lived he would not have understood the logical outcome of his *philosophe* doctrines in the French Revolution. His works, written wholly in French, have been published in thirty-one volumes under the auspices of the Berlin Academy (Berlin, 1846–57), which in 1878 also undertook an edition of his *Political Correspondence*.

The chief authorities for the life of Frederick are, besides his own *Œuvres* and *Correspondance*, and the official publications of the Prussian Archives, Preuss's *Friedrich der Grosse* (4 vols. Berlin, 1832–34); Carlyle's *History of Frederick II.* (6 vols. Lond. 1858–65); and Droysen's *Friedrich der Grosse* (2 vols. Leip. 1874–86), being part v. of his *Geschichte der Preussischen Politik*. Numerous monographs upon special epochs in his life or special phases of his character have also been published. The leader of the hostile school of criticism is O. Klopp, in his *Friedrich II. von Preussen und die Deutsche Nation* (Schaffhausen, 1867). Rigollot, in his *Frédéric II. Philosophe* (Paris, 1875), gives us a French view of the king; as does the Duc de Broglie in his *Frédéric II. et Marie Thérèse* (1883). There is an English translation (1877) of Kugler's *History of Frederick the Great*, with 500 famous and characteristic illustrations by Menzel. See also Brackenbury, *Frederick* (1884); Tuttle, *Prussia under Frederick the Great* (N.Y. 1888); Reddaway, *Frederick the Great and the Rise of Prussia* (1904); N. Young, *Life of Frederick the Great* (1919).

Frederick III., second German emperor and eighth king of Prussia, only son of the Emperor William I., was born at Potsdam, 18th October 1831. In 1858 he married Victoria, the British Princess Royal (1840–1901). On becoming Crown-prince of Prussia in 1861, he protested against Bismarck's reactionary policy in relation to constitutional questions and the press. He went through the Danish war (1864), and in the war with Austria (1866) commanded the second Prussian army. In the Franco-German war 'our Fritz' commanded the third army; he had a share in the glory of Wissembourg, Wörth, and Sedan, and was made field-marshal (1870). In 1871 he became Crown-prince of the German empire. In 1878, when the Emperor William was wounded by an assassin, the Crown-prince was appointed provisional regent. In 1887 he began to suffer from an affection of the throat, which in a few months assumed a malignant form; on 9th February 1888 the operation of tracheotomy was performed. On 9th March the Emperor William died; and the Crown-prince, returning from San Remo to Prussia, was proclaimed emperor as Frederick III., but he died at Potsdam, 15th June 1888. His son, William II., succeeded him. Frederick had a great horror of war, intensely disliked autocratic ideas, and sought to liberalise German institutions. See his *Tagebuch* (ed. Engel, 1919), English Life by Rennell Rodd (1888); and German ones by Müller, Ziemssen, Bohn, Freytag (1889), and Philippson (1900).

Frederick V., Electoral Prince Palatine, son of Frederick IV., was born at Amberg, 26th August 1596, and succeeded to the Palatinate in 1610. He married, in 1613, Elizabeth (q.v.), the daughter of James I. of England, through whose ambitious counsels he was induced to put himself at the head of the Protestant union of Germany, and finally, although against his own inclinations, to accept the crown of Bohemia in 1619. His complete defeat at the battle of the Weisse-Berg, near Prague (1620), terminated his short-lived reign, in allusion to which he became henceforth known as the 'Winter King.' In the meantime the Palatinate was occupied by the Spaniards and Bavarians. Frederick therefore took refuge in Holland. Declared under the ban of the empire in 1621, he lost his electoral principality two years later, when the emperor conferred it upon Maximilian of Bavaria. Frederick died at Mainz, 29th November 1632. His son got back the Palatinate after the Treaty of Westphalia (1648).

Frederick III., of Denmark, was born in 1609, succeeded to the throne in 1648, and died in 1670. His reign was rendered memorable by the change effected in the constitution (see Denmark).—Frederick V. (1723–66) ascended the throne in 1746, and proved one of the best and wisest monarchs of his time. Denmark owed to him the increase of her national wealth, and the establishment of various branches of commerce and manufacture. He established an Asiatic Company, opened the American colonial trade to all his subjects, encouraged painting and sculpture, and sent a learned commission to travel and make explorations in Egypt and the East.—Frederick VI. (1768–1839) assumed the regency of the kingdom in

1784, on account of the insanity of his father, on whose death in 1808 he ascended the throne. In his reign feudal serfdom was abolished, the criminal code amended, and the slave-trade prohibited in the Danish colonies. For his luckless participation in the Napoleonic wars, and for the constitution which he granted in 1831, see DENMARK.—FREDERICK VII. (1808–63), who succeeded in 1848, was the last of the Oldenburg line (see DENMARK). The principal events of his reign were the wars and diplomatic negotiations arising out of the revolt of the duchies of Holstein and Sleswick (see SLESWICK-HOLSTEIN).

Frederick, PRINCE OF WALES (1707–51), eldest son of George II., quarrelled with his father over his own marriage. In 1737 he joined the parliamentary opposition, was banished from court in consequence of his ill-treatment of his wife and of his disobedience to his father. He died before his father, leaving his son to ascend the throne as George III. on the death of George II.

Frederick-Charles, a Prussian prince, nicknamed the 'Red Prince' from the colour of his favourite hussar uniform, was born in Berlin, 20th March 1828, the eldest son of Prince Charles, who was a brother of the Emperor William I. Frederick-Charles was educated for the army, and served in the first Sleswick-Holstein war, commanded the right wing in the second Danish war, and in 1866, in the campaign against Austria, won the great victory of Königgrätz. In the Franco-Prussian war he commanded the second army, drove Bazaine back to Metz, and on the 27th October received the capitulation of that fortress (see BAZAINE). He was made a field-marshal next day, captured Orleans, broke up the army of the Loire, and scattered Chanzy's portion of it at Le Mans. This was his last action, for Paris capitulated immediately after. One of the ablest of Prussian generals, he added to his active service successful labours to reform the military system and render it more elastic. He died 15th June 1885.—In March 1879 his third daughter, Louise Margaret, born in 1860, was married to the Duke of Connaught. She died in 1917.

Fredericksburg, a city of Spottsylvania county, Virginia, on the Rappahannock, 56 miles N. of Richmond, with flour-mills and other manufactures. Washington's mother is buried close by. On the hills to the south Burnside (q.v.) attacked and was repulsed by the Confederates in December 1862. Pop. 6000.

Frederick-William, ELECTOR OF BRANDENBURG, commonly called 'the Great Elector,' was born 16th February 1620, at Cölln on the Spree, succeeded to the electorate in 1640, and died 9th May 1688. On his accession he found an empty exchequer, the towns and cities depopulated, and the whole electorate disorganised, exhausted, and horribly devastated by the Swedish and Imperialist armies during the Thirty Years' War. His first acts were to regulate the finances and to conclude a treaty of neutrality with Sweden, which left him at leisure to devote himself to the organisation of his army and the repeopling of the deserted towns and villages with immigrants. By the Treaty of Westphalia (1648), which he zealously promoted, at the sacrifice of a considerable slice of territory in Western Pomerania, he nevertheless recovered the eastern portion of Pomerania, the principalities of Halberstadt, Minden, and Kammin, and the reversion of the archbishopric of Magdeburg. Then in the course of ten years of peace he laboured hard to raise the condition of Brandenburg; but he also created an army of 25,000 men, organised on the Swedish model. Out of a quarrel between Sweden and Poland he contrived to draw advantage for himself, in that he secured the independence of the duchy of Prussia from Poland (1657). After another fifteen years of peace the elector, alarmed at the aggressions of Louis XIV. on the Rhenish frontier, induced the emperor, the king of Denmark, and the Elector of Hesse-Cassel to enter into a league against France. Thereupon Louis incited the Swedes to invade Brandenburg, and to advance upon Berlin. Frederick-William, however, signally defeated them at Rathenow and at Fehrbellin (1675), and drove them from his dominions. Nevertheless, being forsaken by the emperor and the other German princes, and being left to face France single-handed, he was obliged to agree to the Treaty of St Germain (1679), by which he restored all his conquests to the Swedes, in return for the withdrawal of the French army from Brandenburg and the payment to him of an indemnity of 300,000 crowns. From this time forth Frederick-William devoted himself to the task of consolidating his dominions, and fostering their agricultural, industrial, and commercial development. He extended a hearty welcome to several thousand French Protestants after the revocation of the Edict of Nantes, and encouraged the immigration of Dutchmen and other foreigners, whereby he introduced numerous industrial arts among his subjects. He founded the university at Duisburg, and the royal library at Berlin, and reorganised the universities of Frankfort-on-the-Oder and Königsberg, opened canals, established a system of posts, and greatly enlarged and beautified Berlin. He left a well-filled exchequer and a highly-organised army. A man of imposing personal appearance, he was of bold and energetic temperament, of a quick temper, a resolute will, and an ambitious mind that looked a long way ahead and laid plans accordingly. Brandenburg he converted from a weak constitutional state into what was virtually an absolute monarchy only less powerful than Austria in the German polity of states. He laid the foundations of the bureaucratic and military aristocracies of the subsequent kingdom of Prussia, and formed the nucleus of a small fleet. Besides this, he encouraged education, and made himself the champion of religious toleration. He was succeeded by his son, Frederick III., afterwards King Frederick I. of Prussia.

Frederick-William I., king of Prussia, born 15th August 1688 at Berlin, was in almost every particular the opposite of his father, Frederick I. In the same year (1713) that he ascended the throne he became embroiled in the war waged by Sweden against Russia, Poland, and Denmark, on behalf of the latter. At the Peace of Stockholm in 1720 Frederick-William received Hither Pomerania with Stettin. But the remaining twenty years of his reign were devoted to the amelioration of the internal condition of Prussia. Of a sternly practical turn of mind, despising the arts and sciences, rigidly economical, strict in his ideas of justice, blunt and determined, this king carried into all departments of his administration the habits and principles of the frugal military martinet. The results of his policy were seen at his death (31st May 1740), when he left to his son, Frederick II., a treasure of nine million thalers and an army of more than 80,000 men, the best drilled and disciplined force in Europe, so that Prussia, though ranking only twelfth among the powers of Europe in respect of population and area, came fourth in military power. He also fostered the industries and agriculture of his dominions, introducing the manufacture of woollen cloth, and settling in East Prussia 17,000 to 18,000 Protestant refugees from Salzburg. On the whole, his rule, arbitrary though it was, laid the foundation upon

which Frederick the Great worked for the subsequent greatness of Prussia.

Frederick-William II., king of Prussia, nephew of Frederick II., was born 25th September 1744. As a young man he failed to win the goodwill of his uncle, owing to his excesses and his disinclination to work. Nevertheless, the natural mildness of his disposition, together with the abolition of some of the oppressive measures of Frederick II.'s reign, made him very popular at his accession in 1786. But he soon lost the affectionate regard of his subjects by his predilection for unworthy favourites, and by the abrogation of the freedom of the press and religion (1788). His uncle left him a treasury containing more than fifty million thalers; these he dissipated in a useless war with Holland. In short, his foreign policy was weak and lacking in character, whilst at home he starved the budding sense of patriotism in his subjects, and oppressed them with debt and increased taxation. He added New East Prussia, South Prussia, New Silesia, Danzig, and Thorn to his kingdom by the partitions of Poland in 1793 and 1795, and also acquired the districts of Ansbach and Baireuth. Frederick-William II. died 16th November 1797, and was succeeded by his son, Frederick-William III.

Frederick-William III., king of Prussia, son of Frederick-William II., was born 3d August 1770, and ascended the throne in 1797. His reign may be divided into three periods. During the first of these his lack of energy and purpose led him to take up an attitude of passive neutrality towards Napoleon; but at length the truculent policy of the latter so exasperated the Prussians that, instigated by their queen, they forced the king to declare war against the French (1806)—a most disastrous step, as, after being thoroughly worsted at Jena and Auerstädt, Frederick-William was compelled to flee into East Prussia, leaving his kingdom to be overrun and his capital captured by Napoleon. Nor was that all: by the Treaty of Tilsit (1807) Prussia was diminished by one-half, being deprived of all her territories west of the Elbe, and all that she had acquired by the partition of Poland. The second period (1806–15) is marked by the administrative reforms of Stein (q.v.) and the war of liberation (see GERMANY). By the Treaty of Vienna (1815), which terminated that war, Prussia recovered her possessions west of the Elbe, and acquired the duchies of Berg and Juliers (Jülich), the northern half of Saxony, and other districts in Westphalia, besides securing the remaining (Swedish) portion of Hither Pomerania; but she gave up her Polish acquisitions, with the exception of Posen, to Russia, the province of Friesland to Holland, and Ansbach and Baireuth to Bavaria. The last period of this reign was generally one of reaction. The king and his minister Hardenberg applied the Metternichian principles of government in Prussia, rigorously suppressing the democratic movements of 1819 and 1830, and strictly curtailing the freedom of the press. Nevertheless, the policy of reform inaugurated by Stein did not remain altogether stationary; provincial diets were established (1823), though allowed merely consultative functions; the finances were put on a better footing; the system of taxation was greatly improved; education was encouraged; and the Zollverein or customs union was established. In private life this king exhibited the virtues of justice, a strong sense of duty, purity, and love of truth; but his public conduct was rendered unsatisfactory by his indecision of character, his great diffidence, narrowness of view, and the limited extent of his knowledge. His wife was the beautiful and noble-minded Louisa (q.v.), idolised by the Prussian people for her patriotism. He died at Berlin, 7th June 1840, and was succeeded by his son, Frederick-William IV.

Frederick-William IV., king of Prussia, son of Frederick-William III., was born October 15, 1795. His reign is characterised by one long struggle of the people of Prussia against their king for a constitutional form of government. Frederick-William IV. exhibited much of his father's vacillation and instability of purpose; and, although he began his reign (June 7, 1840) by granting minor reforms and promising radical changes of a liberal character, he always evaded the fulfilment of these pledges. He was possessed by high but vague ideas of the divine right of kings, and showed a strong tendency to mystic pietism. A determined enemy to the ideas of the French Revolution, he refused to accept the imperial crown offered him by the Liberal Frankfort Diet in 1849; and at first he resolutely opposed the popular movement which followed the French Revolution of 1848; but when the people emphasised their reiterated demand for constitutional government by storming the arsenal and seizing on the palace of the Prince of Prussia, afterwards the Emperor William I., who was at that time especially obnoxious to the Liberals, the king complied with their wishes. At length, on 31st January 1850, the country was granted a representative parliament, summoned in accordance with the terms of a written constitution, based upon democratic principles. In 1857 Frederick-William was seized with remittent attacks of insanity, and resigned the management of public affairs to his brother and heir, who from 1858 acted as regent of the kingdom till his own accession, as William I., on the death of Frederick-William, 2d January 1861. See his Life by Ranke (1878), and by Petersdorff (1900).

Frederick-William (1771–1815), DUKE OF BRUNSWICK.* See BRUNSWICK.

Fredericton, capital of the province of New Brunswick, Canada, stands on the St John River, 58 miles NNW. of the port of St John. It is the seat of an Anglican bishop and of a university, and has some handsome government buildings. There are some manufactures, and a considerable trade in lumber is carried on. Pop. 8000.

Frederikshavn, a port in the north of Jutland, on the Cattegat, 52 miles NE. of Aalborg by rail. It is much used as a harbour of refuge, and has a considerable trade, exporting butter, cattle, and pigs (to England), and importing wood, iron, corn, cotton-yarn, &c. Pop. 12,000.

Frederiksted, a town of St Croix in the Virgin Islands of the United States; pop. 3000.

Fredrikshald, a fortified seaport of Norway, on the Idde Fjord, near the Swedish border, 85 miles by rail SSE. of Christiania. Having been burned down in 1826, it was rebuilt in modern style, with broad and regular streets. Its inhabitants trade in timber. To the south-east of the town stands the fortress of Fredriksteen, built in 1661, which, though often assaulted, has never yet been taken. Charles XII. of Sweden was killed in the trenches before this fortress on 11th December 1718. A little farther to the east stands the fort of Gyldenlöve, which has played an important part in the wars between Sweden and Norway. It is now, however, of little consequence. Formerly called Halden, Fredrikshald received its present name from King Frederick III. of Denmark. Pop. 11,000.

Fredrikstad, a seaport town of Norway, at the mouth of the Glommen, 58 miles S. of Christiania by rail, exports timber; pop. 16,000.

Free Bench (*Francus Bancus*). By custom of certain manors of England a widow was entitled

to dower, called 'free bench,' out of the lands which were held by her husband, provided she remained unmarried and chaste.

Free Church of England, an Episcopal church founded in 1844, closely agreeing with the evangelical section of the Church of England, arose in opposition to the Tractarian movement. —In 1890–92 there was formed a federation of the evangelical nonconformist churches of England (Congregationalist, Baptist, Methodist, Presbyterian, Free Episcopal, Society of Friends, and others), holding annually a National Council of the Free Churches.

Free Church of Scotland, the name assumed by those who at the 'Disruption' of the Church of Scotland, in 1843, withdrew from connection with the state, and formed themselves into a distinct religious community, claiming to represent the historic church of Scotland, and to maintain the principles for which it had contended since the Reformation. The Free Church (now, as incorporated with the United Presbyterian Church, part of the United Free Church; see below) retained the standards used by the Established Church; but a catechism, approved by the Free Church Assembly after 1843, makes the right to vary the document of creed, or to exchange it for another (without the sanction of the state), one of the tests of the freedom claimed for the church against the decisions of 1843. Speaking generally, it may be said that the laws of the church existing and in force prior to the Disruption are acknowledged as still binding in the Free as in the Established Church, but only in so far as they have had church authority, and with the exception of those which the Free Church has since repealed. The same Presbyterian constitution subsists in both churches, with the same classes of office-bearers and gradations of church-courts. The Free Church, indeed, professes to maintain this constitution and church-government in a perfection impossible in the present circumstances of the Established Church, because of the supremacy of parliament by which the Established Church is trammelled, and interventions of civil authority to which it is liable. And the whole difference between the Free Church and the Established Church relates to the necessary submission of the Established Church to this control of the civil power in things which the Free Church regards as belonging not to the province of civil government, but to the church of Christ, and to its office-bearers and courts as deriving authority from him; so that the controversy was often described as respecting the *Headship of Christ* or the *Kingdom of Christ*. It is to be borne in mind, however, that the doctrine of the headship of Christ over his church, being set forth in the Westminster standards, is fully professed both by the Established Church and by the Free Church of Scotland; the only question between them is whether or not the existing relations of the Established Church of Scotland to the state are consistent with the due maintenance and practical exhibition of this doctrine. And the question does not directly relate to *Voluntaryism* (q.v.). Those who constituted the Free Church of Scotland in 1843 firmly believed that the church might be connected with the state, and receive countenance and support from it, to the advantage of both. But they maintained that there must not, for the sake of any apparent benefits flowing from such connection, be any sacrifice of the independence or self-government of the church, as the kingdom of Christ, deriving its existence, organisation, and laws from him. Even then, too, most of the leaders of the Free Church held, with Dr Candlish and Dr Cunningham, that the separation of 1843 was practically final, and that in the improbable event of the state acknowledging the church's independence the church should hesitate before again forming with it so close and perilous a connection. The leaning thus indicated from that time steadily increased. Many of the second generation of Free Churchmen accepted as practically if not theoretically true the inconsistency repeatedly urged upon their fathers by the law-courts, as existing between the claim of church freedom and all establishment whatever. And in coming to the same conclusion of final separation from establishment they increasingly connected it with the equal rights of conscience of all citizens, and not, as their fathers did, with the claims and confession of the church alone.

The Westminster Confession of Faith asserts that 'there is no other head of the church but the Lord Jesus Christ;' and that 'the Lord Jesus, as King and Head of His church, hath therein appointed a government in the hand of church-officers, distinct from the civil magistrate.' The early Presbyterians of Scotland so far prevailed as to obtain at different times important acts of parliament in recognition of their principles, and 'ratification of the liberty of the true kirk;' and finally, after the Revolution of 1688, an act ratified the Westminster Confession of Faith itself, and incorporated with the statute law of the realm all its statements concerning the province of church-judicatories and that of the civil magistrate, and the bounds of their respective powers. The rights and privileges of the Presbyterian Church of Scotland, guaranteed by the Revolution settlement, were expressly secured by the Treaty of Union, and jealously reserved from the power of the British parliament; yet within five years afterwards, when Jacobite counsels prevailed in the court of Queen Anne, an act was passed for the restoration of patronage in Scotland, with the design of advancing the Jacobite interest by rendering ministers more dependent on the aristocracy. This act soon became the cause of strife within the Church of Scotland, and of separations from it during the 18th century. But when the 'Moderate' party, long dominant in the General Assembly of the Church of Scotland, became again the minority in 1834, the accession of the 'Evangelical' party to power was at once signalised by an attempt to restore to the congregation its influence in the election of their pastor. This was done by the *Veto Law*, by which it was declared that 'it is a fundamental law of this church that no pastor shall be intruded on any congregation contrary to the will of the people.' And the same General Assembly by which the Veto Act was passed asserted the constitutional principles and inherent powers of the church in another important particular, the admission of the ministers of 'chapels of ease' to the same ecclesiastical status as the ministers of endowed parishes, in consequence of which they became members of church-courts, and had districts assigned to them *quoad sacra*, with the full parochial organisation.

These acts were soon the subject of litigation in the Court of Session. A conflict arose which in various forms agitated the whole of Scotland, and which, ere long, related as much to the status of chapel ministers (and of ministers whom the church had of its own authority gladly welcomed back from the seceding bodies outside) as to the mere rights of presentees. It involved, indeed, the whole question of the relations of civil and ecclesiastical powers, at least as far as the Established Church was concerned. There was scarcely a spiritual or ecclesiastical act falling within the region thus dealt with by the church which the court did not now 'interdict' and prohibit; while other spiritual acts, such as admission to the ministry, it ordered the church to perform under penalties. But a graver matter still was the principle upon which

these orders were uniformly based. The court not merely disallowed the claim of the church to freedom and legislative self-expansion; it founded its long series of judgments, beginning with the Auchterarder case, on the absolute subjection of the church to parliament, and on the authority of statute even in matters ecclesiastical. The heads of the Court of Session and House of Lords announced the law that 'parliament is the temporal head of the church, from which it derives all its powers;' that 'the law, and that alone, gave the church jurisdiction;' that therefore it is impossible to admit, not only 'that an establishment can ever possess an independent jurisdiction,' but even that there can be such a thing as 'a conflict between the civil and ecclesiastical courts of a country in which a church is established and endowed by the state.' And as to the plea that the rights of congregations were guarded on the religious side by a 'fundamental law' of the church, the House of Lords laid it down that 'whether that is, or ever was, a law of the Church of Scotland, is perfectly immaterial, if the statutes contain enactments and confer rights inconsistent with it.' These principles, common enough in the jurisprudence of some countries, appeared violently hostile to the old doctrine of the Church of Scotland. But the one thing in which that church now agreed with the court was that its carrying out the orders of the latter in the church sphere would involve acquiescence in the principles of establishment authoritatively laid down. Accordingly, the General Assembly formally refused, and in 1842, by a majority of 241 to 110, passed a *Claim of Right*, declaring to parliament and the crown that the church, unless relief were granted, must separate from the state. In November of the same year a *Convocation* was held to arrange for the future. In parliament Mr Fox Maule's motion for inquiry, made on 7th March 1843, was supported by a large majority of the Scottish members, but rejected by Sir Robert Peel and the house. The crisis came on 18th May 1843, when the General Assembly should have constituted itself in Edinburgh. Instead of doing so, the ex-Moderator, Dr Welsh, handed a protest to the Queen's commissioner, and he and the others who had signed it, issuing from St Andrew's Church, moved in a long procession down the northern slope of Edinburgh to Canonmills. There 474 ministers (out of a total of 1203) resigned their churches, incomes, and homes; and amid a scene of great emotion Dr Chalmers was called to the chair of the first Assembly of the Free Church of Scotland.

The event produced an impression throughout Christendom. 'To the moral attitude of the Free Church,' said Mr Gladstone to the House of Commons a quarter of a century later, 'scarcely any word weaker or lower than that of majesty is, according to the spirit of historical criticism, justly applicable.' The sacrifices and sufferings which not only its ministers but its congregations were called on to undergo, especially in districts where land-owners for years refused sites for buildings, were no doubt the first cause of this. But something must be allowed to the extraordinary qualities of the Scotsmen who became the leaders and founders of the new body. Dr Chalmers, the greatest of them all; Dr Candlish, for thirty years his brilliant successor; Dr William Cunningham, the controversialist and theologian of the body; Dr Robert Buchanan, its administrator and (in his *Ten Years' Conflict*) its historian; Dr Guthrie, its orator; Mr Murray Dunlop, its lawyer; Hugh Miller, its *littérateur;* these men and some others, as they are sketched in their own utterances and in books like Lord Cockburn's *Journal*, take no common rank even as individuals. And they formed a group so impressive, intellectually and morally, that even the Duke of Argyll, who declined as a young man to follow the Free Church, when looking back thirty years later over the Victorian age with its statesmen and thinkers, describes these as 'the best and greatest men whom I have ever known.' But what chiefly attracted the eyes of public men outside Scotland to the Free Church was its success as an experiment in the voluntary support of the church on the great scale—by means of contributions not local or congregational, but with a national altruism and solidarity. The foundation for this success was already laid in its Presbyterian constitution, which, as Lord Selborne observes, always enables a church, so long as it is not impeded from without, to exercise itself 'in the whole art and power of self-government, self-legislation, and self-expansion.' But the crisis called for new efforts and more powerful organisation. The order of deacons was restored or enlarged; an army of local collectors worked under them, and the money locally collected was paid into a central *Sustentation Fund* and equally divided among the ministers throughout Scotland. A hundred thousand pounds was subscribed for building the churches even before the day of the disruption: five hundred of them were built within the first year. Manses were erected; schools built for the schoolmasters, for they also had been obliged to leave the parish schools; colleges instituted for theological students, under professors now excluded by law from the universities; and a home mission or church extension scheme was founded, through whose influence the number of pastoral charges in the Free Church vastly increased. But the church found it impossible, even amid the struggles of its infancy, to confine itself within Scotland. All its missionaries throughout the world had left the state with it, and thrown up their emoluments; and schemes and funds for foreign missions, for colonial missions, for continental missions, for Jewish missions, and a special scheme for the Highlands and Islands were instantly and simultaneously started. That enthusiasm should initiate all this in the moment of suffering was, perhaps, not wonderful: what is more noteworthy is the permanence of the results. In 1900 there were 1070 regular charges in the church.

The history of the Free Church from 1843 reflected increasingly the general course of church life outside it in Scotland. In its earlier years it was much occupied, like every body on a national scale, with questions of centralisation as against local government. Thus, a controversy whether it should have one college or more was terminated by its adherents in Glasgow and Aberdeen liberally endowing, and so securing, the institutions in either city. In 1858 the *Cardross Case* arose, and created much interest, as raising legal questions affecting Free Church principles. But, while the earlier decisions of the Scottish courts in it appeared to threaten interference even with the internal action of churches, their later findings refused to the deposed minister of Cardross the means of prosecuting even that civil action of damages which the church professed their readiness to meet. In 1863 Dr Candlish and Dr Buchanan started the proposal of union with the United Presbyterian Church, which had by this time gathered into itself nearly all the Scottish secessions of the 18th century. Negotiations went on for years, and terminated in 1873 in a postponement of incorporating union, but with an obligation for a working agreement in the meantime, to include 'mutual eligibility of ministers from all the churches that had taken part in the negotiations. In 1874 patronage was abolished by parliament in the church established, without any proposed change upon the general Scottish law of church and state. The Free Church

Assembly at once resolved that disestablishment was the proper remedy for the divisions of Scottish Presbyterianism; and its union in 1876 with the Cameronian body (see CAMERONIANS) seemed to unite these ancient traditions with modern views. Theological questions of course retained their dominant interest; and in 1881 the church refused to retain Mr Robertson Smith as its professor in Aberdeen, while declining at the same time to affirm that his biblical views were heretical. This compromise was unsatisfactory to all sides. In 1889 a large committee was appointed to consider the question of revising the church's confession while maintaining its central doctrines of faith. Although its Highland ministers were well known not to agree with their Lowland brethren about the necessity for creed revision and union with churches that renounce the Establishment principle, on the resumption of negotiations for union with the United Presbyterian Church it became clear that the party insisting on maintaining in full the testimony of the church to the Establishment principle had decreased; from 1896 on increasing majorities voted for the union under the leadership of Principal Rainy. The two churches, each retaining its principles, finally agreed (the Free Church by a majority of 643 to 27, the United Presbyterians unanimously) to incorporation as the United Free Church; and though a small protesting party withdrew and claimed the name and rights of the Free Church, the union was consummated at Edinburgh in a joint assembly on 31st October 1900. In 1904, on appeal, the House of Lords confirmed the claim of the protesting minority, now organised as a separate church, to the property and funds of the Free Church, regarded as a trust for the maintenance of the original testimony of the church, to which the dissentients had (as on the questions of predestination and church establishments) adhered without any modification. After the judgment, government appointed a commission to advise as to the settlement of matters in dispute, as to property and other considerations, between the two churches. The result was an act (1905) appointing an executive commission to allocate between the churches all questions of property defined by the act, having regard to all the circumstances of the case, but subject to the provisions of the act.

See *Subordinate Standards of the Free Church*, with 'Claim of Right' and 'Protest' (1851); Buchanan's *Ten Years' Conflict* (1849); Taylor Innes, *Law of Creeds in Scotland* (1867); *Annals of the Disruption* (1877); Peter Bayne's *Free Church of Scotland* (1893); the reports of the case in the House of Lords and of the Royal Commission; M'Crie, *The Church of Scotland, her Divisions and her Re-unions* (1905); and the articles CHALMERS, CANDLISH, GUTHRIE, &c.

Freedom of a City. See BURGESS.

Freehold. Tenures of land in England are divided into free and base or customary. As free were reckoned the military tenure of knight-service and socage—now the normal lay freehold (see TENURE). Copyhold (q.v.) is now the only form of customary tenure. None but an estate for life or an estate of inheritance ranks as a freehold; a term of years, however long, is less than freehold. Now almost all freeholders hold of the crown. The freeholders of a county were constituent members of the ancient county court; they had formerly the right to vote in the election of county coroners; and freehold property of the value required by modern statutes is a qualification for jurymen and parliamentary electors, and for certain public offices.

Free Imperial Cities, in the German empire, were those cities which owed allegiance to none but the emperor, which exercised suzerain rights within their own territories, and had the right of sitting and voting in the imperial diet. At first free cities were distinguished from imperial cities, the difference consisting in the fact that the former paid no feudal dues to the emperor, whereas the latter did. But from the 13th century there was practically no distinction, all towns which formed an integral part of the imperial polity of states being called free imperial cities. These cities, which had not a uniform municipal organisation, some being governed on democratic, others on aristocratic principles, were generally ruled by one or two imperial officers, called *Reichsvogt*, *Schultheiss*, or *Burggraf*. The peculiar privileges attaching to these cities were acquired in different ways—by creation of the emperor, by purchasing freedom from the minor prince or lord to whom they owed allegiance, by the dying out of the family of the territorial superior, or by force of arms. And they were lost by the corresponding opposite means: some towns were seized by the neighbouring lords, others passed by conquest out of the empire altogether, others voluntarily sold their privileges of freedom, others again were deprived of their position by the emperor as punishment for contumacy. The creation of free imperial cities was generally encouraged by the emperors, who found in them a useful means of checkmating the ambitions of the petty princes. But between the 13th and 15th centuries the majority of them succeeded in securing the office of *Reichsvogt*, *Schultheiss*, or *Burggraf* for their own citizens. In 1474 the free imperial cities formed two groups in the diet, the Rhenish and the Swabian; and they were formally constituted the third college of the diet after the Peace of Westphalia (1648). In February 1803 all the free imperial towns of Germany, except Hamburg, Lübeck, Bremen, Augsburg, Nürnberg, and Frankfort-on-Main, lost their privileges; and of these Augsburg, Nürnberg, and Frankfort ceased to be free imperial cities in 1806. In 1815, however, the three Hanse towns, together with Frankfort, were admitted into the German Confederation as free towns. But by the incorporation of Frankfort with Prussia in 1866 only Lübeck, Bremen, and Hamburg were left. These became states of the German reich, as empire and republic. See Wilson-King, *German Free Cities* (1914).

Free-lances were roving companies of knights and men-at-arms, who, especially after the Crusades had ceased to give them employment, wandered from state to state selling their services to any lord who was willing to purchase their aid in the perpetual feuds of the middle ages. In Italy they were known as Condottieri (q.v.). In Germany the name *Landsknechte* was given to a famous organisation of mercenary foot-soldiers, originally raised by Maximilian I. in 1487 from the inhabitants of his Austrian hereditary dominions. The name is not, as is commonly said, a corruption of *Lanzknechte* ('lancemen'), but was given to distinguish the men of the Austrian lands from the Swiss mercenaries. The Landsknechte played a distinguished part in the wars of the 15th and 16th centuries, but fell into disrepute after the Thirty Years' War.

Free Lovers. See PERFECTIONISTS.

Freeman is one who has inherited the full privileges and immunities of citizenship; *freedman*, one who has been delivered from the restraints of bondage, but who, usually, is not placed in a position of full social or even political equality with him who was born free. In old Rome, indeed, the equivalent for freeman (*liber homo*) comprehended all classes of those who were not slaves; but the distinction here pointed out was preserved by the application of the term *ingenuus* to him who

was born free, and of *libertinus* to him who, being born in servitude, was emancipated. As the organisation of Roman society survived the convulsions of the middle ages to a far greater extent in the towns than in the landward districts, where the institutions of Feudalism (q.v.) almost entirely superseded it, it is in the borough and other municipal corporations that we still find *freemen*, or persons inheriting or acquiring by adoption, purchase, or apprenticeship the rights of citizenship. In Anglo-Saxon England the freemen were divided into Ceorls (q.v.) and Eorls (see EARLS). See BOROUGH, BURGESS, CITY, SLAVERY. In the United States the term freedmen was used of the coloured people emancipated by the civil war. The duty of caring for those helpless people, finding them work, organising education, and preparing them for the privileges of freedom was thrown on the war department; and in 1865 an act of congress created in that department the bureau commonly known as the 'Freedmen's Bureau,' whose duties practically ceased in 1870. The founding of several seminaries for coloured persons, such as Howard University and Fisk University, was a permanent result of its work.

FREEMAN'S ROLL.—By the Municipal Corporations Act of 1835 it was provided that every person who, if the act had not passed, would, as a burgess or freeman, have enjoyed, or might have acquired, the right of voting in the election of members of parliament was to be entitled to enjoy or acquire such right as heretofore. And it was further enacted that the town-clerk of each borough should make out a list, to be called the *Freeman's Roll*, of all persons admitted burgesses or freemen, for the purpose of such reserved rights as aforesaid, as distinguished from the burgesses newly created by the act, and entitled to the rights which it newly conferred; these last were to be entered on another roll, to be called the *Burgess Roll*. See BURGESS.

Freeman, EDWARD AUGUSTUS, historian, born at Mitchley Abbey, in the parish of Harborne in Staffordshire, 2d August 1823, was elected scholar of Trinity College, Oxford, in 1841, and fellow in 1845. He held the examinership in the School of Law and Modern History in 1857 and 1863, and in the School of Modern History in 1873; and was created D.C.L. of Oxford in 1870, and LL.D. of Cambridge in 1874. In 1884 he became regius professor of Modern History at Oxford. In 1860 he had settled at Somerleaze, where he lived the life of a country gentleman, but travelled frequently (see his *Studies of Travel*, 1894); and he stood unsuccessfully for Mid-Somerset as a Liberal. He had Greek and Servian decorations, and was a member of various academies. His principal work is his *History of the Norman Conquest* (5 vols. 1867–76), one of the greatest monuments of English historical learning, which shows its author to possess almost every requisite of an historical style save one—that of condensation. His other works include *A History of Architecture* (1849); *History and Conquests of the Saracens* (1856); *History of Federal Government* (vol. i. 1863); *History of the Cathedral Church of Wells* (1870); *Old English History* (1869); *Growth of the English Constitution* (1872); *Historical Essays* (3 series, 1872–79); *Comparative Politics* (1873); *Historical and Architectural Sketches*, chiefly Italian (1876); *The Ottoman Power in Europe* (1877); *Historical Geography of Europe* (2 vols. 1881); *The Reign of William Rufus, and the Accession of Henry I.* (2 vols. 1882); *Some Impressions of the United States* (1883); *English Towns and Districts* (1883); *Chief Periods of European History* (1886); *Methods of Historical Study* (1886); *Exeter* (1887); and an unfinished *History of Sicily* (i.–iii. 1891–93). He died of smallpox at Alicante, 17th March 1892. The leader of 'the Teutonic school,' Freeman, placed too great reliance on the evidence offered by the language and institutions. His learning is marred by its pedantry: his argument, by its iteration; while his insight and breadth of view are scarce proportional to his knowledge. He maintains a high ideal of the dignity of real history, and made unsparing onslaught on writers who subordinate the true to the picturesque. See his *Life and Letters* by Dean Stephens (2 vols. 1895).

Freeman, JOHN, poet, was born in London in 1880. His works include *Stone Trees* (1916), *Memories of Childhood* (1918–19), *Poems Old and New* (1920), *Music* (1921), *The Moderns* (criticism, 1916), *Portrait of George Moore* (1922), *The Grove* (1925).

Freemasons. The masonic brotherhoods of the middle ages were organised incorporations, not substantially different in their nature from the other guilds, governed by rules of their own, and recruited from a body of apprentices who had undergone a period of probationary servitude. Fable and imagination have traced back the origin of freemasonry to the Knights Templars, the old Roman empire, the Pharaohs, Hiram of Tyre and the Temple of Solomon, or even the times of the Tower of Babel and of the Ark of Noah. The masonic craft in reality sprang into being about the same time and from the same set of causes as other incorporated crafts; but a variety of circumstances combined to give it an importance and influence beyond the rest. Men skilled in the hewing and setting of stones were naturally prized in an eminently church-building age. Their vocation necessarily involved travelling from place to place in search of employment. Wherever a great church or cathedral was built the local masons had to be reinforced by a large accession of craftsmen from other parts; and the masons from neighbouring towns and districts flocked to the spot and took part in the work, living in a camp of huts reared beside the building on which they were engaged. A master presided over the whole, and was assisted by wardens having surveillance of the rest. A mason, therefore, after going through his apprenticeship and probations, could not settle down like other craftsmen among his neighbours and acquaintances, but must travel from place to place to find employment; hence it became desirable or necessary to devise means by which a person once a member of the fraternity might be universally accepted as such, without requiring, wherever he went, to give fresh evidence of his skill, or having to undergo a renewed examination on his qualifications. In order to accomplish this end, and to enable a mason travelling to his work to claim the hospitality of his brother-masons on his way, certain signs and words were conveyed to him, which he was bound to keep secret. This arrangement is the sole shadow of foundation for the popular notion that the masonic brethren were in possession of secrets of vital importance, the knowledge of which had been from generation to generation confined to their own order. It has been supposed that the possession of the masonic secrets enabled the masons to design the great cathedrals of the 13th and 14th centuries; whereas it is now certain that during the purest ages of Gothic architecture, both in France and in England, the architects were not members of the masonic fraternity at all, but either laymen of skill and taste, uninitiated in the mysteries of masoncraft, or oftener bishops and abbots. The masons who worked from the architect's design were, at the same time, not the mere human machines that modern workmen too generally are, but men who, in carrying out an idea

imparted to them, could stamp an individuality of their own on every stone. Architecture was then a progressive art, and the architect of every great church or cathedral had made himself acquainted with the works of his predecessors, and profited by experience, adopting their beauties and shunning their defects. The nature of the advance which architecture was then making has been compared by Fergusson to the advance with which we are familiar in the present day in shipbuilding and other useful arts. 'Neither to the masons nor to their employers, nor to the Abbé Suger, Maurice de Sully, Robert de Susarches, nor Fulbert de Chartres is the whole merit to be ascribed, but to all classes of the French community carrying on steadily a combined movement towards a well-defined end.' In Germany, however, the masons of the 14th century, who had attained a wonderful skill in carving and in constructing arches, overstepping their original functions, took to a great extent the office of architect into their own hands; and it is undeniable that the churches designed by German masons, though rich in the most exquisite workmanship, are not comparable in the higher elements of beauty to the works of non-masonic architects.

The epithet 'Free,' as applied to the craft, was originally used as an abbreviation of the term 'freemen masons'—free of their guild. Scotland possesses the earliest record of the presence of theoretical or speculative masons in mason lodges. This is shown in the minute of a conventicle of the Lodge of Edinburgh, held at Holyrood House in the year 1600.

The history of freemasonry has been overlaid with fiction and absurdity, partly from an exaggerated estimate of its importance in the development of architecture, and partly from a wish to connect medieval masonry with the institution that passes under the same name in the present day. Modern (or so-called 'speculative') freemasonry is an innocent mystification unconnected either with the building craft or with architecture. It is of English origin, and dates from the 18th century. According to its peculiar phraseology, it is founded in the 'practice of moral and social virtue;' its distinguishing characteristic is charity, in its most extended sense; and brotherly love, relief, and truth are inculcated by its precepts. In freemasonry there are three grades—apprentice, fellow-craft, and master-mason; there being peculiar ceremonies at the making of each; and it is only on attaining to the degree of master-mason that a brother enjoys the full benefits and privileges of the craft.

The 'Lodges' of Scotland profess to trace their origin to the foreign masons who came to Scotland in the 12th century to build the Abbeys of Holyrood, Kilwinning, and Melrose. Those of England go still further back, to an assemblage of masons held by King Athelstan, at York, in 926. The mother-lodges of York and Kilwinning were the parents of many lodges erected in different parts of Great Britain; while several of the pre-18th century Scottish lodges were self-constituted. Towards the close of the 18th century it was in some quarters (as by Robison in his *Proof of a Conspiracy*, &c. 1797) made a charge against freemasonry that under its symbolism was concealed a dangerous conspiracy against all government and religion. The accusation was probably groundless enough as regards British freemasonry; and so little effect was produced by it that, in an act passed in 1799 for the suppression of secret societies, an exception was made in favour of freemasons. On the Continent political intriguers may sometimes have availed themselves of the secrecy afforded by freemasonry to further their schemes. In 1717 a Grand Lodge was formed in London, with power to grant charters to other lodges. Under its sanction the first edition of the constitutions of the fraternity was published. The Grand Lodge was for a length of time on an unfriendly footing with the lodge of York, in consequence of having introduced various innovations not approved of by the older lodge, and of having granted charters within the district which York claimed as its own. In 1782 the then Duke of Cumberland (brother of George III.) was elected Grand Master of the Grand Lodge; and on his death George IV., then Prince of Wales, succeeded to the office, which he continued to hold till he was appointed regent, when, it being considered unsuitable that he should longer exercise any personal superintendence, he took the title of Grand Patron. In 1813 an understanding and a union was brought about between the two rival Grand Lodges by their respective Grand Masters, the Dukes of Kent and Sussex. The fraternity has since been managed by the 'United Grand Lodge of Ancient Free and Accepted Masons of England,' consisting of the Grand Master, with his Deputy, Grand Wardens, and other officers, the provincial Grand Masters, and the Masters and Wardens of all regular lodges, with a certain number of stewards annually elected, who meet four times a year for the despatch of business, besides which there is an annual masonic festival, at which every mason is entitled to attend. The Grand Lodge of England has at present nearly two thousand lodges under its protection; King Edward VII. was its Grand Master from 1874 to his accession.

In Scotland the masons, when they were a real company of artificers, were, like other handicrafts, governed by wardens of districts appointed by the king. In 1598 a reorganisation of the mason lodges was effected under William Schaw, principal warden and chief master of masons, who in the following year confirmed the three 'heid lodges' in their ancient order of priority—Edinburgh first, Kilwinning second, and Stirling third. In 1736, the operative element in mason lodges having become absorbed in speculative masonry, the Grand Lodge of Scotland was instituted by the representatives of thirty-four lodges, by whom also William St Clair of Roslin was elected Grand Master, on account of his ancestors' alleged ancient connection with the mason craft as patrons and protectors. Priority was assigned to the lodges according to the antiquity of their written records. The Lodge of Edinburgh (Mary's Chapel), with its records dating from 1599, was placed first, and Kilwinning, possessing records from 1642, second. The Lodge of Kilwinning did not formally object to this till 1744, when it withdrew from the Grand Lodge and resumed its independence. On relinquishing this position in 1807 it was re-admitted into the Grand Lodge by the title of Mother Kilwinning, with precedence over the other lodges, and the Provincial Grand Mastership of Ayrshire confirmed in perpetuity to its Master.

Besides granting charters of affiliation, the chief use of the Grand Lodge, whether of England or Scotland, consists in its acknowledged authority to enforce uniformity of ceremonial and other observances, and to settle all disputes that may arise within the lodges under its charge. In Scotland the officers and members of the Grand Lodge are delegates from the respective lodges; the delegation being the masters and wardens or their proxies. As a source of revenue, for each member made by a lodge a fee must be remitted to the Grand Lodge, whereupon a diploma of brotherhood will be issued. There are upwards of six hundred lodges under the Grand Lodge of Scotland. The Grand Lodge of Ireland, instituted in 1730, exercises jurisdiction over nine hundred

lodges. There are funds of benevolence connected with each of the British Grand Lodges.

Modern freemasonry spread from Britain to the Continent, to America, and to India. It was introduced into France in 1721, into America in 1730, Russia in 1731, and Germany in 1740; and there are now Grand Lodges all over the world. Roman Catholics treat freemasonry as a pantheistic system, essentially opposed to belief in the personality of God, subversive of all legitimate authority, whether of the church or of the state—the hatching-ground of most of the revolutionary societies of continental Europe. Some French societies are frankly atheistic. It has been expressly condemned by bulls or encyclicals from seven popes, including Leo XIII. and Pius X.

The deep symbolical meaning supposed to be couched under the jargon of the masonic fraternity is as apocryphal as the dangers of masonry to government and order. A set of passwords and a peculiar grip of the hand enable the initiated to recognise each other, and give a zest to their convivial meetings; and, if the institution possesses any practical utility, it is in its enabling a mason, in a place where he is a stranger, to make himself known to his brother-masons and claim their protection and assistance.

See A. E. Waite, *The Secret Tradition in Freemasonry* (1911); J. How, *Freemasons' Manual* (1880); A. G. Mackey's *Encyclopædia of Freemasonry* (New York, 1874; new ed. 1908), *Lexicon of Freemasonry* (7th ed. 1885), and *History of Freemasonry* (1898); Yarker, *The Arcane Schools* (1909); an article on 'Illuminism' in the *Edinburgh Review*, July 1906; Meredith Sanderson, *An Examination of the Masonic Ritual* (1923); J. S. M. Ward, *The F.C.'s Handbook* (1923); Paton, *Freemasonry, its Symbolism and Religious Nature* (1873); Lyon, *Freemasonry in Scotland* (1873); R. F. Gould, *History of Freemasonry* (1886); the *Handbuch der Freimaurerei*, published as 2d ed. of Lenning's *Encyklopädie der Freimaurerei* (4 vols. 1863–79); Schauberg's *Vergleichendes Handbuch der Symbolik der Freimaurerei* (3 vols. 1861–63); and the anonymous *Maçonnerie Pratique* (2 vols. Paris, 1885–86); Findel's collected works on Freemasonry (6 vols. Leip. 1882–85); Fort's *Antiquities of Freemasonry* (Phila. 1878); and R. F. Gould's *Concise History of Freemasonry* (1904).

Free Port, a port at whose wharves the vessels of all nations can load and unload free of customs duties and commercial charges, with the exception of the usual harbour dues. A free port is thus, from the commercial point of view, an open harbour in contradistinction to one that is closed to all vessels except those of the country in which it is situated, and from the administrative point of view financially a foreign territory within the state to which it politically belongs. In the middle ages free ports were established for the purpose of attracting trade to particular maritime centres, especially by Italy, France, Spain, Austria, and Portugal, at the period when the exploitation of their colonies for the benefit of the mother-country was the ruling principle in the commercial policy of those states. In the end of the 18th and the beginning of the 19th century free ports acquired a position of peculiar importance in consequence of the prohibitive measures which were at that time in force. Since then, however, they have decreased both in importance and in number. At the present time their chief use is that of entrepôts for facilitating the more convenient interchange and distribution of commodities destined for more or less distant markets. To all intents and purposes their utility has been destroyed by the rival system of bonded warehousing, which has always prevailed in England and the United States in preference to the other system (see BONDED WAREHOUSES). In 1889 the only free ports remaining on the continent of Europe were Trieste, Fiume, Hamburg and Bremen—the latter two having since 1888 only a restricted area within the free port. Trieste and Fiume ceased to be free ports in 1891, while in that year Copenhagen was made one. Outside of Europe, Hong-kong, Menado in Celebes, Singapore, Georgetown (Penang), Amboyna, Banda, Ternate, St Thomas (West Indies), Livingstone in Guatemala, and Zanzibar, are, or were recently, free ports.

Freeport, capital of Stephenson county, Illinois, on the Pecatonica River, 121 miles WNW. of Chicago by rail, with a college and some manufactures; pop. 20,000.

Freesoilers, a political party in the United States, the outcome of the Wilmot (q.v.) proviso, founded in 1848 to oppose the extension of slavery to the territories. At Buffalo in that year they nominated Martin Van Buren for president and Charles Francis Adams for vice-president, who secured a popular vote of 291,000, but no electoral votes. In 1852 their candidates polled only 156,000 votes; but in the period of political agitation that followed the freesoil principles assumed great prominence, and were adopted by the Republicans, in whose party, on its organisation in 1856, the Freesoilers were absorbed.

Free Spirit, BRETHREN OF THE, a fanatical sect diffused (often secretly) over Germany, Italy, and France, between the 13th and 15th centuries. Their doctrine was a species of pantheistic mysticism, which they applied with fearless consistency to all the details of moral obligation. Often condemned as heretics, they suffered severely at the hands of the Inquisition; and were confounded with the Beghards (q.v.). See BROTHERHOODS.

Freethinkers, a term used loosely of all who reject belief in divine revelation, but especially of the Deists. See AGNOSTICISM, ATHEISM, DEISM, POSITIVISM, RATIONALISM, RELATIVITY OF KNOWLEDGE, SECULARISM; and J. M. Robertson, *History of Freethought* (3d ed. 1915).

Free-town, capital of Sierra Leone, is the best harbour in West Africa, a second-class British coaling station, and the headquarters of the British West African forces. The town is enclosed by a range of wooded hills, and, though the temperature is tolerably uniform, the climate is unhealthy, especially for Europeans. Pop. 44,000, mainly descendants of liberated negroes. The town was founded in 1787.

Free Trade. 'Free Trade' is often used in a loose popular sense as practically equivalent to freedom of contract and *laisser-faire;* and thus particular kinds of land laws, bimetallism, factory acts, and various regulations affecting labour and manufactures are spoken of as infringements of free trade. Nothing, however, is gained by giving such an extended meaning to a definite expression, perfectly clear and precise in the historical sense. Historically, free trade refers to a particular policy as regards international or foreign trade only, and its principal features are absence of differential duties, and of artificial encouragements, such as bounties, by which the home producer is favoured as compared with the foreigner in the same department. The essence of free trade is equality and uniformity in the financial treatment of home, colonial, and foreign produce of the same kind. Thus the imposition of taxes upon commodities merely for revenue purposes (e.g. the tax on tea in the United Kingdom) is not held to be an infringement of free trade. Similarly the absolute prohibition of the importation of certain articles, supposing that the production at home is equally prohibited (e.g. immoral books), would not offend against free trade in its historical sense.

The economic system opposed to free trade, and the essence of which lies in the preferential treatment of the products of the home country or of

certain 'favoured' nations, has received different names according to the objects professedly in view. When Adam Smith advocated the principles of free trade, he attacked the elaborate economic policy known as the Commercial or Mercantile System (q.v.). Of this system, protection to home industries was only a part. At least equal stress was laid upon a favourable balance of trade which was supposed to be indicated by a balance of the precious metals being due to a country. By this principle of a favourable balance a government was guided in framing commercial treaties and in the treatment of its colonies. At a later date, however, the use of the term protection was extended to cover practically the same ground as the expression 'Mercantile System,' which fell into disuse. Still more recently the name 'fair trade' has been invented to describe a mild form of the protective system, in which the basis of economic policy is supposed to be reciprocity or free trade only with such nations as grant similar privileges. Sometimes 'fair trade' is also held to include differential treatment of colonies by the mother-country as against foreigners, and is thus associated with schemes for imperial federation. It is worth noting that up to the beginning of the 19th century fair trade was the polite name for smuggling, and that, according to Adam Smith, 'to pretend to have any scruple about buying smuggled goods would, in most countries, be regarded as a pedantic piece of hypocrisy.'

The principal practical difficulty in deciding whether a tax is really opposed to free-trade principles arises in the case of the possible use of substitutes. If, for example, the cheaper kinds of foreign wines are being taxed avowedly for revenue purposes only, an indirect encouragement may at the same time be given to the production and consumption of beer in the home country. Again, it is difficult in many cases to find a fair common measure for home and foreign articles, and thus to make customs and excise duties really equivalent. In wines and spirits the alcoholic test alone is obviously unfair, but it is difficult to decide how much should be fairly allowed for other qualities. Nor will a simple *ad valorem* tax be a sufficient guide, because the effect upon demand of a rise in price is different in different cases. It may even be said that all taxation of those foreign goods which, from the nature of the case, cannot be produced at home (such as tropical products in the temperate zones) furnishes an artificial encouragement to home industries. If, for example, tea and coffee are rendered very dear by taxation, the use of aerated waters and home-made wines may be stimulated. The case of drawbacks, in which an excise duty is drawn back upon the exportation of the article taxed, presents similar difficulties. If the drawback really exceeds the tax already paid, it amounts to a bounty; and in fact most of the bounties given upon exportation are disguised in the form of drawbacks.

Taking free trade in this historical if somewhat narrow meaning, it is convenient to examine the general economic theory on which the policy rests before giving actual examples of free-trade policy and its opposite, protection. The question is, 'Why should a nation give no preference to its own subjects over foreigners in the financial treatment of commodities in general, or at least of some particular kinds?' It will be seen at once that the establishment of a universal negative in any question of practical politics is only possible by making very stringent assumptions as to the object or end of political union. Suppose, for example, that we accept the maxim of Adam Smith, that defence is of far more importance than opulence, we at once make out a *primâ facie* case for the encouragement of those industries—e.g. shipbuilding and navigation—which may be assumed indirectly to contribute to national defence; and we understand why Adam Smith considered the Navigation Acts to be the wisest commercial provisions in the statute-book. Similarly various other social or political objects may be thought so desirable that the state ought to use its influence, by adjusting industrial finance, in order to promote these objects. It may be argued, for instance, that the state should look to the conditions under which labour does its work quite as much as to the mere cheapness of the final product; and that a nation ought to consider much more than individuals can be expected to do the remote consequences of certain lines of industrial development. In this way the arguments for protection founded upon a variety of industries, the possible exhaustion of peculiar natural resources, the encouragement of the growth of towns and manufactures in young countries, must be deemed *primâ facie* worthy of consideration; although, of course, it may prove in the sequel that free trade is much more likely than protection to attain these and other important social ends, in addition to cheapness and plenty.

It is necessary, then, in order to understand the purely economic theory of free trade, to omit provisionally, for the sake of simplicity, not only many possible objects of financial policy, but also various considerations of great social and moral importance. We must begin by regarding the primary object aimed at as the present acquisition of the means of satisfying material wants at a minimum real cost—that is to say, the question must first of all be considered from the point of view of the consumer for the time being. With this narrow view of the subject it is easy to establish the case in favour of free trade. For with freedom of competition no foreign commodity would be imported unless it could be sold at least as cheaply as when produced at home, and the natural result of competition would be to lower the price; hence, to discourage importation by differential taxation would be to raise prices by restraining competition. Again, to artificially encourage exportation by means of a bounty may by diminishing the supply in the home-market raise the price; and, if an increased supply can only be obtained at an increasing cost, this must be the result. But although free trade may result, as just shown, in present maximum cheapness, it may be objected that all cheapness is relative to the means of purchase—i.e. to income—and that, if the former is promoted by free trade, the latter is augmented by protection. And at first sight it seems plausible to argue that if a certain policy increases employment it increases earnings, and that employment must be increased by encouraging home industry at the expense of foreign. The refutation of this fallacy in its grossest form is one of the greatest triumphs of the so-called orthodox political economists. Bastiat, for example, in his famous petition of the candle-makers against the sun, in which it is ironically shown how much encouragement would be given to all the industries directly and indirectly concerned in the production of artificial light by shutting up windows, &c., has made clear the error involved in 'making work,' or in increasing obstacles in order to encourage employment. Again, whilst it is allowed by free-traders that protection to any particular industry may turn more labour and capital into that channel, and thus increase the gross earnings of those employed in it, it is maintained that on the whole, from the national point of view, there is a loss. In the first place, the very object of protection is to raise the price above what it would be if foreign imports were admitted freely,

and thus the large body of consumers (including other labourers) are taxed for the benefit of the small class of producers. Secondly, the labour and capital of the country are drawn from the channels into which they would naturally flow, and are thus on the whole less advantageously employed; in other words, the gross annual produce of the land and labour of the society is less than it otherwise would have been. If, for example, by the exclusion of foreign corn the price is raised, not only are consumers taxed by the rise in price, but the labour and capital devoted to the production of corn are drawn from other employments, in which more commodities might have been produced, and on balance exchanged for more corn. We thus arrive at the great maxim of free-traders, that imports are paid for by exports, and 'if you take care of the imports the exports will take care of themselves'—in other words, if foreign labour is encouraged by the free admission of foreign goods, still, *ipso facto*, the home industry must be equally encouraged, because goods to an equal value must be made to be exported to pay for these imports. In fact, it is maintained that the home industry is more encouraged than otherwise would be the case, because there is less waste of labour, capital, and natural resources. A certain quantity of labour and capital devoted to the more careful cultivation of land would raise more agricultural produce, but if devoted to some kind of export, this export might obtain by exchange far more corn raised at much less expense on virgin soil.

To the statement, however, that a country need regard only its exports, preliminary objection may be raised on the same ground on which the above maxim itself is really founded—viz. that all trade is reciprocal, and that ultimately imports and exports are a form of barter. For it may be said that, unless a country's exports are sent by the best route to the best market, they cannot purchase so great a quantity of imports, and it is quite as reasonable to regard the export trade as active, and the import trade as passive, instead of the converse. Suppose, for example, to take an extreme case, all other nations effectually prevented the importation of English manufactures, England would be unable to pay for its imports, and imports must cease. And, without going so far, it may still be maintained (as by Adam Smith) that distant and roundabout trades are not so advantageous to a country as near and direct trades.

Apart from this objection the position of free-traders appears to be sound under the assumptions usually made. These assumptions, however, require careful statement. In the first place, it is assumed that labour and capital can without loss or difficulty be turned from a decaying into a thriving industry, and that, if any home product is displaced by foreign competition, 'something else' will be made with the same labour and capital. But it may be objected that every industry requires a certain amount of specialised capital and peculiar skill and training which cannot be transferred to other employments; capital and labour, for example, formerly used in agriculture cannot without great loss be turned into the manufacture of cotton goods. There is some force in this objection, and Adam Smith placed it under the possible exceptions to a general free-trade policy which he considered worthy of consideration. At the same time, as he points out, there is a tendency to exaggerate the difficulty of absorbing any surplus labour set free from an old industry, and at anyrate the argument is one not for absolute protection, but for partial protection during a limited transition period, whilst labour and capital are being withdrawn. There is, however, a more serious objection to this assumption of the perfect mobility of labour and capital from one industry to another. A merchant, as Adam Smith said, is a citizen of no particular country, and if capital and labour are supposed to move without any difficulty within the limits of one country, their migration from country to country cannot be considered, especially in modern times, to offer any insuperable difficulty. Thus, it is theoretically possible that under the stress of foreign competition agriculturists might take their labour and capital from the United Kingdom to the United States, instead of to the cotton-mills of Lancashire or the coal-mines of Northumberland. The result would be that a trade formerly conducted between the rural and the manufacturing districts of England would now be conducted between the latter and the western states of America. Nor is this migration of industries a pure theory; we find many examples in history not only of the transference of industries from one part of the same country to another, but also from one country to another. Whether this transference would have been prevented by protection is, of course, a matter for further inquiry; the point at issue at present is simply the possibility of the free-trade assumption, that any displaced capital and labour will find employment within the country, not being realised. The importance of the exception is seen from a popular argument, often used as a rough and ready proof of free trade—viz. that if protection is a good thing for one country against another, it must be good for one district, county, town, &c. against others in the same country. But the answer is obvious, that, although from the national point of view the migration of industries within the country is a matter of indifference, it is a matter of supreme importance to the districts affected; and historically it may be noted that in England, as in other countries during the medieval period, the towns adopted stringent protective measures against one another; and, although this parochial patriotism has disappeared to a great extent, the commercial rivalry of nations is as strong as ever.

It is worth observing that Adam Smith always emphasised the importance to a country of employing its capital, so far as possible, within its own borders, and if it were employed out of the country he ranked the relative advantages according to the nearness of the foreign locality and the frequency of the returns. And, in his view, it was not a question of profit, for he expressly says that greater profits may be earned in distant than in near trades, and in foreign countries than at home. But the point is that if the capital is employed at home the labour of the country finds employment at home, and the home country enjoys the things produced. Suppose, for example, that a large quantity of British capital is exported to make harbours, railways, &c. in a foreign state; greater profits may be earned, but so far there will be less employment for British labourers whilst the works are being made, and when they are finished the benefits of use will be enjoyed by the foreigner. Many of the successors of Adam Smith, in their eagerness to give free trade the simplicity of an axiom, have omitted from their argument the element of nationality, and have forgotten that there is a question of 'somewhere else' as well as of 'something else.' The great merit of Adam Smith is that he fully recognises at every stage of his reasoning the difficulties which spring from territory being of the essence of the modern nation; and instead of arguing simply (but illogically) that, because universal free trade would be good for the world at large, therefore it would be equally good for every part of it, he maintains that, taking everything into account, and giving due weight to the principle of nationality, the interest of a par-

ticular nation would be advanced by free trade and retarded by protection or artificial management on the part of government. At the same time, however, it may be admitted that in some respects Adam Smith's argument needs development, because no economist would now feel justified in laying so much stress as he did upon reasons drawn from a peculiar view of natural theology and an optimistic mode of regarding the operations of nature. No matter how strong may be the belief in the beneficent guidance of an 'invisible hand' which leads the individual, whilst pursuing his own interest, to promote that of the public, it is necessary to give more specific grounds, and of a more purely economic character, in deciding between two methods of taxation and two methods of conducting international trade. Certainly, too much reliance must not be laid on the general argument derived from a survey of life as a whole in an age in which nature has come to be regarded as 'red in tooth and claw,' and as working out its ends by a prodigal waste of suffering and misapplied effect. It will be found, however, that the principal result of Adam Smith's natural theology has been negative omission rather than positive error.

Taking the world as a whole at any particular time, we can easily see that free trade would give the most advantageous employment of labour and capital, because everything would be produced under the most favourable conditions; but the difficulty is to show that free trade is the best policy for a country which adopts Adam Smith's fundamental position as to the relative advantage of keeping capital and labour employed within its own borders. On this view it is not enough to show that under free trade the consumer would obtain maximum cheapness and the capitalist maximum profits, but we must also show that the nation makes the best use of its resources for its own members. The arguments relied upon by Adam Smith are partly positive and partly negative, the former being based on the power of the self-interest of individuals, and the latter on the weakness of governmental control. Every person, he says, naturally prefers to employ his capital in the support of domestic industry, but then this qualifying clause is added, 'provided always that he can thereby obtain the ordinary, or not a great deal less than the ordinary, profits of stock.' This leaves the position open to the attack that, by supporting foreign in place of home industry, the individual may obtain more profits; or more generally that profit, as Adam Smith himself often points out, is not synonymous with national advantage. But the objection is not so serious as at first sight appears. For, in the first place, if capital when employed at home does not obtain ordinary profits, a check will be placed on accumulation, and it is certainly more advantageous for a nation to employ some of its surplus capital abroad, or in encouraging foreign industries, than to have no surplus through forcing it to stay at home; secondly, it must be noted that most of those who support a protectionist policy, on the ground of encouraging home industry, estimate the encouragement given by the profit earned, and would to the last disapprove of any policy which would lead to less than the ordinary rate being obtained.

It may, however, be further objected that by protection to home industries, and by the prevention of the admission of certain kinds of foreign goods, more capital may be employed at home at the ordinary rate of profit. The usual answer is that this capital must be drawn from other more advantageous industries also at home; but in an old country in which profit is at a minimum and capital overflowing its channels this answer does not hold good. It is true that the consumers of the protected article lose so much by the rise in price, but it may be rejoined that to the nation this loss is more than compensated by the increase in the field for employment. Again, take a simple hypothetical case. Suppose that a new country yields only agricultural produce, and exchanges part of this for manufactures. If it imposes protective duties on manufactures, and if it can provide, through the growth of wealth and population, the necessary labour and capital without diminishing the amount of agricultural produce, the result is that its agricultural labour supports its own instead of foreign cities. Under the supposition made, the agriculturists will obtain less home manufactures than they would have done from abroad, at least for a time, but it is possible that the diversion of labour and capital may ultimately result in more wealth. In the ordinary argument for free trade sufficient allowance is not made for the growth of capital and population, nor for the advantages to be gained from employing them within the country. The question is regarded exclusively from the point of view of the consumer, under the hypothesis of a fixed amount of labour and capital already fully employed in the most advantageous manner.

The theoretical exception to free trade which has just been considered may be strengthened by the argument drawn from the stimulus given to production by a variety of industries, and by promoting trade directly between the towns and the neighbouring country districts, a consideration which was the basis of Wakefield's scheme of colonisation. It is urged, especially in the case of new countries, that, unless towns are encouraged by the protection of manufactures, there will not be a ready market for all the by-products of agriculture.

At this stage it may be well to note the other principal exceptions which have been taken to free trade from the nationalist standpoint. It is said that every nation should retain for the benefit of its own people any peculiar natural resources, and if possible also any inventions and artificial means of production. In the United Kingdom, for example, one of the principal causes of commercial supremacy is always said to be the close proximity of excellent coal and iron fields. But coal and iron are exhaustible, and the more they are exported so much the sooner will the point of exhaustion be reached. It is maintained that in the interests of posterity we should sacrifice the profits of a present trade and restrain the exportation. Carey even argues that the continuous exportation of all raw produce is practically equivalent to the exportation of the soil. In former times the wool of England was supposed (though, as is shown in Smith's *Memoirs of Wool*, probably without good cause) to be much superior to that of other countries, and accordingly, after being for some centuries the great staple of export, the exportation was later on forbidden under most severe penalties, and similar penalties were imposed on the exporters of sheep and rams. The same policy was carried out in reference to machinery and the instruments of production generally, including 'the living instrument' man. The answer made to this case of protection on the part of free trade is that it is impossible to tell, as regards the remote future, whether the peculiar advantage attaching to natural resources will continue (e.g. coal with the development of electricity from other forms of energy), and that, as regards instruments, they can be copied and imitated although the actual exportation is prevented. It is also argued that restraints upon the production of machinery by limiting the market will tend to check the progress of invention.

Another exception to free trade has been made on the ground of national independence. As already noted, it was on this ground that Adam Smith approved of the Navigation Acts. Recently the increasing dependence of the United Kingdom upon foreign nations for its food-supplies (see FOOD) has attracted much attention, and has led to proposals for differential duties in favour of the colonies. The same argument was the principal one used in the long agitation which resulted in the repeal of the Corn Laws. The answer is that cheap food is of such importance to the masses of the people that nothing which would raise its price would be assented to, and that indirectly through the growth of wealth and population under the stimulus of cheap food the nation has become much stronger than it would have been if it had tried to preserve its independence. Further, it is said that the dependence is really mutual, and that the food-growing countries rely upon selling their food to obtain clothes and other necessaries just as much as the importers of food rely upon them.

A favourite exception to free trade is that a nation ought to consider principally, not the cheapness of goods to the consumer, but the effect of the conditions of labour upon the producer. No nation would be content with being the hewer of wood and drawer of water to the rest of the world, and the more a nation is composed of highly-skilled workers engaged in healthy, pleasant, and energising occupations, so much the better. It is assumed that, if by protective or prohibitive duties foreign wares of the higher class be excluded, they will be produced at home by native artists and craftsmen. It is, however, more probable that many of the articles would not be produced at all, and that in any case the absence of the foreign stimulus would eventually check the higher industrial development. If, for example, foreign paintings were excluded from a country to encourage painting, and engravings to encourage engraving, and so on, it is more than probable that the art of the country in question would lose not only in quality but in quantity. It may also be pointed out that the best way to promote the higher forms of industry is not by the simple process of exclusion, but rather by an elaborate system of technical and artistic education. The protectionist is always in danger of forgetting that it is not enough to show that certain ends are worthy of attainment, but that he must also prove that the rough and ready device of excluding foreign competition is the best means to adopt.

At this point it is convenient to complete the positive argument in favour of free trade. Hitherto the question has been regarded on the free-trade side mainly from the point of view of cheapness to the consumer, whilst abundant and varied employment for the producer and other important social aims have only been considered as possible grounds of exception to a free-trade policy. But Adam Smith, especially, and many of his successors have supported free trade with these objects professedly aimed at by protectionists always in view. Freedom of action and freedom of movement free-traders hold to give the greatest encouragement to the development of enterprise, and to the progress of invention, and thus indirectly at least to the employment of labour in a variety of industries. The natural result of free trade is to increase the efficiency of labour and capital through the stimulus of open competition, whilst the natural result of protection is to establish routine methods. Here it is important to observe that the practical abandonment of the wages-fund theory, according to which wages were supposed to be paid simply out of pre-accumulated capital, for the theory that wages are paid out of the price of the produce of labour, renders the usual statement of the theory of free trade, from the standpoint of capital only, incomplete and one-sided. The new theory of wages adds, however, much force to the position that the efficiency of labour is, on the whole, increased by free trade and diminished by protection. Again, under free trade an industry which ceases to be profitable, and to satisfy consumers, on the opening up of foreign markets is soon abandoned with a loss only to those engaged in it at the time, whilst under protection vested interests are created, and the loss is perpetuated. It must, however, be allowed that this argument from the absence of the stimulus of competition under protection loses force in proportion to the area, wealth, and population of the country to which it is applied. In the United States, for example, there is abundant scope for competition, and the same remark applies to a possible federation of the colonies and dependencies of the British empire.

On the whole, then, so far as the positive arguments are concerned, by which free trade is generally supported, it must be allowed that it is easy from the national standpoint to discover hypothetical exceptions, which might be thought, to adopt Smith's language, 'worthy of deliberation.' And, contrary to the popular opinion in England, most economists of repute have allowed theoretically that under certain circumstances a country might gain by stepping aside from a general policy of free trade. Adam Smith, in addition to the exceptions already noted, approves of retaliation, if by that means a great market might be secured for exports; Ricardo points out a mode by which a country might gain by the monopoly of its colonial trade, and J. S. Mill allows that the Navigation Acts, though economically disadvantageous, were politically expedient, and also supports the argument derived from Adam Smith in favour of temporary protection, with a view to the more speedy development of industries for which a new country seems naturally adapted. One of the most systematic of English writers on the subject, Professor Sidgwick, expressly says that, when the matter is considered from the point of view of abstract theory, it is easy to show that protection, under certain not improbable circumstances, would yield a direct economic gain to the protecting country.

But it must always be remembered that the positive argument in support of a general free-trade policy is only part, and probably the least important part, of the case. It is one thing to allow that, provided a government is perfectly wise and able at once to change its policy according to the variations of industry, it might use its power in such a manner as to direct the capital and labour of the country into more advantageous channels than those of pure free trade; but it is quite another thing to admit that any government would be capable of managing the industries of a great nation in this way. Those who quote Adam Smith for his theoretical exceptions forget that he always laid most stress on the negative side of the argument—that is to say, on the weakness and incapacity of governments. 'The statesman,' he writes, 'who should attempt to direct private people in what manner they ought to employ their capitals, would assume an authority which could safely be trusted not only to no single person, but to no council or senate whatever.' The clearest illustrations in support of this position are found in the commercial history of England. Even in the middle ages, when changes were comparatively slow and competition was fettered in all directions by custom and routine, the government was unable to carry out the objects which it had in view in protecting certain native industries. It is worth noting also that several important manufactures took their rise through imitation of foreign wares, under the guidance of foreign workmen, in direct

opposition to the supposed interests of home producers. It is a curious fact that precisely that part of the old commercial system which was most approved of by Adam Smith—viz. the Navigation Laws—was the first to be seriously attacked on the ground of the practical difficulties involved. These acts naturally induced foreign nations to retaliate, and the attempt to obviate this difficulty by means of reciprocity treaties led to still further complications with other countries. Apart from the peculiar practical difficulties that arise in particular cases, certain general reasons may be given why protection is likely to fail when everything is taken into account. The taxation for protective purposes of any product necessarily involves the taxation of substitutes; and since in general a duty so far as it is protective is not productive of revenue, for the main object of protection is to exclude the foreign product, there is the expense of supervising and guarding against the evasion of a number of unproductive taxes. Apart from these indirect evils, the real incidence of import duties is extremely difficult to determine. Again, in every industry there are always a certain number of producers and traders on the margin of bankruptcy, and they ascribe their failure to the insufficiency of the duties. Thus a duty which at first might have been proposed as a temporary expedient tends not only to become perpetual, but to increase. It is well known, for example, that under the old Corn Laws there was a constant demand for increasing protective duties. Those actually engaged in any industry at the time when protection is given may gain immediately through obtaining a practical monopoly of the market, and exceptional profits and wages may be obtained until they are reduced by competition. But when those employed in other industries see this apparent advantage obtained by the favoured industry, they also naturally clamour for protection, and thus the interference of government once begun spreads with increasing rapidity, a fact which has found illustration in every protectionist country. The insuperable practical difficulty is not only to decide on national grounds what industries should be protected, but afterwards to persuade those engaged in other employments that they do not require protection. Hence it is easy to understand why under the old system England and other countries were practically compelled to impose a general duty upon all foreign manufactures not specially taxed. Thus the general result of protection is to stifle foreign trade, and indirectly, by curtailing the market for exports, to fetter home industries. To render the negative argument in support of free trade complete, it would be necessary to take into account also the more general arguments advanced in support of natural liberty as against governmental interference—e.g. the increasing burdens of the necessary functions of government with the progress of civilisation, the dangers of the increase of power by increasing the functions of officials, the evils of restraints upon individual liberty, &c., which obviously have an important bearing upon the particular case of protection, but which are too general to be more than indicated in a special article. When on the one side the simplicity of free trade is considered, and on the other a complete survey is made of the practical difficulties involved in protection, compared with the doubtful advantages to be gained in the exceptional theoretical cases noted, and when it is borne in mind that the objects avowedly aimed at by protectionists—e.g. variety, skill, national independence, &c.—are much more likely to be obtained by other social methods under the system of natural liberty than by the simple device of imposing heavy taxes on foreign goods, a strong case is made out on balance for adopting free trade as the general rule of industrial policy; and in all probability free trade would have been more generally adopted, if the economical arguments had not been overshadowed by political prejudices, resting on very different foundations.

The question of Free Trade and Protection is discussed at length in all the text-books on political economy; and to PROTECTION we ourselves devote a special article. The introductory essay in Macculloch's edition of the *Wealth of Nations* (1828; new ed. 1857), still the great storehouse of facts and theories, gives a good account of the literature of the subject previous to Adam Smith. The principal subsequent addition to the arguments for free trade is the theory of foreign trade in Ricardo's *Principles* (1817), developed by J. S. Mill, Cairnes, and more recently by Professor Bastable, and criticised somewhat adversely by the French mathematician and economist Cournot, and by H. Sidgwick. Popular expositions of free-trade principles are well represented by Chevalier's *Examination of the Commercial System known as Protective*, Bastiat's *Sophismes économiques* (Eng. trans., *Popular Fallacies regarding General Interests*, 1846), Sir Thomas H. Farrer's *Free Trade versus Fair Trade* (1885), Fawcett's *Free Trade and Protection* (1878; 6th ed. 1885). The history of the free-trade movement in England is given in Lord Morley's *Life of Cobden* (1881). For the fiscal controversy 1903–10 see *A Project of Empire*, by J. S. Nicholson (1909); *Free Trade in Being*, by Russell Rea (1908); *The Case against Tariff Reform*, by E. E. Todd (1911). For the question in the light of the war—*Report of the Paris Economic Conference* (1916); *Final Report of Committee on Commercial and Industrial Policy after the War* (1918); *The New Tariffism*, J. M. Robertson (1919).

Free-will. See WILL.

Freezing Mixtures. When matter passes from the solid to the liquid, or from the liquid to the gaseous (or vaporous) state, a considerable quantity of heat in general disappears or is rendered 'latent,' owing to the fact that, energy being required to effect these changes of molecular state, it is taken from the energy in the form of heat already existing in the substance; and this abstraction of heat causes a fall of temperature (see HEAT; MATTER; GAS AND GASES). This property is taken advantage of for the production of low temperatures. The solution of a salt in a liquid, and the liquefaction of two or more solid substances when mixed, are both examples of the change from the solid to the liquid state, accompanied by a lowering of temperature, unless this be neutralised by heat developed by some purely chemical action. The following table gives the composition of freezing mixtures commonly in use. The solid materials should be finely powdered and intimately mixed together in a vessel of low thermal conductivity. The first column of the table gives the components in each mixture; the second their relative proportions by weight; in the third the resulting temperature (Centigrade) of the mixture, assuming that, with the exception of snow or ice, the temperature of the materials previous to mixture is 10° C. The fourth column gives the diminution of temperature in degrees Centigrade:

Components.	Relative proportion by weight.	Temperature of mixture.	Diminution of temperature.
Water	1	16°	26°
Ammonium nitrate	1		
Snow or pounded ice	5	..	20°
Common salt	2		
Snow or pounded ice	1	..	45°
Calcium chloride, crystals	2		
Ammonium nitrate	1	14°	29°
Sodium carbonate	1		
Water	1		
Sodium phosphate	27	29°	39°
Ammonium nitrate	18		
Fuming nitrous acid	8		
Water	4		
Sodium sulphate	8	18°	28°
Hydrochloric acid	5		
Snow	8	32°	42°
Hydrochloric acid (at 0° C.)	5		

Such mixtures are only applicable where a low temperature is required for a short space of time, and are of no use where a continuous process of refrigeration is necessary. For this latter purpose the low temperature produced by the expansion of gases and vapours is chiefly used, the principal substances employed being water, ether, ammonia, and carbon bisulphide. An account of these processes, and of the apparatus connected with them, will be found under REFRIGERATION. Low temperatures are also obtained by the evaporation of a liquid, either under artificially diminished pressure, or where its vapour pressure is constantly small, the energy necessary to effect the change of state being taken from the heat in the substance itself. The evaporation (and consequent cooling) of water from the surface of porous earthenware vessels, called water-coolers, is due to this principle. The same is true of the formation of ice in shallow lakes at night in tropical climates.

Low temperatures reached by Natterer and others, in their experiments on the liquefaction of gas, were obtained by a mixture of solid carbonic anhydride and ether; or of solid nitrous oxide and carbon bisulphide. By such means the temperature of −140° C. was reached. Lower temperatures can be obtained by other methods. See GAS; also COLD, FROST, ICE, MELTING-POINT, TEMPERATURE, THERMOMETER, WATER.

Freiberg, an old German mining centre, is situated on the northern slope of the Erzgebirge Mountains, at a railway junction, 20 miles SW. of Dresden. The existing cathedral, built in the late Gothic style, on the site of an earlier one (burned in 1484), contains tombs of the Saxon electors of the Albertine line, and has a Romanesque portal called the Golden Gate. The town owes its origin to its silver-mines, discovered about the year 1163. Parts of the ancient walls and flanking towers still remain. At the school of mines, founded in 1765, the most famous institution of the kind in Europe, instruction is given in surveying, mining, the preparation of ores, geology, mineralogy &c. It possesses a laboratory, a library, a collection of mining models, and mineralogical and geological collections. The mineral ores extracted near Freiberg are silver, bismuth, nickel, cobalt, zinc, arsenic, &c. The manufactures consist principally of gold and silver ware, wire, chemicals, machines, leather, and cigars. Founded in 1175, Freiberg suffered more than once in the Thirty Years' War and the Seven Years' War. Pop. (1875) 23,559; (1890) 28,995; (1900) 30,175; (1910) 36,237; (1919) 32,981.

Freiburg, or FRIBOURG, a canton of Switzerland, bounded on the N. and E. by Bern, and on the S. and W. by Vaud and the Lake of Neuchâtel, with three enclaves in Vaud. Area, 644 sq. m.; population, 143,000, principally of French descent and Roman Catholics in religion. The official language is French, but all the laws and decrees binding on the whole canton are published in both French and German. The surface is hilly, the canton being invaded by offshoots of the Bernese Alps, which rise to upwards of 7000 feet in height. The river Saane or Sarine, a tributary of the Rhine, traverses almost the whole extent of the canton from its southern to its northern extremity. The country abounds in excellent meadows and pastures, upon which are reared fine breeds of horses and cattle. Dairy-farming, especially cheese-making (Gruyère), is pursued with great success. The other chief pursuits are agriculture, watch-making, and straw-plaiting. Timber, cheese, and cherry brandy are exported. Freiburg was received as a member of the Swiss confederation in 1481, and in 1848 a liberal constitution was established, but revised in a reactionary direction in 1857. It sends six members to the national council.—The capital is Freiburg, or Fribourg, on the Saane, 19 miles by rail SW. of Bern. The town is built in the valley and up the slopes of the hill to the edge of the precipice overhanging the river. The banks of the Saane (Sarine) are united by a stone and concrete bridge. The church of St Nicholas, a fine Gothic structure, begun in 1283, has one of the finest-toned organs in Europe, and a lofty belfry. There is a university. Pop. 20,000.

Freiburg IM BREISGAU, a town of Germany, in the land of Baden, is situated on the western edge of the Black Forest, 32 miles NNE. of Basel. It is an open, well-built town; the walls and ditches with which it was formerly surrounded have been converted into promenades and vineyards. The cathedral, one of the most beautiful and perfect specimens of Gothic architecture in Germany, cruciform in shape, and built of red sandstone, was begun in 1122, but not completed till 1513. Its western steeple, 381 feet high, is remarkable for its elegance and lightness. The university, which was founded in 1455, has about 150 professors and teachers and 3000 students. The chief manufactures are sewing silk, cotton and thread, buttons, beads, chicory, paper, parquetry, &c. Wine and timber are the chief articles of trade. Pop. (1865) 19,085; (1919) 87,946, of whom more than one-half are Protestants. Freiburg is the seat of a Catholic archbishop. Founded in 1091 by the Duke of Zähringen, and created a town in 1115, Freiburg has repeatedly changed masters; twice it was given over to France (1679–97 and 1744–48). It also played an eventful part in the Thirty Years' War. In 1806 it fell to Baden; and in 1848 the Baden revolutionists were defeated here by the troops of the German confederation.

Freight is the reward paid to the owner of a ship for the carriage and safe delivery of goods. A person chartering a ship pays freight for the goods sent by it, and dead freight in respect of any deficiency of cargo; the terms of the agreement are fixed by the Charter-party (q.v.). A person sending goods by a general ship pays freight for them; and the contract takes the form of a bill of lading. So far as the rights of parties are not made the subjects of positive stipulation in the contract of affreightment, they are ascertained with reference to the usage of trade. The carrier's duty is to have the ship ready to start at the time appointed (wind and weather permitting), and to receive the goods and carry them to their destination; having performed these duties, he has a lien on the goods and a right of action in case of non-payment of freight. The shipper's duty is to have his goods forward in time. Freight is not usually payable unless the voyage is completed; but it is sometimes prepaid, in whole or in part, at the risk of the shipper. It was formerly held that the wages of the crew depended on the earning of freight by the ship; as Lord Stowell expressed it, 'freight was the mother of wages.' This rule has been finally set aside by the Merchant Shipping Act, 1854. Even in case of shipwreck a seaman may recover his wages; but his claim will be barred if evidence can be given to show that he failed to exert himself to the utmost to save the ship and cargo. The old rule is adhered to in America; but it does not apply to the master, nor does it apply to seamen if freight has been lost by the fault of the master or owners. Freight may be made the subject of insurance. See CARRIER, INSURANCE.

Freiligrath, FERDINAND, a poet of Germany, was born at Detmold, in the principality of Lippe, 17th June 1810. The favourable reception accorded

to his first collection of *Poems* in 1838 induced him to abandon commercial pursuits and devote himself to literature. From this time onwards he led a very unsettled life. In the poetry of this his earlier period it is the originality both of subject and of treatment, the oriental glow of the diction, the energy of the descriptions, and the finish of form that have secured the poet fame. But about the year 1844 a great change came over the spirit of his writing. Freiligrath was drawn into the political contest of the period as a bold champion and singer of democratic opinions. The publication of his radical *Glaubensbekenntniss* ('Confession of Faith'), in the same year, compelled him to take refuge in Belgium. In 1846 he repaired to London, and, although two years later he celebrated the revolutionary movement in the poems *Die Revolution* and *Februarklänge*, he was nevertheless included in the amnesty of March 19, and returned to Germany, settling at Düsseldorf, where he become the leader of the democratic party. Shortly after, he was impeached on account of his poem, *Die Todten an die Lebenden* ('The Dead to the Living'), but after a celebrated trial acquitted, 3d October 1848. Nevertheless, a second prosecution in 1851 compelled him to flee once more, and he again took refuge in London. Nor did he return to Germany until 1868. His last years were spent at Stuttgart and Cannstatt, where he died 18th March 1876. In his later years Freiligrath returned in some respects to the style of his first work, a decided contrast to the somewhat strained and artificial poems of his political period, chief amongst which are *Ça Ira!* (1846) and *Neuere politische und sociale Gedichte* (1851). The latest poems were published as *Neue Gedichte* (1876). Freiligrath is also memorable as a translator from the English, particularly by his renderings of Longfellow, Shakespeare, &c. The popularity of his earliest book, *Gedichte*, is attested by its fifty editions before the end of the century. A complete edition of his works appeared at Stuttgart (6 vols. 1870; 5th ed. 1886). See his Life by Schmidt-Weissenfels (1876), and Buchner (1881).

Freischütz ('free-shot'), the name given to a legendary hunter and marksman who gets a number of bullets (*Freikugeln*) from the devil, six of which always hit the mark, while the seventh is at the absolute disposal of the devil himself, who directs it at his pleasure. A northern variant makes the man a fowler who sells his soul to the devil for an unerring aim for seven years. Fortunately there is one condition—that the enemy should always be able to name the game being shot, and the fowler's wife, seeing in this a way of escape for her unhappy husband, strips, tars, and feathers herself, and so outwits the devil to her husband's salvation. The story was first treated by Apel in the first part of his *Gespensterbuch* (1810), and was adapted by F. Kind for the opera, *Der Freischütz* (Fr. *Roland des Bois*), which the genius of Weber has given to the world. See Grässe, *Die Quelle des Freischütz* (Dresden, 1875).

Freising, a town of Bavaria, on the Isar, 22 miles NNE. of Munich by rail, with 16,000 inhabitants, and manufactures of threshing-machines and hand-mills, turf-cutting, and book-printing (since 1495). The chief buildings are the beautiful cathedral (1160) and the former episcopal palace (now a theological seminary). Close by is an old Benedictine abbey (725–1803), now a model farm, with schools of brewing and horticulture. The bishopric of Freising dated as far back as 724 A.D., and its bishops were made princes of the empire in the 17th century, their authority embracing an area of 320 sq. m.; the see was secularised in 1802.

Freistadtl (Hung. *Galgócz*), a market-town of Czechoslovakia (till 1920 Hungary), 35 miles NE. of Pressburg, on the left bank of the Waag, opposite the fortress and prison of Leopoldstadtl. Pop. 9000.

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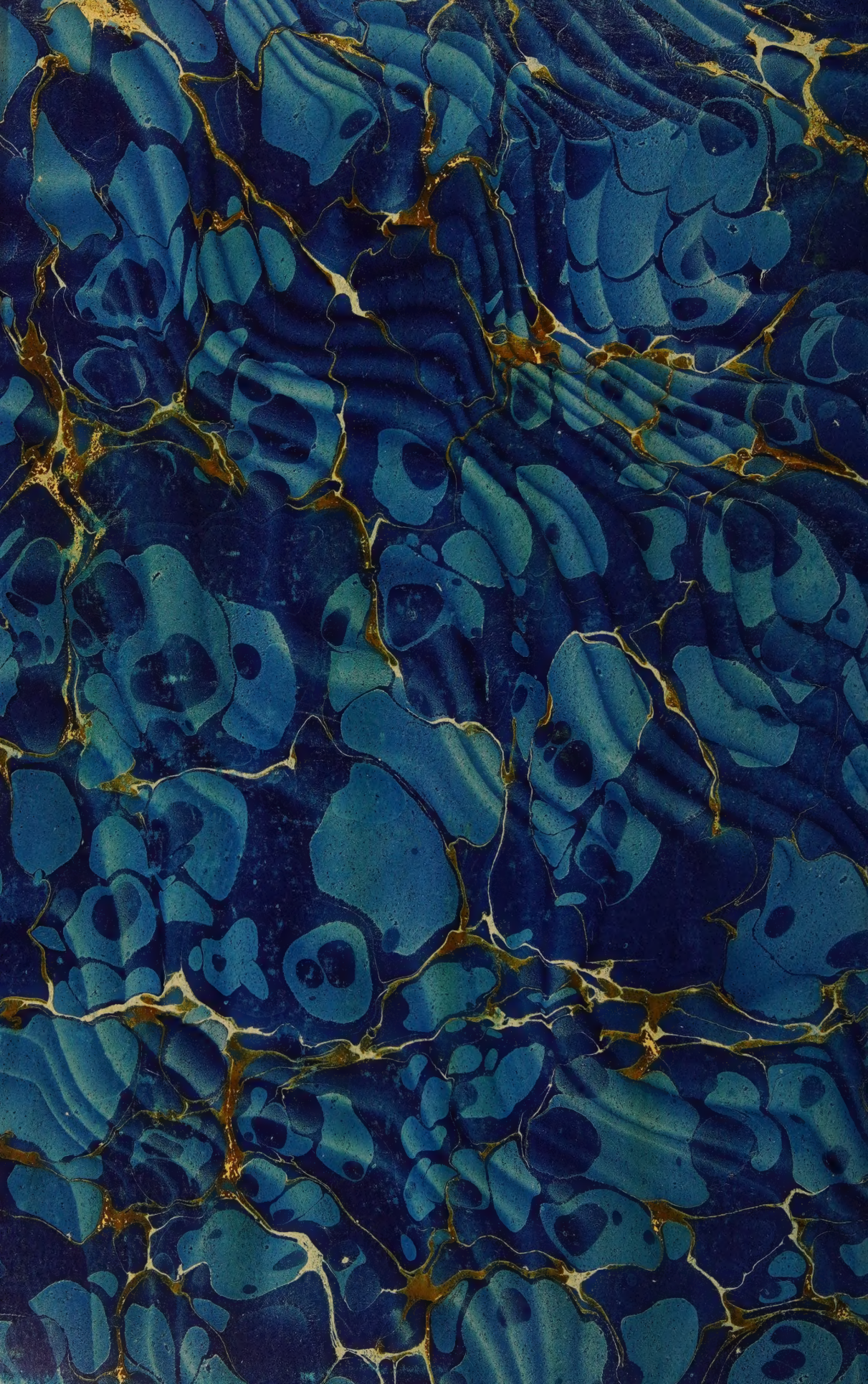
Edinburgh:
Printed by W. & R. Chambers, Limited.

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